

The Sustainable Energy Forum



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Executive Summary

Introduction

This submission seeks to build on the change in direction represented by the Government's draft energy and climate change policy documents. Since the draft documents were released, the economic, scientific and political landscape of energy and climate change policy has changed significantly, meaning that more ambitious policies are not only possible but necessary.

This submission outlines a set of policy proposals which take account of this new reality, focusing on the NZES and the NZEECS, but also extending into climate change and land use policies. It calls for specific, measurable absolute GHG emission reduction targets, and other subsidiary targets, and puts forward policies designed to achieve them. Both the transport and stationary energy sectors are discussed in detail, and a range of proposals put forward in each designed to achieve the transition to a sustainable, low carbon energy system within the timeframe required to meet the constraints imposed by the Earth's biophysical systems.

Summary of Proposals

This section includes the broad proposals made in this submission, and indicates where more detailed proposals are to be found.

Goals

Five goals for a New Zealand Energy Strategy are proposed:

1. Reduce greenhouse gas emission levels through reducing fossil fuel consumption and adapting land use practices to reduce and/or offset emissions.
2. Institute rational economy-wide carbon pricing and stable regulation promptly, so people and businesses can invest with confidence.
3. Minimise the risk of the disruption or failure of stationary energy and transport systems by increasing their resilience.
4. Promote the transition to lower-emissions or no-net-emissions alternatives in both the stationary energy and transport sectors. This will need a mixture of regulations, incentives and pricing.
5. Ensure that any regressive social and economic effects of the above policies are mitigated for those least able to afford them.

Targets and Data Issues

An important early step in implementing the New Zealand Energy Strategy and related documents should be to review the current data and modelling capacity,

determine the gaps between what exists and what is required, and devise and implement a plan to fill these gaps and create a data and modelling infrastructure which can operate at the required level of both thoroughness and sophistication.

The draft NZES and related documents should adopt a maximum greenhouse gas concentration target of 450ppm CO₂-e, designed to avoid a warming of the atmosphere of more than 2° C above pre-industrial levels. This target can be modified in the light of future international agreements.

Pilot projects in managing biosphere carbon stocks should be supported by the Government and should begin as soon as possible, so that the effectiveness, benefits, and difficulties of this approach can be better understood.

The long-term economy-wide emissions reduction target should be an 80-90% reduction in New Zealand's greenhouse gas emissions, compared to 1990 levels, by 2050. This target should be subject to both revision and an increase in precision as understanding of the risks of both abrupt and gradual climate change increases.

The following subsidiary targets should be adopted:

1. A 20% reduction in New Zealand's greenhouse gas emissions, compared to 1990 levels, by 2020.
2. A target of moving to a close-to-100% renewable stationary energy system by 2025.¹
3. A target year should be set for New Zealand's peak fossil energy use: that is, the year after which total fossil energy use in New Zealand must decline at an agreed rate. This year should initially be set as 2015, with provision to revise this towards 2010 if it becomes clear that 'peak oil' has arrived sooner than the International Energy Agency expects.

The first binding emissions reduction progress target should be set down for 2012.

Land Transport

The following land transport emissions reductions goals should be set:

- A 15% reduction in net transport carbon emissions on 1990 levels by 2025
- A 50% reduction in net transport carbon emissions on 1990 levels by 2040
- A 90% reduction in net transport carbon emissions on 1990 levels by 2050²

NZES Transport Objective 1 should be reworded as “Continue to provide access to the services presently provided by transport”.

Five principles should be used to guide the transition to a resilient, low-carbon transport system:

1. Reduce the demand for motorised transport

¹ Although the goal of a 100% renewable electricity system is both simple and attractive, it is not yet clear that this target is achievable. For a discussion of the issues, and a proposed approach to creating an electricity system which meets the criterion of “close to 100% renewable”, see Appendix 1.

² Aviation and shipping are covered separately below.

2. Where motorised transport is needed, encourage alternatives to private road transport
3. Provide transport energy in ways which have a low net emissions profile and use the minimum possible quantity of fossil fuels
4. Where fossil fuels are being used for transport, use them as efficiently as possible, and with a low net emissions profile.
5. Ensure that fossil fuel prices remain high enough to encourage the transition to lower-emission alternatives.

Detailed measures to put these principles into practice are proposed in the Transport section, under 2.1.3.1 Discussion of the Transport Principles and 2.1.3.2 Measures to Support Transport Principles 1-4.

Air and Sea Transport

The NZES, NZEECS and climate change documents should be amended to give substantially more coverage to air transport (and also sea transport), and that the following steps be taken:

1. Ensure that the necessary data collection facilities are in place to be able to do full lifecycle emissions accounting for air and sea transport to, from, and around New Zealand.
2. Play a positive part in international negotiations to ensure that emissions from international travel are included in international accounting for GHG emissions, and that the factors which exacerbate aviation's climate effects (such as the formation of contrails, and the height at which emissions are released) are taken into account.
3. In parallel with greater support for teleworking and telecommuting within New Zealand, provide support and incentives for international business travel to be replaced by teleconferencing and internet-based communications wherever possible.
4. Work towards establishing a greenhouse gas emissions cap for international transport to and from New Zealand, this cap to reduce over time.
5. Encourage research into environmentally more sustainable alternatives to present methods of air and sea travel.
6. Encourage the tourism industry to prepare for the risk of a future in which fewer tourists visit New Zealand, and those that do, stay for longer.

Stationary Energy

The NZES principle “to invest in energy efficiency whenever this is cheaper than the long run marginal cost, including externalities, of new generation” should be

reworded as “to enable consumers and suppliers to invest in improved energy efficiency whenever this is cost-effective for them”.

The New Zealand Energy Strategy should include strong support for the NERI initiative and should avoid the creation of a redundant sustainable energy research and education centre.

The following six principles should guide the transition to a sustainable, low-emissions stationary energy system:

1. Invest in energy efficiency whenever this is more cost-effective than new energy supply.
2. Recognise multiple benefits of local energy resources.
3. Use “engineering efficiency” and “ecological efficiency” as the main criteria for assessing priorities for action.
4. Invest in the transition towards sustainability.
5. Fund low carbon policies.
6. Focus research, development, and resource assessment on technologies and skills to achieve early results.

Detailed measures to put these principles into practice are proposed in the Stationary Energy section below, under 2.3.3 The Transition to a Sustainable, Low Emissions Stationary Energy System: Six Principles.

Part 1: Overall Response

1.1 Preamble

Note: This submission includes contributions from many members of the Sustainable Energy Forum. It has been compiled by Tim Jones, Convenor of the Sustainable Energy Forum. The Appendices consist of a number of contributions from named members of the Sustainable Energy Forum, which discuss issues raised in the main text of the submission in more detail.³

The five energy and climate change policy documents released by the Government in December 2006 represent a major and very welcome change in New Zealand's approach to energy: the first official proposals for reducing energy use, instead of merely hoping to lower the rate of growth. The Sustainable Energy Forum appreciates the effort that has been put into these documents by Ministers, officials, and others involved with the process.⁴

Nevertheless, the suite of documents represents an inadequate response to the scale of the energy and climate change problems which face us. A more ambitious and comprehensive set of energy and climate change policies is achievable; increasingly politically acceptable; and necessary to:

- meet the environmental and energy supply challenges which are before us;
- maintain New Zealand's international standing and competitiveness in a world in which lagging the field on climate change will increasingly have economic as well as political repercussions;
- provide opportunities to develop efficient and environmentally sustainable processes, technologies and products.

The New Zealand Energy Strategy and related documents should embody a transitional strategy, designed to manage our energy system's transition to one that is appropriate for a carbon-constrained world. These constraints apply to both the supply of carbon – in particular, the future supply of fossil oil – and to the ecosystem's ability to absorb the byproducts of the consumption of carbon.⁵ Therefore, the overarching task of Government energy, land use and climate change policy should be to design an environmentally, socially and economically sustainable energy system that can operate within these constraints,

³ Those members contributing material for these appendices do not necessarily agree with everything in this document. In particular Steve Goldthorpe has expressed some fundamental philosophical disagreements with the recommendations of this submission concerning climate change strategies

⁴ The Sustainable Energy Forum (SEF) is a group of individuals and companies interested in promoting information and supporting action which will help move New Zealand toward a sustainable energy future. The objective of SEF is to “facilitate the use of energy for economic, environmental and social sustainability”. SEF has a membership around 150 ranging from staff in major energy companies to students and retired people. Many members are active in small-scale sustainable energy supply and energy efficiency businesses.

⁵ And other byproducts of the human use of energy and land, such as human-induced emissions of methane, nitrous oxide, and particulates.

Thus, in addition to commenting on the objectives and proposals contained in the draft NZES and NZEECS, this submission proposes strategies to enable such a transition.

While 30 March is the end of the submission period, it is only the beginning of the process of consultation and engagement. To be effective, these strategies must be revisited, revised and updated frequently, in consultation with stakeholder groups.

1.2 Goals

Five goals for a New Zealand Energy Strategy are proposed:

1. Reduce greenhouse gas emission levels through reducing fossil fuel consumption and adapting land use practices to reduce and/or offset emissions.
2. Institute rational economy-wide carbon pricing and stable regulation promptly, so people and businesses can invest with confidence.
3. Minimise the risk of the disruption or failure of stationary energy and transport systems by increasing their resilience.
4. Promote the transition to lower-emissions or no-net-emissions alternatives in both the stationary energy and transport sectors. This will need a mixture of regulations, incentives and pricing.
5. Ensure that any regressive social and economic effects of the above policies are mitigated for those least able to afford them.

A mechanism to move towards these goals is proposed:

1. Establish principles to drive the New Zealand economy towards sustainability in all three sectors – energy, land use and climate change.⁶
2. Take early action based on those principles.
3. Set targets for greenhouse gas reduction based on the results of climate modelling and impact assessment (as discussed under Targets).
4. Progressively improve data collection and energy modelling techniques to allow measures to be assessed and modified on the basis of this assessment.

⁶ Such changes will provide a new environment for business. However, we anticipate that new businesses will arise, and existing businesses adapt, to take advantage of the opportunities which a sustainable economy creates.

1.3 Targets and Data Issues

A major flaw in the energy and climate change policy documents is their lack of targets - both overall targets for greenhouse gas emissions reductions, and sectoral targets. Such targets need to be a cornerstone of the Government's energy and climate change policies. The overall targets should derive from the need to preserve the ability of Earth's biophysical systems to regulate the planet's temperature within a range which is safe for its ecosystems and their members, including humans.

Within the overall targets, progress and sectoral goals of various types need to be set. These need to be based on a data collection and modelling capacity which is far more sophisticated and robust than that which presently exists.

1.3.1 Why Are Targets Needed?

Targets by themselves do not achieve any reduction in greenhouse gas emissions or increase in the energy system's resilience. But well-designed targets provide a clear, public commitment to action and a framework within which the required systemic changes can take place.

Furthermore, since these documents were drafted, there have been major changes in both the domestic and international political environment which:

- encourage the setting of bold targets; and
- provide pointers to what approaches may be useful for New Zealand.

Domestically, public concern about, and willingness for action on, climate change has greatly increased, and the Prime Minister has articulated her vision of New Zealand achieving carbon neutrality. Internationally, both the European Union and individual countries, such as Ireland and the United Kingdom, have recently set targets relating to GHG emissions reductions and renewable electricity generation.

A year ago, it could have been argued that New Zealand would be going out on a limb by setting emissions reduction and other targets. Now we risk going out on a limb by not doing so. Failure to set and act on targets means that New Zealand risks falling behind the emerging international consensus, and increasing its vulnerability to the 'food miles' and 'tourist miles' arguments.

It is essential that overall economy-wide GHG emissions reductions targets be absolute targets. Only binding, progressive absolute emissions reductions targets can ensure that an emissions reduction pathway is set and kept to. Intensity targets do have a role within individual sectors and industries.

A crucial consideration is how to set and enforce the binding nature of targets. This issue is currently being grappled with in the UK, and as part of the process of setting long-term and progressive targets, a New Zealand legal framework for binding targets, including penalties for failing to meet them, needs to be developed.

1.3.2 Data and Modelling Issues

Both targets and the measures designed to achieve them should be evidence-based. The history of New Zealand's energy system shows that it is all too easy for well-intentioned but inadequately analysed measures to lead to unanticipated and perverse outcomes. In such a complex area as energy policy, these outcomes are always possible. Nevertheless, they can be mitigated against by "the three Ms":

- **model** the effect of policies and developments in advance
- **measure** the effect of implementing policies and developments
- **modify** strategies and policies in the light of evidence.

This approach will not work without an adequate capacity to gather and analyse the evidence and model the effects of proposed measures. Experience shows that what is measured is what gets done.

Relevant Ministries, and various private-sector organisations and NGOs, have developed expertise in collecting data on, and modelling, various aspects of our climate and energy systems. Overall, however, the data collection, analysis, and modelling capacity available is inadequate to the greatly expanded range of tasks to which it will need to be put if the suite of targets proposed above is insufficient.

Nothing shows this more clearly than the difficulties experienced in calculating New Zealand's projected liability under the First Commitment Period of the Kyoto Protocol. Issues here included assumed energy efficiency savings which were not based on rigorous modelling and proved to be unattainable, undue reliance on one estimate of a likely value of carbon, and the assumptions used about forestry plantings. These assumptions, and the policy decisions which resulted from them, have led to a substantial projected financial liability for the country.

The intention here is not to denigrate past performance, but to point up the need for better data collection and more sophisticated modelling and analysis in future.

Proposal: An important early step in implementing the New Zealand Energy Strategy and related documents should be to review the current data and modelling capacity, determine the gaps between what exists and what is required, and devise and implement a plan to fill these gaps and create a data and modelling infrastructure which can operate at the required level of both thoroughness and sophistication.

It is important that energy and climate change data be publicly available, so that stakeholders are able to test the reliability of the data and the validity of the modelling.

Throughout our submission, individual aspects of the present data and modelling weaknesses are discussed in more detail.

1.3.3 Overall Targets

The documents acknowledge the seriousness of the climate change issues facing both New Zealand and the world. These issues cannot be addressed without setting targets for the maximum permissible concentration of greenhouse gases in the atmosphere, and subsequently setting a pathway to return greenhouse gas concentrations to some internationally agreed level.

In the present absence of an international agreement on what the maximum permissible temperature increase above pre-industrial levels, maximum concentration of greenhouse gases, and reduction pathway should be,

Proposal: The draft NZES and related documents should adopt a maximum greenhouse gas concentration target of 450ppm CO₂-e, designed to avoid a warming of the atmosphere of more than 2° C above pre-industrial levels. This target can be modified in the light of future international agreements.

Management of the natural carbon cycle should play a part in stabilising and subsequently reducing atmospheric GHG concentration levels.⁷

Proposal: Pilot projects in managing biosphere carbon stocks should be supported by the Government and should begin as soon as possible, so that the effectiveness, benefits, and difficulties of this approach can be better understood.

However, major emissions reductions, starting now and taking significant effect within the next ten years, are needed to reverse New Zealand's present trend of rapidly rising emissions.

Proposal: The long-term economy-wide emissions reduction target should be an 80-90% reduction in New Zealand's greenhouse gas emissions, compared to 1990 levels, by 2050. This target should be subject to both revision and an increase in precision as understanding of the risks of both abrupt and gradual climate change increases.

To bring the implications of this long-term target closer to the present day,

Proposal: The following subsidiary targets should be adopted:

1. A 20% reduction in New Zealand's greenhouse gas emissions, compared to 1990 levels, by 2020.
2. A target of moving to a close-to-100% renewable stationary energy system by 2025.⁸
3. A target year should be set for New Zealand's peak fossil energy use: that is, the year after which total fossil energy use in New Zealand must decline at an agreed rate. This year should initially be set as 2015, with provision to revise

⁷ As outlined in Peter Read, "Climate and Energy: Today Problem with a Today Solution", available at <http://www.energyfed.org.nz/PRead2.pdf>, cited 15 March 2007.

⁸ Although the goal of a 100% renewable electricity system is both simple and attractive, it is not yet clear that this target is achievable. For a discussion of the issues, and a proposed approach to creating an electricity system which meets the criterion of "close to 100% renewable", see Appendix 1.

this towards 2010 if it becomes clear that ‘peak oil’ has arrived sooner than the International Energy Agency expects.

Once again, all these targets need to be subject to careful analysis and revision in the light of new evidence.

1.3.4 Progress Targets

To ensure prompt and effective action on emissions reductions, such long-term targets need to be embodied in shorter-term progress targets. Therefore, interim economy-wide targets, on a range of time-scales, also need to be set. To ensure maximum engagement in meeting the targets from the government of the time, these targets should be comparatively frequent – on a three- or five-year basis – and the immediately forthcoming target (i.e. the next three- or five-year target) should be binding.

At the conclusion of each short-term progress target period, the Government should set out a range of measures designed to meet the next one or two short-term progress targets. This will ensure that, during each target period, the focus is on those measures which are actually available to be used during the time period, rather than on measures which depend on technologies yet to be developed.⁹

To align the progress targets with the timing of the first Kyoto commitment period,

Proposal: The first economy-wide binding emissions reduction progress target should be set down for 2012.

1.3.5 Sectoral Targets

All sectors of the economy need to contribute to the overall emissions reduction target. However, they will not do so at the same pace, due both to their historical emissions profile and the different conditions pertaining to each sector. In practical terms, rapid emissions reductions are easiest in stationary energy and hardest in agriculture. Transport falls somewhere in between, as emissions reductions possibilities beyond 2020 are likely to be substantial, but the first priority is to halt and reverse the 62% rise in domestic transport CO₂ emissions since 1990.

Therefore, within the overall target, sectoral targets should be set; and within these, it may be worth considering targets for individual industries. A balance will need to be struck between the benefits of finely-gradated targets and the research and administrative overhead necessary to set and to administer them.

⁹ Although it is important that the development of new technologies occurs concurrently with the deployment of existing technologies.

1.4 The Five Consultation Documents Considered Together: An Integrated Approach

Energy, climate change and land use are highly interconnected. Hence it is very good that all three subjects are open to consultation in the same time period.

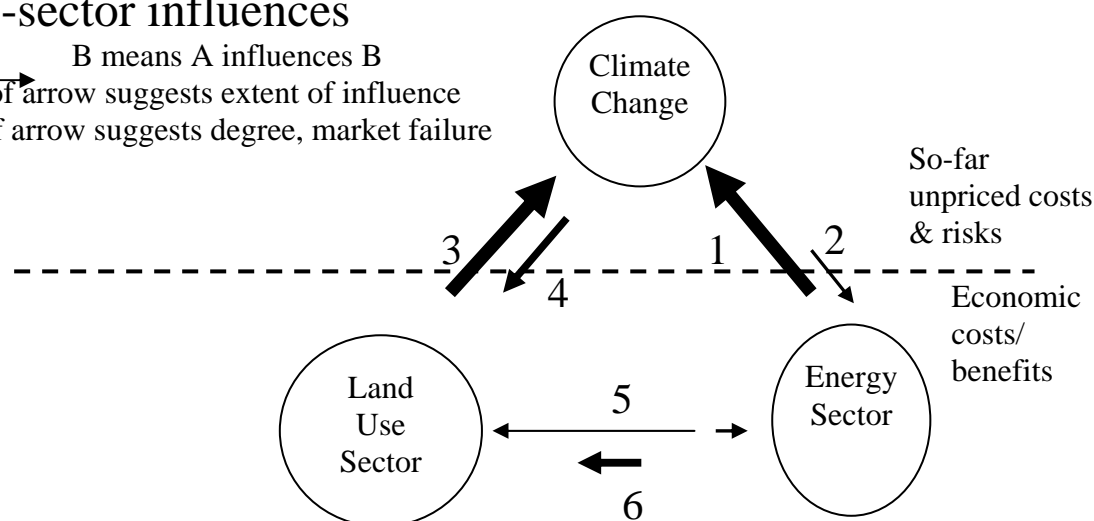
Figure 1: Cross-Sector Influences

Cross-sector influences

A → B means A influences B

Length of arrow suggests extent of influence

Width of arrow suggests degree, market failure



Notes on Figure 1

1. The energy sector is a major contributor to climate change. Transport energy is the largest contributor but requires big changes in urban systems and/ or technology to make much difference. Replacing coal by wood in boilers, up to 20 PJ/yr, could make early reductions.
2. Climate change has some impacts on energy sector (storm-related blackouts, possibly less space heating, more air conditioning).
3. Land use is a major contributor to climate change, both good and bad: rapid conversion of forests to dairy is releasing stored carbon into the atmosphere without making best use of either timber or residues; this is sheer waste. Increasing forest area will lock up carbon, but unless trees are actively managed and remain healthy, sequestration slows down as trees mature.¹⁰
4. Climate change has significant impact on agriculture and forestry – increases in extreme weather such as droughts and flood; new pests
5. Land use sector (agriculture and forestry) purchases energy and supplies some biomass energy – not much market failure.
6. Energy sector impacts on land use: hydro dams and canals: wind power visual impacts, land disturbance and emissions from coal; geothermal subsidence; Think Big petrochemicals on horticultural quality land; etc.

¹⁰ In his personal submission, and in the presentation noted in Footnote 7, Dr Peter Read of Massey University describes the concept of Biosphere Carbon Stock Management, in which trees and crops are managed for energy production as well as high value products. A byproduct of several bioenergy technologies is char; this, where practicable, is ploughed into agricultural soils, where it has a lifetime of many thousands of years. This enables growing biomass to actually remove CO₂ from the atmosphere, while increasing rather than reducing the energy availability to the economy.

1.4.1 Major Issues in Energy, Land Use and Climate Change

The carrying capacity of the natural environment to provide for human needs is being depleted rapidly. To maintain a sustainable society will require major policy changes.

- The ability of the biosphere to manage increasing GHGs is approaching or exceeding limits.
- Natural gas is depleting and new sources are much smaller and less flexible. Aquifers feeding irrigation systems and town supply are depleting, river systems are over-used with loss of productive and ecological values.
- Productive land is being lost to housing and lifestyle blocks. Indigenous forests are continuing to degrade with poor control of pests.
- On the positive side, planted forests took much of the pressure off native forests for timber supply, and created a major export industry. Both indigenous and planted forests hold a stock of sequestered carbon.
- The recent conversion of plantation forest to dairy carries a double penalty in a carbon-constrained economy – the sequestration of carbon dioxide in wood is replaced by emissions of methane and nitrous oxides.

The built environment is also running short of capacity, and will require major reinvestment; which in turn will put further stress on scarce environmental resources.

- Motorways become congested soon after completion, the rail track system is becoming run-down, as are the carriages; commuter buses and trains are overloaded.
- Transmission and distribution lines are overloaded and ageing.
- New fossil fuelled power stations have already committed more gas than is confirmed to be available, though gas prices have decreased recently due to short-term surpluses.
- On the positive side, railway and port capacity are underutilized and could be redeveloped to advantage; a few lifestyle blocks are highly productive per hectare.

Social and economic impacts of energy and land use policies are barely discussed in the consultation documents or other reviews of energy issues.

- Residential electricity prices have risen 5.5% per year in real terms since 2000. Greenhouse gas emissions from household energy use now comprise 9% of New

Zealand's energy sector emissions. Yet there are no significant policies in NZES to reduce power bills or emissions from the residential sector

- Clean air legislation has led to a virtual ban on wood burners in new houses in Christchurch, likely to be copied by other towns and cities including Auckland. Wood is the most affordable heating option for many people. Officials have not yet answered criticisms of the cost-benefit analyses, and say that the analyses will not be revisited.
- A review by officials of the electricity market structure was presented to Cabinet in September, concluding that no significant changes were needed to the status quo. The Electricity Commission has just announced a further review of the wholesale and retail markets – both of these reviews are outside the NZES consultation structure.
- Issues of market power in electricity are also being investigated by the Commerce Commission and the Electricity Commission, but apparently within narrow terms of reference. Difficulties of small-scale energy service providers trying to compete with electricity supply are not part of the investigation.
- The obligation to supply remote rural customers ceases in 2013. A review of whether the law should be changed to retain the obligation has so far failed to engage two key stakeholders, the Sustainable Electricity Association NZ and Rural Women New Zealand.
- Land use policies also ignore social impacts. Policies could cause rural depopulation if “carbon farming” leads to large areas of untended permanent forest. Conversely, they could stimulate rural economies if the potential to develop local energy resources is fully realised.
- Funding for energy research and development has so far been captured largely by existing research organizations, giving few opportunities to independent researchers or universities.

1.4.2 The Draft NZ Energy Strategy: Measures Do Not Match the Government's Vision

The measures proposed in the New Zealand Energy Strategy (NZES) and Land Use documents are not generally compatible with Government's vision of resilient, low-carbon, sustainable energy. Proposed measures focus on protecting the interests of only some parts of the community, and are therefore small, incremental, or delayed.

The political focus of NZES is clear. Most of the issues discussed have seen much media attention in the last few years – notably electricity security, transport issues and climate change. NZES and NZEECS offer a great many options but few indications of the Government's preferences; these will be sorted out, as always, through political processes.

What is not acknowledged is the Government's conflicts of interest. Residential power bills provide most of retailer-generators' profits and therefore dividends. Household energy sources that compete with electricity – natural gas, LPG and firewood – are barely mentioned. Firewood is actually “modeled” as providing no household energy at all. The fact that “unexpected” government surpluses were put into roading projects goes unmentioned.

The HEEP (Household Energy End-use Project) research has found that on average 29% of household energy goes on heating water and 34% on heating air – in total just under two thirds of the energy is for low grade heat that does not need to be provided by electricity. The HEEP analysis suggest that, contrary to popular belief, the real problem with occurs at the top end of the market – in big, electricity-hungry homes.

Analysis of HEEP data shows that shifting to high efficiency electric heat pumps does not alter the overall residential electricity demand and actually makes the peak demand worse – this is a consequence of the importance of solid fuel for space heating. It is only as a result of the HEEP work that we now understand the relative importance of different fuels and the purposes for which they are used. The HEEP results show that policy should be based on data, not inaccurate assumptions.¹¹

The Electricity Commission is a system of self-governance by electricity market participants, and represents their interests at public expense. It says it will conduct a new review of the wholesale and retail market “from the consumer's perspective”, but small consumers are effectively unrepresented in its advisory system. The former independent chairman of the Commission, sacked after the controversial decision not to approve Transpower's 400 kV line into Auckland, has said in public that “New Zealand fails to meet standards of regulatory independence”, and spoke of “heavy lobbying by decision-losers”.

New policies in energy, climate change and land use (as listed under 1.2 Goals above) have the potential to reverse some or most of the adverse trends listed above.

These policies would affect energy prices, and therefore businesses and lifestyles, especially as affected by transport costs. They would affect the balance between pastoral agriculture, forests, horticulture, and indigenous ecosystems.

The necessary changes would be major in comparison to economic developments of recent years – but no more dramatic than earlier phases of New Zealand's rural or urban development.

Changes would need to be made through proper consultative processes, to mitigate social as well as environmental impacts. Non-government organizations were consulted only sporadically before the draft NZES was released, and many problems they foreshadowed were addressed poorly or not at all.

¹¹ For more on this, see Nigel Isaacs, “Electricity Security & Supply – The Role of Demand”, available at <http://www.energyfed.org.nz/NIsaacs1.pdf>

Well-designed policies and measures could reverse the adverse trends, and set New Zealand onto a path towards sustainable energy and land use. Such policies would have significant costs, but these costs would be outweighed by the multiple benefits they would yield to the economy and society as well as the environment. Furthermore, New Zealand, with its excellent growing conditions, educated population and technological expertise, could offer world leadership in biosphere carbon stock management.

If properly documented and promoted, the necessary changes could also do much to restore New Zealand's tarnished image – so valuable on the world stage – as a “clean and green” country.

Delayed or small incremental changes, by contrast, can only increase constraints on climate change, energy resources, land uses, and affordability of energy to households and businesses, which will not remain unnoticed by our trading partners.

Part 2: Sectoral Issues

2.1 Land Transport

2.1.1 Comments on the NZES Transport Goal

The overall transport goal proposed by the NZES is “A resilient, low carbon transport system”.

2.1.1.1 The Goal

A resilient, low-carbon transport system could be a huge improvement. The problem is that neither resilience nor low-carbon are defined, and the scale of the responses proposed in the NZES and NZEECS is insufficient to achieve either. Of the two components of this goal, resilience is harder to define.

2.1.1.2 A Resilient Transport System

Resilience may be interpreted as the ability to absorb disrupting influences with minimum harm and then to recover or adapt quickly. It implies a strong focus on vehicle efficiency and renewable fuels, and especially modes which do not use fossil fuels.

A prime potential source of transport disruption is the cost or availability of fuel. Possible reasons include high taxation or artificial supply restrictions as part of the international response to climate change, or absolute supply restrictions created by supply chain failures or ‘peak oil’. It follows that this goal is strongly aligned with the goal of a low-carbon transport system by 2050, provided no attempt is made to substitute oil made from other fossil fuel sources, like coal, in an effort to improve resilience.

A useful proxy for resilience in transport is diversity. Therefore, to measure progress towards resilience, progressive diversity targets (rising over time) might be set, such as:

- Proportion of trips made by walking, cycling or public transport
- Proportion of freight (in tonne-kilometres) moved by rail or coastal shipping
- Proportion of commuter trips shorter than five kilometres made by cycling or walking
- Proportion of commuter trips avoided by telecommuting
- Proportion of children using walking school buses

Further analysis is needed to work out detailed targets.

This is the appropriate point to note that, although the NZES acknowledges the issue of peak oil – that is, the forthcoming peak and subsequent decline in the production of fossil oil – the coverage of the issue is both cursory (it is given only three paragraphs on pp. 18-19 of the draft NZES) and dismissive. This dismissal does not reflect the opinion of many independent experts in world energy markets and oil production, such as Matthew Simmons, investment banker and author of *Twilight in the Desert*, recently brought to New Zealand by EECA to speak.¹² Nor is it congruent with the Prime Minister's statement at her post-Cabinet press conference on 18 April 2006, at which she observed that the world was at or near peak oil production.¹³

Mostly recently, the Australian Senate Standing Committee on Rural and Regional Affairs and Transport has completed an enquiry into Peak Oil and its effects on Australia, Australia's future oil supply and alternative transport fuels,¹⁴ and it notes that:

The essence of the peak oil problem is risk management. The risks involved are high if peak oil comes earlier than expected, or if economies cannot adapt quickly enough to the post peak decline. (p. xi)

The proportion of annual oil consumption offset by new discoveries has been falling for some 40 years and is unlikely to ever return to current production levels. Production is declining in many old fields, some of them very large, and the numbers in decline can only increase. While estimating the date of peak oil is inherently difficult, many independent estimates place it within the next decade.

Nevertheless, although a high oil price scenario was included in the *New Zealand Energy Outlook 2006*, its consequences do not appear to have been considered, even as an alternative scenario, in the NZES. Give the prudential approach being taken to the issue of climate change in the Government's suite of energy policy documents, the lack of a risk management approach to oil supply issues, other than those caused by temporary disruptions, is particularly disappointing.

2.1.1.3 A Low-Carbon Transport System

To be meaningful, the transport emissions goal has to specify what reduction in transport carbon emissions (compared with 1990 levels) is to be achieved by when.

Section 1.3 of this submission, Targets and Data Issues, discusses the overall greenhouse gas reduction goals which the Government's energy and climate change policies should be working towards. Rapid progress will be easier in the stationary energy sector than in the transport sector. However, given the alarming 62% rise in transport CO₂ emissions since 1990, action needs to start in 2007 – not wait until 2012 – to control and then reverse this rise and bring transport emissions below 1990 levels.

¹² See his presentation to the New Zealand Petroleum Conference 2006, available at <http://www.simmonsco-intl.com/files/2006%20New%20Zealand%20Petroleum%20Conference.pdf>

¹³ From <http://www.scoop.co.nz/stories/HL0604/S00206.htm>, April 2006.

¹⁴ Available at http://www.aph.gov.au/senate/committee/rrat_ctte/oil_supply/report/index.htm, cited 15 March 2007

The transport measures proposed in the draft NZES and NZEECS go nowhere near achieving this. Figure 4.1, p. 21 in the draft NZES shows that transport emissions have risen from 10 to over 15 million tonnes CO₂-e from 1990 to 2005, and projects that, if all “emissions reductions opportunities in transport energy” are taken, emissions will still be well above 1990 levels in 2030.

Officials have explained that this graph is “indicative only”, but that merely illustrates the problem: where are the measurable targets?

As discussed in Section 1.3, while the overarching emissions reduction goal should be set, and subsequently modified if necessary, in the light of a prudent response to the risks of both “consensus-level” and dangerous climate change, detailed emissions reduction targets need to be subject to modelling, measurement, and modification. Subject to this analysis,

Proposal: The following land transport emissions reductions goals should be set:

- A 15% reduction in net transport carbon emissions on 1990 levels by 2025
- A 50% reduction in net transport carbon emissions on 1990 levels by 2040
- A 90% reduction in net transport carbon emissions on 1990 levels by 2050¹⁵

It is acknowledged that the first of these goals is going to be very difficult to meet. It requires a near halving of fossil energy use in transport by 2025 compared to 2005 levels. Changes in fuel and vehicle types will be able to have a significant impact during the post-2015 period, but policy, planning and financial measures, as discussed in the five proposed transport principles (Section 2.1.3), will need to be instituted soon to end and then reverse the growth in vehicle kilometres travelled which has led to the sharply rising transport GHG emissions.

Shorter-term progress targets, as discussed in 1.3.4 Progress Targets, should then be set to give effect to these goals.

These targets should be associated with the proposal expressed in 1.3 Targets and Data Issues that 2015 should be set as the target year for New Zealand’s peak fossil energy use: that is, the year after which total fossil energy use in New Zealand must decline at an agreed rate. In transport, to prepare for the risk of oil supply shortages and/or extremely high prices affecting New Zealand before 2015, contingency plans should be made for achieving this target more rapidly.

Four key factors are needed to drive this transition. Three are measures which do not need to wait for technological developments:

- A rising price of fossil fuel used for road transport
- The provision of alternatives to the use of private passenger vehicles¹⁶

¹⁵ Aviation and shipping are covered separately below.

¹⁶ “Provision of alternatives” encompasses not only their physical provision, but also the social marketing, information provision, system integration, and other steps necessary to make the use of these alternatives easier, cheaper and more attractive than the use of private passenger vehicles.

- Pressure to encourage the adoption of smaller, less powerful, and less emissions-intensive vehicles

The fourth, although already underway, is dependent on technological innovation:

- Changes in engine and vehicle technology

The draft NZES focuses on the fourth factor (plus biofuels) and ignores or downplays the first two. The result is to lose a major opportunity to make serious, early progress on transport emissions.

Below, five objectives to drive the transition to a resilient, low carbon transport system are proposed, and the key factors are discussed in more detail

2.1.2 Comments on the NZES Transport Objectives

The NZES Transport objectives (p. 31) are:

1. Continue to meet the demand for transport services
2. Reduce greenhouse gas emissions from transport
3. Continue to manage other effects of transport, such as exhaust emissions that affect local air quality
4. Maintain reliable supplies of transport fuel during any short-term disruptions
5. Increase the transport system's resilience to higher or more volatile fuel prices

1. Continue to meet the demand for transport services

This objective, as worded, assumes that all demand is desirable and efficient. This is clearly not the case even for motor vehicles, which may have external costs greater than their internal benefits. It is very far from the case when more sustainable transport modes are disadvantaged by lack of investment and the dangers of sharing space on roads designed for motor traffic.

The problem is that building a new road sets off a ‘triple convergence’ of effects which consume most or all of the capacity gains, sometimes in as little as three years. New traffic fills up the road from three sources:

- Rerouted trips (“the motorway is now much faster than going through...”).
- Retimed trips (“I don’t need to avoid peak hours now”).

- Trips previously made on other modes — walking, cycling or public transport (“The car is so much more safe/pleasant/ convenient now”). Some commentators believe that this effect alone is enough to ensure failure.¹⁷

There is also ‘conventional’ traffic growth, which is focussed on the city fringe if journey times appear reasonable (“commuting/shopping to/from there is easy on the new motorway”). In the process new, sprawled housing has been built, often before the new road is open and usually relying on remote shopping centres. The result is that trips have become longer and cars more necessary. In Auckland, the average length of all trips increased by 10% between the 1991 and 1996 censuses.

To deal with climate change and oil supply problems, there is no alternative to controlling sprawl and providing viable alternatives to the car. As noted above, absolute targets are needed: total emissions or percentage reductions, not emissions per head or reductions in the rate of increase.

Proposal: NZES Transport Objective 1 should be reworded as “Continue to provide access to the services presently provided by transport”.

This highlights the crucial role of non-transport ways of meeting this demand, as discussed below.

2. Reduce greenhouse gas emissions from transport

This is a most important goal but it needs to be quantified in measurable, progressive absolute emissions reduction targets of the sort proposed under 2.1.1.3 A Low-Carbon Transport System.

3. Continue to manage other effects of transport, such as exhaust emissions that affect local air quality

This goal is worthy of support. The sustainability of transport energy is enhanced when all environmental effects of transport are taken into account. Reducing particulate (PM₁₀) emissions from transport requires government action, such as improving vehicle emissions standards and fuel efficiencies and targeting gross emitters. This work programme is now underway, and the measures generally tie in well with reducing GHG emissions.

One issue of concern in this area is the desire expressed in the draft NZES to promote a shift in the vehicle fleet from petrol to diesel vehicles to reduce CO₂ emissions. Given the high public health cost of particulate emissions, it is essential that such a move not result in a rise in particulate emissions – at a time when, to meet the Air Quality National Environmental Standards by 2013, the Auckland region's PM₁₀ levels need to drop 53% from current levels.

Therefore, any move to increase the proportion of diesel vehicles in the fleet should, at minimum, be accompanied by a ban on imported diesels which do not meet a tough

¹⁷ See M. J. H. Mogridge, “The Self-Defeating Nature of Urban Road Capacity Policy”, *Transport Policy* 4, no. 1 (1997), 5-23, and Todd Litman, *Generated Traffic and Induced Travel*, Victoria: Victoria Transport Policy Institute (2005), available from www.vtpi.org.

recent standard. At present, Euro 3 may be an appropriate standard, with this soon to be upgraded to Euro 4.

4. Maintain reliable supplies of transport fuel during any short-term disruptions

The SEF Transport Working Group has already commented on these issues in detail in its submission on the Government's Oil Emergency Response Strategy¹⁸

To quote from the introduction to this submission:

The SEF Transport Working Group commends the Government in continuing to plan for oil supply disruptions. Both the geopolitical situation and the underlying depletion of oil supplies suggest that such disruptions are increasingly likely. However, we believe that many of the measures proposed to respond to a short-term supply disruption are equally applicable to a situation in which the use of fossil oil is becoming increasingly constrained both by concerns over supply and price levels, and by the need to make sharp reductions in greenhouse gas emissions from transport. Therefore, we feel a sense of frustration that so many of the measures proposed ... which could be playing a part now, or in the near future, in reducing the use of fossil oil, are consigned to the status of measures to be introduced only in an emergency situation.

We are also disappointed that the document proposes, in general, to leave detailed investigation of the implementation of these options until a disruption is imminent or has occurred. To be deployed effectively, these interventions need to be thoroughly researched and prepared for well in advance of their implementation. To delay this work until a crisis is upon us makes it more likely that the steps taken will be inappropriate, ineffective, or will cut across other long-term goals, such as reducing transport emissions. Again, we identify such issues in our detailed comments below.

In this area, as with every other area of energy policy, there is an urgent need for a more extensive and more sophisticated research effort which examines a range of possible developments in the oil supply field, encompassing short-term events, long-term trends, and the relationship between them, and models likely scenarios and appropriate responses within the overall context of carbon constraint. Proposed policies need to have outcomes which can be measured and tested against robust modelling.

The only comments in addition to these points are that:

- The proposed contract for holding of New Zealand oil reserves in Europe will not be much use in an emergency. There would be shipping delays of at least half the 90 days reserve period; vessels to carry the oil might be unobtainable at short notice; or foreign shipowners might be instructed to divert cargoes to other destinations.

¹⁸ Available at http://www.sef.org.nz/papers/sef_oil_supply_disruptn_sub.pdf

- Although the 90-day period is an International Energy Agency requirement which New Zealand is obliged to meet, it is not a prediction of the length of a likely supply disruption. In addition to preparing for long-term oil supply shortages and disruptions (as discussed in 2.1.1.2 A Resilient Transport System), New Zealand also ought to be preparing for longer-term supply disruptions caused by geopolitical factors.

5. Increase the transport system's resilience to higher or more volatile fuel prices

The issue of resilience is discussed under 2.1.1.2 A Resilient Transport System, and addressed further in the proposed Transport Principle 5 below.

2.1.3 The Transition to a Resilient, Low Carbon Transport System: Five Principles

Proposal: Five principles should be used to guide the transition to a resilient, low-carbon transport system:

1. Reduce the demand for motorised transport
2. Where motorised transport is needed, encourage alternatives to private road transport
3. Provide transport energy in ways which have a low net emissions profile and use the minimum possible quantity of fossil fuels
4. Where fossil fuels are being used for transport, use them as efficiently as possible, and with a low net emissions profile
5. Ensure that fossil fuel prices remain high enough to encourage the transition to lower-emissions alternatives.

The first four principles form a hierarchy, similar to the ‘hierarchy’ of how to reduce the environmental effects of transport, which were noted in the Transport and Environment Select Committee report in 1998, namely: 1. reduce the need to travel; 2. switch to more environmentally preferable modes; 3. switch propulsion methods; 4. improve efficiencies of modes.

Unfortunately, the draft NZES seems to turn this hierarchy on its head. It places most faith in achieving GHG reductions with fuel efficiencies, then with switching to biofuels; it credits virtually no gains to mode-shifting and doesn't seem to want to reduce the need to travel. In transport as in stationary energy, demand management must play an essential part in reducing the GHG emissions and increasing the resilience of the transport system.

2.1.3.1 Discussion of the Transport Principles

1. Reduce the demand for motorised transport, by:

- improving urban design to minimise travel distances and facilitate safe walking and cycling, including the provision of walkways and cycleways.
- charging transport users something close to their real costs, including externalities.
- promoting walking and cycling for both their transport and health benefits.
- providing institutional, social, regulatory and possibly tax support for teleworking/working from home.

The scope of urban design procedures to reduce transport demand, and promote sustainable transport, is wide. Among significant measures are the development of urban villages (of greater density, and designed around walking and cycling rather than private passenger vehicles), the development of more dispersed services so that trips to reach them do not have to be either lengthy or motorised, and urban planning to make walking more direct. Decisions in both urban and rural areas on issues such as school and hospital closures and school zoning also need to take their effect on transport demand into account.

Recent New Zealand research¹⁹ shows that there is latent demand for walking and cycling which is not being met. The Government has a number of strategies designed to promote walking and cycling. This is laudable, but these strategies are poorly integrated – in particular, those addressing the issue from the transport side aren't integrated with those addressing it from the public health side. The NZEECS merely states that a target for walking and cycling is to be developed. A whole-of-government approach to this is recommended, so that resources are allocated efficiently. It is important that promotion of walking and cycling, as well as infrastructure, is addressed.

Telework/telecommuting is another area which offers potentially substantial emissions reduction and resilience benefits at comparatively low cost, but which is hindered in New Zealand by falling between two stools: it affects transport, but tends to be treated as a labour market issue.

Minimising the length of trips and even the need for travel is critical to creating a sustainable transport system. Doing so reduces congestion, emissions, and could lead to long-term savings in the capital cost of all transport-related infrastructure.

(It should be noted here that, when all or almost all motorised transport is fuelled by renewable means, then the need to reduce the demand for motorised transport will lessen. However, the public health and congestion benefits of the alternative modes discussed in this section will remain.)

Limited Government funding, properly directed, can achieve much to promote telework:

¹⁹ Described in Carolyn O'Fallon, "Walking & Cycling in NZ & the Draft NEECS", available at <http://www.energyfed.org.nz/CO'Fallon.pdf>, cited 15 March 2007

- Once a company starts teleworking, the practice (and therefore the traffic benefits) continues to increase with no further cost implications for Government. Furthermore, reducing work trips has also been shown to reduce non-work trips. (A 20% reduction in commuting leads to 22% reduction in total car usage and even some reduction in car ownership.)
- The benefits would be available within months, not years, as there is no lead time for construction.

Proposal: The Government should investigate the current infrastructure, institutional, and business barriers which are hindering the uptake of telework, and works with existing telework providers and promoters on measures to increase its uptake.²⁰

2. Where motorised transport is needed, encourage alternatives to private road transport, by:

- Changing the present institutional and financial arrangement which favour road building, over other transport modes.
- Evaluating all proposals for new transport infrastructure against a set of criteria which take into account national as well as local environmental effects (including GHG emissions), effects on the reliance of the transport system, and public health effects.
- Creating a New Zealand Freight Strategy which directs investment towards the lowest-net-emissions methods of moving particular items of freight. It should draw on the results of the Ministry of Transport's *Surface Transport Costs and Charges* (STCC) study (March 2005), which estimated that cars pay 64% of their total costs, including externalities and allocated fixed charges, trucks pay 56% and rail users pay 77%. Implementing the recommendations of this study progressively between now and 2015 would be an excellent starting point.
- Removing the institutional, financial and infrastructural barriers which are currently preventing an increase in the movement of freight by rail.
- Providing funding for public transport services to meet existing and future demand. This funding should be spent not just on improving the number and extent of services, but also on improving the quality and useability of services. Criteria here include access, waiting times, transit and transfer times, timekeeping, and providing real-time information to travellers.
- Putting urban planning provisions in place to ensure that housing developments are transit-friendly.
- Using social marketing to encourage behavioural change in individuals' personal decisions on transport mode use.

A number of these measures are discussed in more detail in "Measures to Support Transport Principles 1-4" below.

3. Provide transport energy in ways which have a low net emissions profile and use the minimum possible quantity of fossil fuels, by:

- Electrifying transport wherever possible, where that electrification can be done in ways which reduce net emissions. Priorities for electrification include urban

²⁰ For a slightly dated but valuable overview of teleworking, see International Labour Organization, *The High Road to Teleworking*, available at <http://www.ilo.org/public/english/protection/safework/telework/hrdptl.pdf>, cited 16 March 2007.

public transport (road and rail), the more heavily-used rail freight lines and electric vehicles.

- Replacing fossil fuels with biofuels, where this can be done in a way which meets environmental standards (which should ensure, for example, that we do not import biofuels which have been produced on land cleared from tropical rainforests), deals with land use issues, and reduces net emissions
- Further researching and piloting the growing and harvesting of biofuels as part of holistic greenhouse gas management strategies which make use of the natural carbon cycle in managing net GHG emissions.²¹

Note: The history of New Zealand energy policy – in particular, the “Think Big” era and Kyoto first commitment period policy decisions – has led to justified caution about the Government “picking winners” on the basis of unrealised expectations. The Government needs to pilot and evaluate the effect of a range of technologies in New Zealand conditions – and then decide what will work best.

Note too that measures to reduce private vehicle use and promote transport mode-shifting can be introduced quickly and have a substantial impact, whereas the major impact of developments in vehicle and fuel technologies will be over the longer term.

In a presentation to the joint SEF/EFNZ seminar on 16 Feb,²² Andrew Campbell of CRL Energy Ltd looked at vehicle and fuel technology, from the points of view of feasibility in New Zealand, time to have a significant impact, and emissions reduction possibilities. He estimated that, to have a significant impact on the vehicle fleet, all-electric vehicles would have a lead time of 20-30 years, hydrogen vehicles 20 years, and plug-in hybrids also 10-20 years (with 5-10 years needed to solve the technical problems). Planning should start now to be best prepared for the uptake of these vehicle types.

Freight transport is also reducible. Charging real costs will encourage shippers to re-optimize their supply chains, favouring warehousing over ‘just-in-time’ or local manufacture over centralised production; giving a price advantage to local contractors; and encouraging wider use of energy-efficient transport modes.

4. Where fossil fuels are being used for transport, use them as efficiently as possible, and with a low net emissions profile, by:

- using a mixture of regulation and incentives to reward the fuel-efficient use of efficient internal combustion vehicles
- using a mixture of regulations, incentives and information provision to encourage and reward the importation, purchase and retention of fuel-efficient vehicles
- providing disincentives for multiple car ownership by one household
- educating drivers in vehicle maintenance and driving techniques which enhance fuel economy
- implementing price-based measures to discourage car use in urban centres (e.g. congestion charging), and using the proceeds to enhance the provision of alternative modes.

²¹ As outlined in Peter Read, “Climate and Energy: Today Problem with a Today Solution”, op cit.

²² See Andrew Campbell, “Vehicle Technology: Can it Support the Strategy’s Aspirations?”, available at <http://www.energyfed.org.nz/ACampbell1.pdf>, cited 16 March 2007.

As for Principles 1 and 2, measures in this area can be implemented with a lead time of one to a few years. A number of these measures are discussed in more detail in 2.1.3.2 Measures to Support Transport Principles 1-4.

5. Ensure that fossil fuel prices remain high enough to encourage the transition to lower-emissions alternatives.

The evidence of the steep rise in oil prices from late 2004 until mid-2006 shows that fuel price rises, particularly if they are maintained, do have the potential to reduce private vehicle trips and encourage transport mode-shifting, though the full benefits of this are not apparent unless the infrastructure for the alternative modes, whether transport modes (such as public transport) or non-transport modes (such as teleworking), is in place.

It is likely that the world price of oil will continue to maintain an average considerably higher than its pre-2005 level, and it may rise steeply, along the lines discussed in the *New Zealand Energy Outlook 2006*'s high oil price scenario, if world conventional oil production peaks soon. However, geological, economic, and geopolitical uncertainty means that oil price movements are notoriously hard to predict. This uncertainty makes potential investors in alternatives to oil, in transport and in other areas, reluctant to invest.

The Government should evaluate a range of possible measures designed to ensure that the oil price experienced by New Zealand motorists (whether they drive petrol or diesel vehicles) remains high enough to encourage transport mode-shifting and investment in alternatives, rather than relying on the world price of oil to deliver these benefits. The possible measures encompass both the price and the supply of oil. The following measures should be modelled and evaluated, and the most suitable measure (or combination of measures) chosen:

1. Using variable levels of fuel tax to ensure that the price of liquid fuels derived from fossil fuels remains at or above a certain "floor" price (this price to rise over time, in line with emissions reduction and resilience targets), and using the additional tax revenue gained when the world price of fuel is lower than this floor to fund transport alternatives. Liquid fuels derived from non-fossil sources should not be subject to fuel tax.
2. Issuing fossil GHG emission permits under a cap-and-trade system, with a reducing cap.
3. Establishing a national quota for fossil fuels (either imported or total) and issuing permits to suppliers for quantities that add up to the national quota.
4. Government issued quotas or rations for individual GHG emissions – also known as “domestic carbon quotas” or a Citizen Entitlement. These could be either tradeable as proposed by the Sustainability Council, or non-tradeable; the latter could function like a debit card.

2.1.3.2 Measures to Support Transport Principles 1-4

2.1.3.2.1 Kick-start the new regime

In New Zealand transport it is effectively a given that energy use grows faster than either gross national product or population. A switch to constant energy requirements, let alone reductions, is a huge change. Such a major change of direction needs a ‘kick-start’ approach, to get across the message that the rules have changed and business-as-usual is no longer an option. A two-pronged approach is suggested:

- Introduce multiple ‘kick-start’ measures quickly. This will need an acceptance that mistakes can be managed but not avoided. A more carefully considered approach could avoid at least some mistakes but would almost inevitably make the greatest mistake of all: responding too slowly.
- Use the power of the market where possible, by giving businesses and individuals incentives to action. While well-designed taxation can provide good incentives, the objective should be to encourage a search for opportunities rather than settling for minimum compliance. In effect, that means a carbon charge, however structured.

Examples of ‘kick-start’ measures possibly suitable for early introduction are given below. The suggested approach is initially empirical, to allow early introduction, followed by refining as needed:

- Order new buses, trains, and associated infrastructure (electric where practicable) as soon as possible to meet rising demand for public transport.
- Change motor taxation to put costs on a mileage basis instead of the present time basis: insurance and registration as well as petrol tax.
- Offset increased transport costs by tax changes, especially for those least able to pay. Special attention should also be paid to meeting the demand for transport services of low-income and rural transport users in ways which do not unduly disadvantage them.
- Charge for carbon, initially as a tax (if that will speed introduction) but linked to an international market as soon as practicable. The charge should apply to all non-renewable fuel use, including aircraft fuel.
- Introduce energy efficiency standards for all New Zealand-new vehicles.
- Introduce congestion charging in main centres, and eventually on all roads subject to congestion.
- Reduce the open-road speed limit to 90 km/h, with a view to a subsequent reduction to 80 km/h. Make 30 km/h the default speed limit in shopping streets, past schools and in residential areas. These measures will bring energy savings both directly, through lower speeds, and indirectly through making streets safer and more attractive for walking and cycling.

- Tougher enforcement of parking on footpaths. For walking, an unobstructed footpath is the most basic need of all.
- Put serious effort into traffic demand management. If done well this should be much more cost-effective than building motorways. See 2.1.3.2.7 Policy support
- Introduce a feebate system to encourage the importing of lighter vehicles with smaller engines.
- Apply additional rules to government vehicles: No petrol engines 2 litre or larger — use diesel, hybrid or electric.
- Progressively raise charges until all modes are paying their full costs, including estimated externalities. An empirical alternative would be to subsidise modes meeting most or all of their costs.²³
- Disallow tax relief for car advertising on TV. Such advertising is almost always used to sell speed, power and size; features that are not in the public interest if climate change is an issue.

2.1.3.2.2 Detailed targets

The targets in the consultation documents are unclear. It is hard to tell whether the proposed savings are absolute reductions or merely a reduced rate of increase. For example, the draft target in NZEECS for ‘further on a full tank’ is an energy saving of 35 PJ/yr in 2030. This begs three major questions:

- Is ‘energy saving’ the same as ‘energy demand reduction’, or is it savings on some hypothetical business-as-usual scenario?
- What are the intermediate targets? There is a big difference between achieving half a 2030 target in 2010 or not until 2025. In the former case the target can probably be improved on, in the latter case it may not be met at all.
- Which actions are to be deferred and for how long? The 23 years to the primary target date of 2030 is substantially longer than the average life of an imported vehicle: does this imply no effective action for another decade?

Targets in the draft NZEECS document are particularly unclear because there is no comparison with current use and no measure of cumulative reductions. Some targets are too hedged by qualifications to mean anything. For example, what does it mean to require government agencies to “purchase 70% of their vehicles fit for purpose in the top 20% of fuel efficiency for class by 2009”? (NZEECS page 15):

- Why do only 70% of government vehicle purchases have to comply?

²³ Uncertainties in the value of externalities are not an argument against charging: it is better to be 80% right than 100% wrong. However, uncertainty may be a reason to set charges towards the bottom of the probability range.

- What does ‘fit for purpose’ mean? To be unfit, would a vehicle have to be completely incapable of doing the job, objectively unsuitable, subjectively unsuitable or merely ‘not what we usually buy’?
- What does vehicle ‘class’ mean? In the motor industry it usually means whatever advertisers wish.
- Why not in 2008?

A better approach might be to maintain a list of approved vehicles, published for use by the general public, with all government-funded exceptions to be approved by a central agency. A further step might be differential taxation of non-approved vehicles.

2.1.3.2.3 Alternative fuels

The biofuel proposals seem too optimistic, at least in the short term. Fuels made from tallow and whey can be blended into diesel and petrol, and existing readily available sources are adequate for roughly a 5% blend. Presumably these sources can be introduced quickly. Biofuels from other sources can be blended as they become available but overambitious targets may be counterproductive; too many cars may be unsuitable for the blended fuels or need expensive modification.

Biofuel sources may also create problems:

- Dedicating unsuitable land to biofuel production may create or exacerbate environmental problems. Palm oil grown in the Pacific Islands is mentioned as one option but the replacement of rainforest by palm oil plantations in South-East Asia is already causing widespread environmental problems.
- Unsuitable biofuel sources or processes may consume too much energy (sometimes more than the energy in the fuel). Or a source may be less energy-efficient as a motor fuel than when used in other ways, such as direct combustion for heating or electricity generation.

Another approach to promoting biofuels would be to ensure that the government or energy companies offer premium prices for biofuels from new sources. An initial five year contract might be reasonable, as is done in Germany. Any supplies in excess of a practical maximum blend for motor vehicles could be used unblended in railway or marine diesels, or selected heavy trucks refuelling at a limited network of biodiesel pumps.

An important alternative transport fuel in many countries is electricity for railway use. In New Zealand electric passenger transport is already used in Wellington and proposed for Auckland. Light rail and perhaps more trolley buses will also be suitable in some places.

New Zealand railways are predominantly used for freight and one section is already electrified: Hamilton to Palmerston North. Extensions to this electrification might be

justified — to Auckland and Tauranga are obvious examples — but many routes are too lightly used to justify electrification. Where suitable, rail electrification offers several advantages over diesel:

- Indigenous fuel use, roughly half of it from sustainable sources.
- Generally greater energy conversion efficiency and power availability.
- Regenerative braking in electric trains could increase rail freight energy efficiency by around 20% and urban passenger energy efficiency by around 50%.

Domestic electricity supplies are also a likely source for recharging electric cars, especially if the charging is done off-peak. Further analysis of this is needed, building on recent work done by the Electricity Commission.²⁴

2.1.3.2.4 Vehicle efficiency

An essential early step will be to introduce efficiency standards for all imported vehicles. The alternative is to continue as a dumping ground for polluting and inefficient second-hand vehicles. Rapid changes can be expected in new vehicle technologies and the chosen standards will need to be revised regularly. It might be helpful to allow manufacturers to comply with any of several standards, but probably unhelpful to allow them to pick and choose.

Standards for second-hand vehicles could reasonably be based on older versions of new-vehicle standards. This might be a better approach than simple vehicle age, because not all second-hand vehicles will have met the chosen standards when new.

There would be a case for limiting second-hand imports to smaller-engined vehicles.

A feebate system could be used to encourage lighter vehicles with smaller engines. In New Zealand this may well be a better option than average fuel consumption across a manufacturer's model range because it can be easily applied to all imported vehicles, both new and second-hand. For early introduction of feebates a simple and reasonably accurate proxy for fuel consumption could be (weight x engine capacity x constant). However, this would tend to create perverse effects and would probably need a more advanced system before long.

Feebates will tend to disadvantage those who need large light vehicles, such as farmers and tradesmen, but a blanket exemption for commercial use of light vehicles would be too easily abused. Another approach might be to exempt qualifying light commercial vehicles from some or all of the 'fee' side of feebate. Vehicles qualifying for exemption would need to meet special conditions such as: no petrol engines larger than, say, 1.8 litres (otherwise use diesel, hybrid or electric); maximum weight:power ratio (say) 80 kW/tonne; and limitations on body types (no cars).

²⁴ As available under "Demand side scenarios" at <http://www.electricitycommission.govt.nz/opdev/modelling/gpas/index.html#dss>

The vehicle efficiency field is likely to change rapidly as vehicle manufacturers react to climate change. A useful approach would be a specialist government agency to give advice.

2.1.3.2.5 Other transport efficiency measures

Litman²⁵ proposes twelve ‘win-win’ approaches to increased transport energy efficiency. Litman describes these approaches as, “cost-effective, technically feasible policy reforms and programs that help solve transport problems by improving transport options and correcting market distortions that result in economically excessive motor vehicle travel.” Many of Litman’s strategies are intended to expose drivers to their real costs and so encourage lower vehicle use. His strategies are:

Planning reforms	Revised planning and investment practices to increase support for alternative modes and mobility management. The aim is to ensure that all options are considered together on an equal cost-effective basis, looking at all costs and benefits, all treated in the same way. ‘Least-cost planning’ is another term used.
Pay-as-you-drive pricing	Convert fixed vehicle charges into distance-based charges. Perhaps surprisingly, this is helpful to low-income families, who already tend to minimise car use.
Parking cash-out	Offer commuters incentives to use other modes, as an alternative to ‘free’ workplace parking. Incentives may take the form of cash, a transit pass or carpool subsidies.
Parking pricing	Charge users directly for parking, often with variable rates. Commercial providers of ‘free’ parking, such as supermarkets, could be required to make an explicit and realistic charge.
Road pricing	Charge users directly for road use, reflecting true costs. This is particularly effective in reducing congested vehicle kilometres.
Transport demand management	Local and regional programmes that support and encourage use of alternative modes by providing information and encouragement.
Transit, rideshare improvements	Improve transit (and perhaps carpooling) by measures such as bus lanes and signal priority.

²⁵ In Todd Litman, *Win-win Emission-Reduction Strategies*. Victoria (Canada): Victoria Transport Policy Institute (2007), available at www.vtpi.org

Walking,cycling improvements	Improve conditions for walking and cycling by measures to provide safe, direct and pleasant routes. These measures also support transit and smart growth.
Smart growth	Accessible, compact, multi-modal land use reduces trip lengths and makes walking and cycling more practicable.
Freight transport management	Encourage businesses to use more efficient transport modes and practices, with better siting of industry and depots to reduce use of trucks.
Carsharing	Vehicle rental services that substitute for private automobile ownership reduce car ownership and use.
Revenue-neutral tax-shifting	Increase fuel and other vehicle taxes while reducing other taxation, and particularly increasing the tax-free income threshold.

Litman points out that these strategies have much broader benefits than either road-building or vehicle efficiency improvements. These include reduced costs of parking and other facilities; consumer cost savings; crash savings; improved mobility options; improved population health; more effective land use and more liveable communities.

Two planning and investment reforms (Litman's first point above) needing particular attention in New Zealand are:

- The road rules need to be much more user-friendly to pedestrians and cyclists, who are seldom given priority. Worse, by attempting to specify vehicle priority in all cases, the road rules inadvertently specify who does **not** give way and positively encourage aggressive driving.
- Transport investment decisions are much too diluted to achieve the integration needed. Transit NZ plans state highways, local councils plan local roads, ONTRACK plans rail and regional councils plan public transport. The only links are through regional plans and Land Transport NZ funding, but neither is able to ensure equal consideration for all projects.

2.1.3.2.6 Land use

It is disappointing that none of the transport measures proposed in either consultation document recognise the crucial interactions between transport and land use. It is widely recognised that New Zealand cities have low densities and correspondingly high car use, and cannot be compared directly with more compact European cities. This is clearly a barrier to reducing transport energy use. However, a much greater barrier is the perception that this situation is unchangeable and can only be

perpetuated. Newman and Kenworthy identify ten myths of the inevitability of this ‘automobile dependence’.²⁶

The reality is that most cities renew existing infrastructure, including buildings, at an average rate of about 1-2% each year. This is an addition to new construction. Using ‘smart growth’ (another name is ‘urban villages’) a proportion of infrastructure renewal can be focussed on localised areas with higher density. Medium-density housing and commercial development can be grouped around parks, shops and a good public transport centre, forming a community where almost all internal trips can be made by walking or cycling. In Europe at least one new town of 20 000 people has been built to such a standard (Houten, Netherlands). However, development within an established area for a population of a few hundred up to 5000 (Vauban, Freiburg) or even 10 000 (Arabella Park, Munich) is more usual. There are also examples in North America (False Creek, Vancouver, River Place, Portland).

Measures influencing land use and supportive of reduced transport energy use include:

- Ensure that local authorities are able to set an effective urban development boundary and restrict development outside it. An effective boundary could perhaps be a condition placed on some types of government funding.
- Ensure that local authorities are able to control land acquisition and development for urban villages.
- Tax breaks for defined types of development as a ‘kick-start’ measure for urban village development. Another approach would be a government-sponsored model project.
- Rapid transit serving suitable development sites.
- Traffic priority for on-street transit.
- Plan industrial land to minimise transport needs.
- Improve transit to minimise the need for cars.
- Traffic calming, including speed-reducing measures; transit lanes; tree planting; traffic barriers; wider footpaths; and segregated or semi-segregated cycle facilities.

Newman and Kenworthy point out that professional planners and engineers, in a range of disciplines, will need to rethink the way they work. The suggested principles for change are recognising values; maximising diversity; crossing boundaries; and facilitating organic processes.

²⁶ In P. Newman and J. Kenworthy, *Sustainability and Cities: Overcoming Automobile Dependence* (Washington: Island Press, 1999), ISBN 1 55963 660 2

2.1.3.2.7 Policy support

Social marketing is a technique that can massively increase the uptake of efforts to change public behaviour. One or more government-sponsored pilot schemes might be a good approach.

Cairns, et al, describe a range of ‘soft’ traffic demand measures, which they describe as: “...fairly new as part of mainstream transport policy, mostly relatively uncontroversial, and often popular.”²⁷ They include:

- Workplace and school travel plans.
- Personalised travel planning, travel awareness campaigns, and public transport information and marketing.
- Car clubs and car sharing schemes.
- Teleworking, teleconferencing and home shopping.

Cairns and her colleagues have developed a ‘high intensity’ programme of demand measures which they estimate could achieve (in the UK) a nation-wide traffic reduction of about 11% in ten years. They give a breakdown of attainable traffic reductions as:

	Peak	Off-peak
Urban traffic	21%	13%
Non-urban traffic	14%	7%

However, Cairns, et al, point out that gains on this scale would tend to attract more car use, by other people, which would offset the gains. They suggest that success depends on a range of supportive policies:

- Re-allocation of road capacity and other measures to improve public transport service levels
- Parking control.
- Traffic calming.
- Pedestrianisation.
- Cycle networks.
- Congestion charging or other traffic restraint.
- Other use of transport prices and fares.

²⁷ In S. Cairns, L. Sloman, C. Newson, J. Anable, A. Kirkbride and P. Goodwin, *Smarter Choices: Changing the Way We Travel*. London: Department for Transport, 2004, available on the ‘Sustainable Travel’ section of www.dft.gov.uk

- Speed regulation.
- Stronger legal enforcement levels.

2.1.3.2.8 Public transport

The NZES offers general support for public transport, and notes that the Auckland Regional Land Transport Strategy aims to double public transport patronage over the next decade (p.35). However, it neglects to mention that this aim won't be achieved by current funding levels. Even though the Government and the Auckland Regional Council have indeed put significantly more funding into public transport over the past five years, this has been nowhere near enough to meet latent demand.

The “Action” on p. 36 of the draft NZES is “Public transport and non-motorised forms of transport will need continued and increasing support”. However, the NZEECS section on public transport only suggests existing levels of funding support will continue. This is completely inadequate, both in Auckland – where the Auckland Regional Council has been discussing the public transport funding shortfall with the Government over the past year and not succeeded in breaking through the funding impasse – and in the rest of the country.

As previously noted, the institutional and financial arrangements which favour road building over other forms of transport funding provision lead directly to a transport system designed to produce ever-increasing levels of greenhouse gas emissions.

Additional measures which could be adopted by local authorities include:

- Encourage local authorities to remove minimum parking requirements from district plans and substitute maximum requirements, using the same or a lower figure.
- Motor vehicles could be required to give way to buses leaving a stop (already done in Brisbane if the speed limit is 70 km/h or above). Alternatively, remove the bus parking bay and have the bus stop in the traffic lane.

Government will need to monitor trends in regional plans, and assist regional planning by developing model plans and technical guidelines. It would be helpful to ensure that local authorities are able, and encouraged, to use district plans to set priorities for urban transport modes, with more sustainable modes often given explicit priority.

2.2 Air and Sea Transport

2.2.1 Air Transport

The draft NZES and other policy documents pay very little attention to air transport. However, air transport emissions, the rising costs of aviation fuel, and public perceptions of the environmental damage done by flights to and from New Zealand (as seen in the current “food miles” debate, and the nascent “tourism miles” debate)

2.2.1.1 Air Travel and Climate Change

World air travel has been growing rapidly, and industry and government projections, based on a business-as-usual model of fuel supply, expect it to continue growing.

Although airplane travel accounts for only 3 percent of global carbon emissions, it is the fastest growing source of emissions. The Aero2K project compared actual emissions in 2002 with projected emissions in 2025, and came up with the following comparison:²⁸

	Distance flown (1000 million nautical miles)	Fuel used (Tg)	CO ₂ produced (Tg)	H ₂ O produced (Tg)	CO produced (Tg)	NO _x produced (Tg)	HC produced (Tg)	Soot produced (Tg)	Particles produced
2002	17.9	156	492	193	.507	2.06	.063	.0039	2.03x10 ²⁵
2025	36.1	327	1029	404	1.15	3.308	.1447	.0087	8.54x10 ²⁵

As this report says, “For 2025, the scenario confirms the challenge faced by civil aviation in mitigating the mass of emissions resulting from the increased passenger and freight demand”. The report assumes that a demand increase of 2.6 times in this period will be met by just over a doubling in distance flown, due to projected larger aircraft and higher load factors.

Emissions from domestic air travel are included in the Kyoto Protocol, but emissions from international air travel are not. The International Civil Aviation Organization, a UN agency, is the body charged with coming up with a way of reducing greenhouse gas emissions from international air travel. Although the ICAO has proclaimed itself to be in favour of emissions trading, it has not taken any concrete steps in this direction. Therefore, the European Union is developing its own plan to deal with aviation emissions.

2.2.1.2 Air Travel and Fuel Costs

²⁸ From

http://www.cate.mmu.ac.uk/aero2kreports/AERO2K_Global_Aviation_Emissions_Inventories_for_2002_and_2025.pdf, p. 7, cited 24 April 2006

Projections of unchecked growth in aviation do not take into account the effects of higher fuel costs on aviation use, and the possibility that aviation fuel may become harder to obtain.

The cost of fuel varies as a percentage of an airline's total costs, depending on its fleet, route structure, load factor, etc. In September 2004, Burston-Marsteller Brussels noted:

However, not all airlines are equal. In the traditional business model, the cost of aviation fuel is approximately 14 – 16 % of an airline's cost base. In contrast, for some newer, leaner airlines with a lower cost base in other parts of the business, this figure can rise to around 20 – 25 %.²⁹

Jet fuel prices tend to run ahead of, but closely correlated with, crude oil prices – this gap is known as the “crack spread”. In the period from April 2004 to April 2006, the benchmark Singapore Jet Fuel price increased by over 100% – from US \$40/bbl to US \$89/bbl. Refining petrol is more profitable than refining aviation fuel, which has implications for aviation fuel supply in times of shortages.

A further factor is that most airlines do not pay the current market price of fuel. Instead, they enter into hedging arrangements, under which they enter into an arrangement to pay a fixed price for fuel for a future period. The airline then benefits if the fuel price during that period is higher than the hedged price, and loses if it is lower. These hedged positions have been shielding airlines from the full effect of rapid jet fuel prices, but as the hedges run out, the airlines are exposed to either a new hedged position at a higher price, or (especially for smaller airlines) the full, unhedged price. On 21 April 2006, in announcing a 10% fare rise across all domestic and international flights effective from 1 May, Air New Zealand Chief Financial Officer Rob McDonald said that the steep rise in jet fuel prices meant Air New Zealand's fuel bill had risen from \$480 million in FY04 to nearly \$1 billion in FY06.

"Until now customers have been shielded from much of the effect of these price rises by the Airline's fuel hedging programme. The Airline has also borne additional fuel costs over and above its hedging, avoiding passing those costs on to customers," he said.

But recent falls in the value of the New Zealand dollar against the US dollar and the fact that Air New Zealand's more favourable fuel hedges have rolled off compound the situation and mean this shortfall must now be addressed.³⁰

Thus, squeezed by concerns over its emissions' disproportionate and rising effect on the global climate on the one hand, and by difficulties caused by high and unpredictable fuel costs on the other, the industry is not in good shape to respond to consumer concerns about “food miles” and “tourist miles”.

²⁹ From http://www.bmbrussels.be/box_bmairline.php, cited 24 April 2006

³⁰ From http://www.nzij.co.nz/index.php/nzij/member_area/announcements?number=130336&code=AIR, cited 24 April 2006

2.2.2 Sea Transport

Sea transport has so far been largely ignored in discussions of the greenhouse gas emissions effects of international transport. However, a recent report claims that global CO₂ emissions from shipping are twice those from aviation.³¹ Therefore, it is important that shipping be subjected to the same scrutiny as aviation. This one of the reasons that we support an integrated New Zealand Freight Strategy, based on a careful analysis of the fossil fuel usage and greenhouse gas emission effects of all freight transport modes, rather than the New Zealand Shipping Strategy proposed in the draft NZES.

2.2.3 Policy Recommendations: Air and Sea Transport

Proposal: The NZES, NZEECS and climate change documents should be amended to give substantially more coverage to air transport (and also sea transport), and that the following steps be taken:

1. Ensure that the necessary data collection facilities are in place to be able to do full lifecycle emissions accounting for air and sea transport to, from, and around New Zealand.
2. Play a positive part in international negotiations to ensure that emissions from international travel are included in international accounting for GHG emissions, and that the factors which exacerbate aviation's climate effects (such as the formation of contrails, and the height at which emissions are released) are taken into account.
3. In parallel with greater support for teleworking and telecommuting within New Zealand, provide support and incentives for international business travel to be replaced by teleconferencing and internet-based communications wherever possible.
4. Encourage research into environmentally more sustainable alternatives to present methods of air and sea travel.
5. Encourage the tourism industry to prepare for the risk of a future in which fewer tourists visit New Zealand, and those that do, stay for longer.

³¹ See <http://environment.guardian.co.uk/climatechange/story/0,,2025726,00.html>, cited 15 March 2007

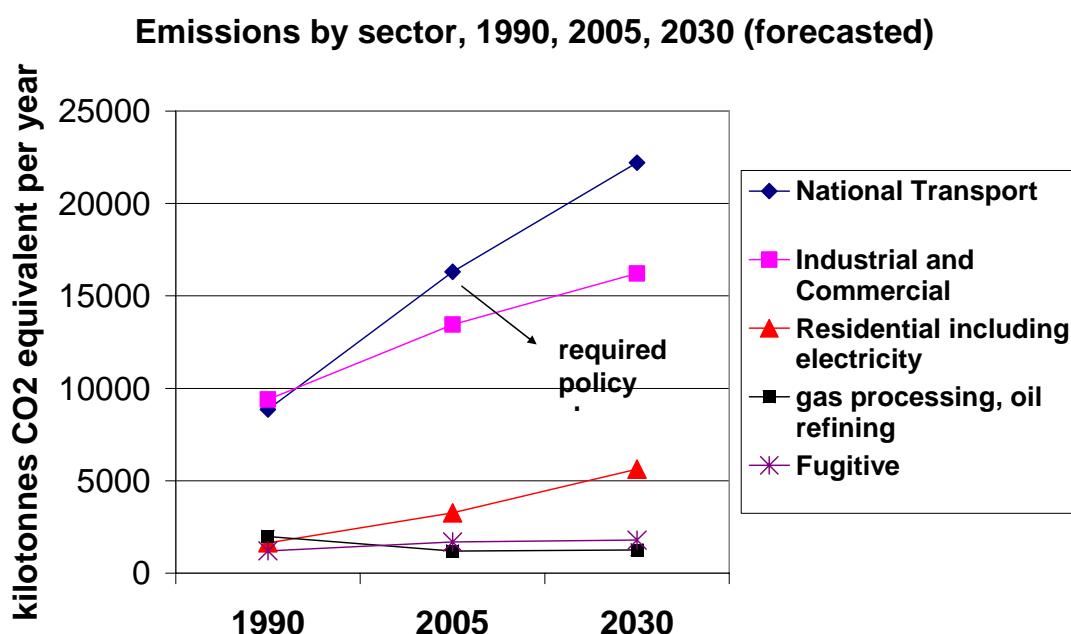
2.3 Stationary Energy

2.3.1 The Vision and Stationary Energy Principles of the Draft NZES

The “vision” of the NZES is given as **“A reliable and resilient system delivering New Zealand sustainable, low emissions energy.”**

The graph indicates the magnitude of this task. It shows emissions from the major sectors in 1990, 2005, and forecasted, based on data recalculated from the tables from *New Zealand Energy Outlook 2006* for 2030 (see Appendix 2, Section 1). All the major sectors are trending strongly upwards, with transport the biggest growth in emissions, and residential emissions also growing strongly.

Figure 2: Emissions by sector, 1990, 2005, 2030 (forecasted)



2.3.2 Principles expressed in the NZES

- NZES, p. 10, states the important principle, **“to invest in energy efficiency whenever this is cheaper than the long run marginal cost, including externalities, of new generation”**.

This principle is repeated in different forms in NZES, NZEECS, and the unpublished background document to NZEECS, the “Sustainable Value Project”.

The definition of “cheaper” varies between documents. The unpublished Sustainable Value Project says it means less than the spot price plus half the network costs. Consumers would judge cost-effective to mean less than retail price..

NZEECS and NZES assume that retail prices will rise in line with the cost of new generation, around 1% real per year. This was confirmed at the March 9th meeting between NGOs and officials. That however would be a complete break from the trend of the last six years, in which residential prices rose by 5.5% real per year. (The issue of the market power of generators and retailers will be addressed later in this submission.)

Proposal: The NZES principle “to invest in energy efficiency whenever this is cheaper than the long run marginal cost, including externalities, of new generation” should be reworded as “to enable consumers and suppliers to invest in improved energy efficiency whenever this is cost-effective for them”.

This task may seem trivial – it is anything but. Many overseas studies, including a major survey by an IEA task group, confirm that a great deal of cost-effective energy efficiency investment does not take place, because of multiple barriers inherent in the current market structure (see Appendix 3). But officials seem unconvinced that there is any market failure, or any policy response required. They appear not to consider the lack of carbon pricing to be a market failure.

In fact the failure to invest in cost-effective energy efficiency – with improvements averaging a mere 0.4%/yr – is a clear case of market failure, as is confirmed by overseas experience. The value of continued internal reviews of energy efficiency performance is questionable. Independence of political agendas will be essential if the performance is to be improved.

- **Providing clear direction on the future of New Zealand’s energy system**

The Prime Minister’s Speech from the Throne has strengthened the hand dealt by NZES. It was followed by a letter by the Minister to generating companies reinforcing his preference for renewable generation. Contact Energy has announced that they will defer Otahuhu C; Mighty River Power has abandoned its proposal to generate from coal at Marsden B. Both are developing only renewable electricity projects.

Some further guidance has been given in a set of regional renewable energy studies, so far including Canterbury, Marlborough, and the Far North. This is an important first move, and could be the basis for development of smaller-scale energy systems, which are more likely than large energy projects to deliver multiple benefits, including economic development, to the regions. However almost all such projects compete with electricity suppliers, who have raised very effective barriers to widespread introduction of distributed energy.

No such clear direction has been yet set towards energy efficiency improvements. EECA’s Sustainable Value Project was apparently to be the basis of a new set of energy efficiency targets. The report is still unpublished. It considered only a small set of residential options, and this is likely to have limited the scope for setting a generous target for residential energy efficiency.

The NZEECS has asked how stringent targets for energy efficiency and renewable energy should be. The lack of supporting data and modelling make it extremely difficult to give a specific answer.

The energy efficiency goal would seem far too modest: an indication given at the February 15 NGO conference, was that some \$2 billion invested in energy efficiency, over a period of about 25 years, might yield \$4 billion of national benefit (assessed at a 5% discount rate). In contrast, the major retailer-generators plan to invest on the order of \$12 billion in the next decade (not all this investment will be realised). Investment in energy efficiency should not be significantly less than investment in new electricity generation.

To maintain direction, supporting policies are needed to improve efficiencies throughout electricity transmission, distribution, end-use, and storage to accommodate intermittencies of renewable energy sources. Otherwise electricity shortages are certain to recur, and there will be a renewed clamour for gas-fired or even coal-fired power stations to be built.

- **Maintaining high levels of security and reliability at competitive prices**

This, like most of the subsidiary goals of NZES, contains internal tradeoffs between security and price. Some domestic customers will prefer lower prices, rather than “secure supply” even in a 1 in 60 dry year. They are not given the choice. High prices are causing many people to cut back on electricity use, leading to cold houses and costly medical problems.

Highly publicised security problems occurred in the electricity system last winter. Reasons for the blackouts were varied – maintenance issues and lack of redundancy of transmission capacity through Otahuhu, storm events in South Canterbury, and sheer growth in electricity demand, exacerbated by a very cold winter with Genesis Energy’s new gas station at Huntly not yet commissioned. But now that this and other power stations have been commissioned, and with expenditure on transmission upgrades rising from \$200 million to \$300 million annually, similar blackouts are extremely unlikely this winter.

Security of gas supply may be a different issue. Gas contracts for power generation are reported to give incentives for continuous offtakes rather than using gas when it is most needed.³² This could well be a result of the physical characteristics of Pohokura, which has been reported to flow much less freely than Maui. If that is true, then it will not be able to contribute as much to security of electricity supply as did the Maui and Kapuni fields.

The failure to find large new reserves of gas induced the government to subsidise the risk that the new combined cycle gas-fired power station at Huntly may not have sufficient gas to run through its economic lifetime.

³² “Pohokura Gas Deal Hard to Manage”, *Sunday Star Times* (March 4, 2007), p. D3

Genesis and Contact Energy have mooted a project to import liquefied natural gas (LNG) to run their power stations – but world prices are rising fast as some of the big fields are being run down.

The lack of specific information in NZES, or the supporting *New Zealand Energy Outlook 2006*, suggests that the “security at competitive prices” is an aspirational rather than a realistic goal. It would be better to separate “security” and “affordability” into two separate goals, so that the potential conflicts between them can be resolved transparently.

- **Maximising how efficiently we use our energy to safeguard affordability, economic productivity and our environment**

Again, this NZES goal contains unresolved tradeoffs. In the last five years, there has not been significant progress towards the goal of “maximising how efficiently we use our energy”. The difficulties of reversing current trends must not be underestimated – but they must be overcome.

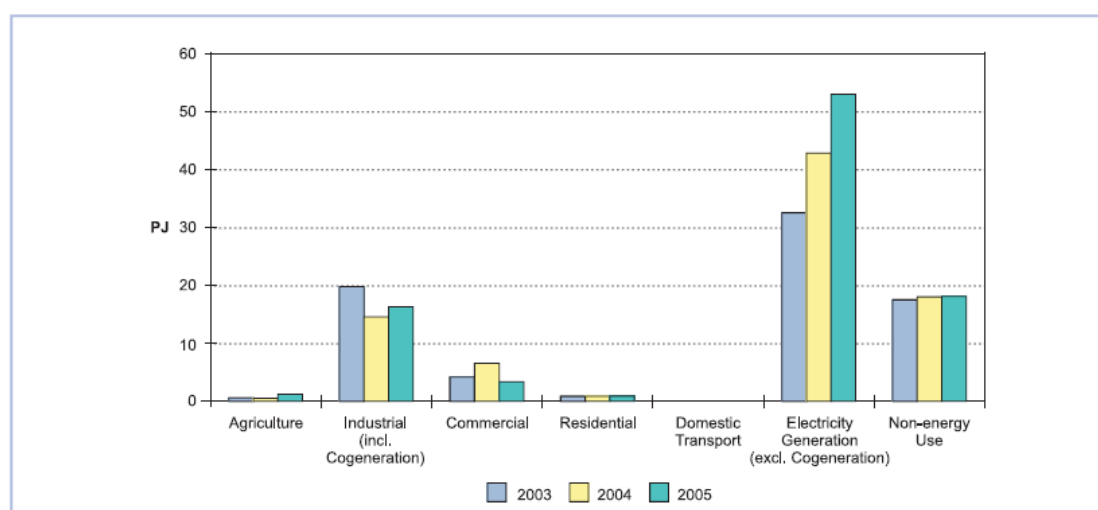
- **Maximising the proportion of energy that comes from our abundant renewable energy resources.**

As with energy efficiency, New Zealand has failed to make progress towards its present renewable energy goal. The amount of renewable energy being developed is increasing, but fossil fuel use is increasing faster in both transport and stationary energy. Until a broad carbon charge is introduced, to bring the carbon charge to all consumers, any improvement is likely to require a host of specific measures, each open to intense lobbying and certain delays.

- **Reducing our greenhouse gas emissions.**

This is a simple, well-defined goal that can be applied sector by sector. As described in Appendix 1, the electricity sector has a regulatory system which could set a goal of “minimal CO₂ from electricity by 2025”. A 10% per year reduction in electricity CO₂ could be achieved by rapid substitution of Huntly coal-fired generation by combined-cycle gas generation, together with new wind power and introduction of low- CO₂ geothermal generation (all geothermal emits at least some greenhouse gases). This could be achieved by Government instructing the Electricity Commission to deliver this emissions profile. The Commission already delivers security-of-supply outcomes, through its reserve generator at Whirinaki, so this is not a new precedent.

A similar opportunity to reduce emissions comes from the fact that some 20 PJ per year of coal is used in industrial or commercial boilers. Many of these could be readily adapted to use wood pellets, thus immediately becoming zero-carbon (save for the energy used to manufacture and transport pellets). More efficient but requiring higher capital cost is to convert coal-fired boilers to use wood chip or hogged wood, or replace them by modern biomass boilers. The Energy Data File, Sept 2006, gives a comparison of coal consumption in years 2003-2005:

Chart C.3: Calendar Years Comparison of Coal Consumption by Sector

Accountability for achieving a target of reduction of coal use is not so easily defined as for the electricity sector. The coal industry is a significant political force, making any transition from coal to wood fuels more difficult.

The residential sector emits about 9% of New Zealand's energy sector greenhouse gases. Most of this comes from winter peak-time energy – electric space heating and lighting. Barriers to reducing these emissions are discussed later.

As shown in Figure 2, to even begin to reduce greenhouse gas emissions is to reverse a strong trend of increasing them. It will require major changes in urban form and rural land use as well as the simpler changes in the stationary energy sector. If it is achieved, New Zealand's landscapes, cities, houses, businesses and transport systems will be transformed.

• Promoting environmentally sustainable technologies (see Appendix 4)

Energy research and development is funded mainly by the Foundation for Research Science and Technology. The process appears to be driven not from the viewpoint of end users of energy research, but rather from the research organizations themselves. This, like any funding (or regulatory) system, risks being captured by those who use it, at the expense of those who might wish to.

Today there is significant funding made available for “saviour technologies” which offer little hope of delivering results for one or two decades or more if at all. Examples include coal carbon sequestration, and the “hydrogen economy”.

Research on energy efficiency is almost negligible, and research on efficient home wood burning is conducted mainly by the Ministry of the Environment. The perception in the firewood industry is that log burners are on their way out, even though perhaps a half of New Zealand's houses are in airsheds that

do not suffer serious pollution. Also, health impact studies relating to household energy use are still having difficulty getting sufficient funds.

Instead of relying on technology-driven projects, sustainability needs to be a systemic aspect of all technology and infrastructure projects, driven by strict efficiency and emission standards. “Highest-value” needs to be a primary criterion in choosing research and development projects, rather than “lowest-cost”.

Coordination of tertiary energy research has already begun through the NERI initiative (see Appendix 4), so it is not clear that a separate “sustainable energy research and education centre”, as proposed in NZES, is needed. It is the low level of funding, especially of university research and polytechnic training programmes that is particularly important.

Proposal: The New Zealand Energy Strategy should include strong support for the NERI initiative and should avoid the creation of a redundant sustainable energy research and education centre.

2.3.3 The Transition to a Sustainable, Low Emissions Stationary Energy System: Six Principles

Proposal: The following six principles should guide the transition to a sustainable, low-emissions stationary energy system:

1. Invest in energy efficiency whenever this is more cost-effective than new energy supply.
2. Recognise multiple benefits of local energy resources.
3. Use “engineering efficiency” and “ecological efficiency” as the main criteria for assessing priorities for action.
4. Invest in the transition towards sustainability.
5. Fund low carbon policies.
6. Focus research, development, and resource assessment on technologies and skills to achieve early results.

These principles, though not a complete logical set, should give guidance for the most effective actions.

1. Invest in energy efficiency whenever this is more cost-effective than new energy supply.

The NZES applies this principle particularly to electricity generation, which it compares to energy efficiency investments.

Winter peak demand is driving new investment in electricity supply, and these peak loads come almost entirely from household demand. Core drivers of the growth in household energy demand were analysed in a Centre for Housing Research study.³³ Of a predicted demand growth of about 23 PJ/year by 2031, about 10 PJ comes from population growth, 8 PJ/yr comes from increased expected heating in houses, and 5 PJ/yr from the trend to bigger houses.

It is difficult to bring policy action to bear on population growth or the trend in house sizes, but home insulation and the efficiency of appliances and heating systems could be modified by suitable incentives. The CHR report extrapolates current trends in home heating and suggests that by 2031, half New Zealand's houses will be using heat pumps for heating – and cooling. While approximately three times as efficient as electric space heating, heat pumps are still driving increases in winter evening demand, in Christchurch at least.³⁴

If the market were perfect, the right investment choices would be met without government intervention. Prices would fully reflect costs, and each consumer would either buy electricity, or find some other way of meeting their needs for energy services.

The worldwide movement to restructure and “unbundle” electricity systems was intended to reveal the real costs of electricity supply, which vary by tens or hundreds of times or more, from time to time and from place to place. The promise of the “electricity market” was that consumers would be shown when and where electricity was expensive, and would shift their load to cheaper times, or use other energy forms (solar, gas, wood) if electricity was too expensive in their location.

New Zealand's electricity market was more complex than almost any overseas example, yet the promise of close reflection of costs has not been fulfilled. Until pricing systems fully reflect costs – including externalities such as greenhouse emissions, energy efficiency will be relegated to a system of “measures” and even subsidies, made necessary by market failures.

Major barriers to energy efficiency investments must be overcome. One of these is the required payback period. Large generators can bank their new power stations at low interest rates, or even fund them off their balance sheet – “They have been putting up prices to help pay for the billions of dollars in new and planned power generation and transmission lines in coming years”³⁵ The lowest third of household income earners cannot invest in anything – they are in a state of permanent cash flow deficit. The upper 3-4 deciles have sufficient discretionary income to consider spending it on energy efficiency

³³ Taylor Baines and Associates, “The Impact on Housing Energy Efficiency of Market Prices, Incentives and Regulatory Requirements” (Oct 2006), 46. Available at <http://www.hnzc.co.nz/chr/pdfs/housing-energy-efficiency-report.pdf>

³⁴ Orion Networks, submission to Electricity Commission “Statement of Opportunities”, Sept 2006

³⁵ “Power Firms’ Profits Soar as Prices Rise”, *Dominion Post* (23 March 2007), p. C1

improvements.³⁶ However, the potential for such investment to defer new electricity investment is not recognised

For both consumers and suppliers, investment in energy efficiency is affected by perverse incentives. As many of the most inefficient households are rented; the landlord has to make the investment, which is unlikely to be recovered in the rental. Householders who own their own homes are more than likely to move every few years, before major investments pay back. The Household Energy Rating Scheme is one means of addressing that barrier, and needs to be pursued vigorously. Meanwhile, energy suppliers, including gas and electricity network companies, have strong incentives to sell more energy in order to make more profits. This perverse incentive is particularly difficult to modify in a fully deregulated, supposedly competitive, market. This is further discussed in Appendix 3, “Institutional Barriers to Demand Side Management”

Often the budgeted appropriations for energy efficiency, both from EECA and the Electricity Commission, are underspent. If there is a reasonable levy for energy efficiency, *and if it is used*, then progress can be made.

Energy efficiency involves education and training, at least as much as it involves technology. Human capital can be built up, or destroyed, as easily or more easily than physical capital investments. A system of household energy audits could be set up so trained auditors, preferably from a similar socio-economic background to those they audit, could give independent recommendations on what is most worthwhile for their particular circumstances in insulation, double glazing, draught stopping, heating appliances, solar water heating, replacing of faulty fridges, etc.³⁷

The highest priority investments are those in the longest-lived assets. Buildings and transmission and distribution lines have lifetimes typically of 70-100 years, and will therefore outlive fossil-fuelled power stations and the mines that provide their fuel. They should be rigorously future-proofed, so they will utilise energy effectively in the long term when energy may be two or three or more times as expensive as today.

Building codes are perhaps the most important means to accomplish this. All buildings that will have large hot water and space heating requirements should be required to supply these from renewable energy – solar heat or wood-based fuels – and the large ones could be expected to install combined heat and power systems. Hospitals and rest homes would be prime candidates for this type of policy.

2. Recognise multiple benefits of local energy resources.

³⁶ Taylor Baines and Associates, op cit, 23.

³⁷ Social marketing studies show that energy audits need to be accompanied with assistance in the installation and use of energy efficient technologies before uptake will be widespread. Such measures need to be instituted alongside energy audits.

Local energy sources, including energy efficiency upgrades, often yield multiple benefits, including healthier and more comfortable housing, improved waste management, and development of regional economies. Such “economies of scope” – the yields of multiple benefits – are much harder to quantify than economies of scale. New Zealand’s public policy is heavily dependent on conventional cost-benefit analysis, the outcomes from which are very dependent on the assumptions. Outputs that are not quantified are all too frequently set to zero.

An important example of multiple benefits is in self-generation of electricity in remote regions, where the distribution lines may be considered uneconomic. As the Electricity Act stands now, those regions could be disconnected after 2013, or their prices could rise drastically. Most such regions have at least some resources which could generate electricity at reasonable cost, though not as cheaply as large-scale generation. Local generation schemes can be assembled into “mini-grids” to improve diversity of supply and storage, and reduce the investment by each consumer in batteries and inverters. The whole system could then be available to generate excess electricity in times of real shortage, especially in very dry years. Storm damage to lines would no longer isolate such a community, which could then rely on its own generation sources. Thus security of local and national supply, increased renewable energy, reduced line losses, and local employment opportunities, could all be improved by developing local energy resources.

In urban areas, passive solar energy can be promoted through much greater use of shade trees: pruning their lower branches can let all the winter sun in, while the high canopies can shade roads and driveways. “Leafy suburbs” are a benefit in cities and rural towns alike, and add character as well as shade. District councils facing the cost of maintaining such trees could well utilise wood-chip for energy – if only the clean efficient wood-burning boilers were available. And this would reduce the present high costs of removing overmature pine trees – a big problem in Wellington and perhaps some other centres.

One concept is the “energy-ecology park” – close to houses, perhaps adjacent to native bush. Trees and shrubs could extend the range of native birds, as is already happening at Karori Sanctuary. Wind turbines in the hills between Porirua and Paekakariki may seem more acceptable if recreation opportunities, already developed in the adjacent pine forests, were extended, and if firewood gathering was allowed.

3. Use “ecological efficiency” or “engineering efficiency” as the main criteria for assessing priorities for action. “Economic efficiency” has its place, but more in deciding what incentives are best to stimulate actions than in prioritizing the actions themselves.

Ecological (including engineering) efficiency principles include:

- **Match energy supply where possible to end uses: use electricity for heat only when it is in surplus.**
- **Develop energy storage technologies, a key to accommodating intermittent renewables.**
- **Recycle and re-use resources, including nutrients from waste water, and also forest products and residues.**

4. Invest in the transition towards sustainability.

As countries in Europe are discovering, public investment in sustainability, properly directed and appropriately monitored, reaps both environmental and economic rewards. Such public investment is not incompatible with independent, non-politicised regulation of the energy sector. Designing such regulation must become a major research and consultative task.

- Regulate to create fair market place where small businesses can compete with incumbent big businesses.
- Modify existing lines company regulation to align commercial incentives with public goals. Present ODV and price cap regulation (as discussed in Appendix 3) is driving lines companies to push more kilowatt-hours over lines of limited capacity; the resulting high losses cause them to sell more electricity and generate higher profits at the expense of increased line losses.
- Require super-profits to be defined and disclosed, so that all or some of them can be re-invested in ways that overcome market barriers or anticompetitive business behaviour.

5. Funding low-carbon policies: The following hierarchy is appropriate –

1. “Polluter pays” is most desirable because it encourages investment in the most desirable energy sources;
2. “Consumer pays” is generally acceptable but not where the consumer is effectively captive to particular fuel types. Consumer impacts should be mitigated by policies that offer low-carbon alternatives to each consumer.
3. “Taxpayer pays” has a place, but only where sustainability services are purchased on behalf of future generations: for example, purchasing carbon sequestration in forests or soils, or setting up training schemes for sustainable energy service providers and auditors. This is investment in human capital, a valid use for public funds.

6. Focus research, development, and resource assessment on technologies and skills to achieve early results.

Energy efficiency

Energy efficiency technologies are generally well known by researchers and enthusiasts, but not so by the wider public, who have serious misconceptions due to years of misinformation, and need implementation mechanisms rather than research and development. In contrast, development of renewable energy technologies needs to be prioritized in terms of their usefulness in the New Zealand context.

For energy efficiency and demand management tools to be taken up by the public, they need to be easy to understand, easy to install, and easy to use. In this area, social marketing campaigns can play an important role. Funding the installation of energy-efficient and demand management consumer products should also be considered.

Smart meters and smart grids will create opportunities for electricity consumers, both large and small users, to reduce peak demands and therefore the overall cost of electricity supply. This will directly reduce electricity losses which are much higher at peak periods, and reduce CO₂ emissions because thermal generators are at the margin at peak times. Today Meridian is introducing “real-time” meters to customers in Central Hawkes Bay and Christchurch – but these do not allow electricity use to be reconciled within the electricity market, so the greatest opportunities for consumers to reduce their power bills will be lost.

Smart grids to realise their full potential will require major changes within distribution networks, as well as giving great opportunities to for small-scale energy generation and storage, and price-responsive demand. They need to be designed in conjunction with introduction of smart meters, and only after extensive consultation with stakeholders. At present the metering initiatives are being undertaken by retailers with no consultation at all.

The International Energy Agency has a major project in how to use technology and pricing systems to facilitate “demand response”. New Zealand was invited to join the task force on network-driven demand response – especially important because of the high cost of the long transmission and distribution lines in New Zealand. Despite much urging by NGOs, New Zealand has not joined this project.³⁸

Renewable energy

Direct solar energy is by far the largest renewable energy resource, and has a very wide range of benefits. Access to it should be protected and enhanced by all our legislation. Solar radiation in New Zealand delivers about 1 kW per square meter, or 1 kWh in an hour at high noon. Averaging this over night and

³⁸ The potential to reduce electricity costs is described in several articles in the “Spotlight” newsletters – see [http://dsm.iea.org/Files/Exco%20File%20Library/Spotlight%20Newsletters/IEA%20DSM%20Spotlight-Issue28-December2006\(v2\).pdf](http://dsm.iea.org/Files/Exco%20File%20Library/Spotlight%20Newsletters/IEA%20DSM%20Spotlight-Issue28-December2006(v2).pdf)

day, sunny and cloudy, winter and summer, solar radiation delivers about 150 watts per square meter – more than enough for a house to supply all its energy needs from photovoltaic plus solar water heat plus passive solar space heating.

Photovoltaic panels convert about 12% of the available solar energy to electricity at a high but reducing capital cost. Solar water heaters convert about half the energy to hot water, at costs comparable to retail electricity prices, assuming a 6-8% return on investment. Passive solar energy for space heating and even cooling is by far the most cost-effective use of solar – but householders are frequently deprived of solar access through shading by neighbouring buildings or trees. Far more effective bylaws need to be in place and enforced if passive solar is to reach its potential.

Hydro: Compared to the virtually unlimited quantity of direct solar energy, hydroelectricity now delivers 84 PJ per year to the New Zealand economy. The capital cost was often very high – Clyde was assessed as having cost \$2.1 billion and delivered electricity at 19c/kWh. But with the lowest running costs, hydro is a particularly valuable resource, and enabled rapid development of energy-intensive industries. The future of energy-intensive materials need to be worked out in the context of realistic carbon pricing – New Zealand may well still have a role in this area.

Future hydro development is feasible at all scales ranging from hundreds of megawatts (the abandoned Project Aqua), down to kilowatt-sized generators located in drop structures in hydro canals and other drop structures. Generating from irrigation canals has the extra benefit of providing electricity for irrigation at exactly the time it is needed, thus reducing peak demands on distribution lines which are now experiencing their peak demands in summer.

Members of the Sustainable Energy Forum have a range of opinions on the merits of developing more hydro, and whether pumped storage schemes could add to short-term storage enabling further wind generation to be accommodated.

Wood residues now coming on stream from the “wall of wood”, particularly in Northland and the East Coast, are probably the third largest, and arguably the cheapest, renewable energy resource. Wood residue availability has been estimated at 50-80 PJ per year, the higher figure depending on the costs of gathering more residues from landings and within the forest (but without whole-tree harvesting which prevents return of nutrients to the soil).

Refining of this estimate requires actual trials of harvesting techniques. But only desk studies have been funded to date, and the results of even these have been delayed so they cannot provide input to submissions on NZES. The official view is that wood residues will be fully utilised by forest industries themselves, and not be available to process into pellets, firelogs, or to sell as firewood.. But back-of-envelope calculations suggest that the home heating market could be more valuable, and certainly less volatile, than overseas markets.

Cleaner and more efficient household wood burning appliances have been developed recently, entirely at the expense of the developers. Arguably any developments that allowed the National Air Quality standard to be reached even in smoggy airsheds would enable wood burning to remain an affordable home heating option, to those who choose it. Encouraging local manufacture of pellet burners, or importing pellet burners in bulk to reduce the present very high prices of imported burners, would seem a priority.

Local processing of sawn timber brings many advantages. Timber framing in houses, and especially structural timber in commercial and industrial buildings, can replace the much more energy-intensive steel and concrete. Today about 0.5 million tonnes per year are stored in timber buildings, for the lifetime of the building. A much larger contribution to the carbon balance will come from using wood residues for energy; this needs further study to quantify it fully.³⁹

Forest industries are now moving progressively towards energy self-sufficiency, and can supply building materials from renewable resources to replace concrete, steel and aluminium. The biggest contribution of structural timber to a carbon-zero economy is not the replacement of energy-intensive building materials, but rather the use of all residues for biofuel, together with replanting to ensure the harvested acreage continues to sequester biomass in the long term.⁴⁰

Wind energy is the fourth largest near-term renewable energy resource, and could supply over 20 PJ/yr with reasonably simple accommodation in New Zealand's electricity supply system to handle the intermittent generation from wind power. Extensive use of demand-side management could undoubtedly enable much more accommodation – large freezers especially are able to switch on or off for significant periods without compromising the temperature, in response to sudden changes in wind generation.

So far “economy of scale” has been the dominant criterion in wind farm development. Generating from smaller, more dispersed wind turbines would reduce the costs of intermittency; and the use of synchronous generators can enable wind turbines to supply “spinning reserve”, thus improving the security of local electricity supply.

Wave and tidal energy is a potentially vast resource, but hazards to marine life and to shipping have not been assessed to date, and the stability of tidal power anchorages in high-energy marine environments needs to be assessed case by case. A significant lead time must therefore be expected.

Geothermal energy is neither free of greenhouse gas emissions nor fully renewable – most draw down on a body of heat so that the temperature

³⁹ Andy Buchanan, Professor of Timber Design, University of Canterbury, “Energy and CO₂ Advantages of Wood for Sustainable Buildings”, presented at IPENZ Convention, 23 March 2007

⁴⁰ Roger Sathre and Leif Gustavsson, “Energy and Carbon Balances Of Wood Cascade Chains,” *Resources, Conservation and Recycling* 47 (2006), 332–355

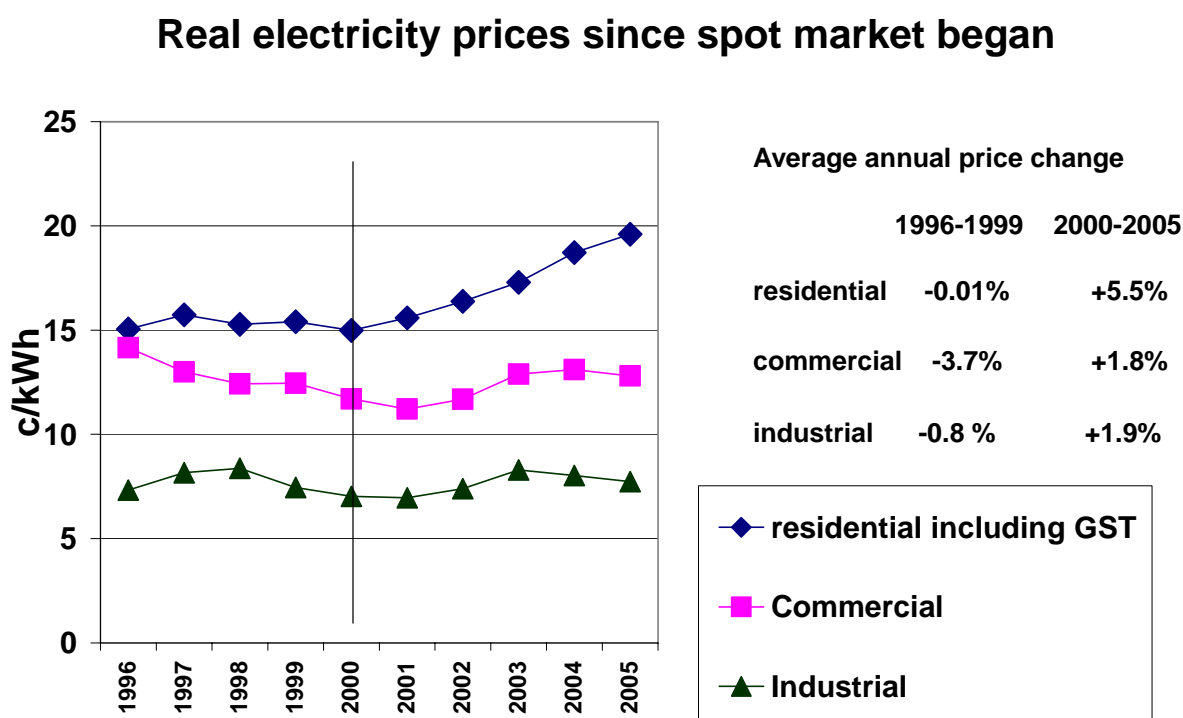
declines with use. At present, most geothermal plants are building in an “Ormat” cycle to convert medium-temperature heat into a further tranche of electricity. The 165 MW generation from Wairakei, for example, was augmented by a further 14.4 MW, generating 120 GWh/yr, at a cost of \$40 million. Arguably a better use of the capital cost would be to dry biomass residues, which can nearly double the fuel value of the residues. This would enable mass-production of pellets to fuel household and industrial/commercial boilers.

2.3.4 Institutional Barriers within the Stationary Energy System

Crown conflict of interest in power profits vs affordable home (and business) energy – price rises are a tax increase by another name

The graph below shows this effect since the launch of the spot market in 1996. A significant surplus of generation capacity until 2000 kept wholesale prices and retail prices down, but with the 2001 electricity shortage, residential prices rose relentlessly.

Figure 3: Real Electricity Prices since Spot Market Began



Source: Energy Data File, Sept 2005, Table I2

The Electricity Commissioner acknowledged publicly in 2004 that retail price rises have enabled capital investments in generation and transmission to be funded. But these investments reduce spot prices to those customers exposed to the competitive spot market. Thus in effect electricity surpluses subsidise industrial electricity consumers at the expense of retail electricity consumers.

Government's excessive supply side focus is exacerbated by extensive lobbying by very well resourced interest groups,⁴¹ and by Government's own interest in the revenues from the SOEs. This breaches both fairness and environmental sustainability criteria. To the extent that the supply side investment is more costly than potential demand-side investment, it also breaches economic efficiency goals.

The value of promoting competition between energy efficiency and electricity supply has been ignored in all the Commission's reports to date on electricity efficiency and barriers to competition in electricity markets.

The role of Electricity Trusts (ETs) in supporting sustainable energy policies also needs to be revisited. Although ETs were established to maintain the perception that local line assets are publicly owned, in effect their only function is to distribute dividend payouts to consumers who have little power to influence their policies. ETs could function far more effectively in support of such policies if they were mandated to invest in DSM support programs that demonstrably reduce the overall cost of energy to consumers while also prolonging the life of the assets of the line companies that generate the dividend flow.

Although an independent regulator would be desirable to support a more balanced electricity market, the Commission, though subject to government influence, is still in a position to provide leadership in promoting demand-side investments to improve energy efficiency which can reduce costs of electricity supply. It has spent approximately \$6 million so far on a compact fluorescent light programme which does exactly that. This energy-efficient lighting reduces both peak and energy demand in households, and is thus very effective in reducing greenhouse gas emissions.

A much larger reduction in peak demand would occur if alternative fuels were used in household space heating – natural gas or pellets in clean air zones, and firewood where it is cheaper in other locations – thus reducing the need to build new generating and network capacity.

Any reduction of electricity sales reduces profits to generators, retailers and distributors alike.

In some states of the U.S., revenue cap regulation is used to decouple profits from sales of electricity. As long as generators and retailers in New Zealand remain unregulated, there would appear to be no straightforward mechanism to remove that barrier.

Therefore the commercial incentive to sell more electricity needs to be offset by separate measures that facilitate investment in energy efficiency and consumer-based renewable energy, in order to moderate growth in electricity demand and reduce its economic and environmental impacts.

⁴¹ See Roy Hemmingway, "Independence of Regulatory Decisions in New Zealand", available at http://www.ksg.harvard.edu/hepg/Papers/Hemmingway_HEPG_113006.pdf

Fragmentation of energy markets and actors means that benefits of energy efficiency and conservation accrue to multiple parties with different incentives.

Fragmentation due to restructuring is one of the types of barriers discussed at some length in an IEA survey of 13 countries on their policies for facilitating energy efficiency and load management in restructured electricity systems.⁴² New Zealand appears to be more fragmented than is typical overseas. Just one example is the fact that the Electricity Commission does not consider energy efficiency as a core responsibility, but only “electricity efficiency”.

Different parties must generally contract with each other if the benefits of energy efficiency are to be shared. Otherwise, the Government would need to subsidise the energy efficiency investment on the basis of its public benefit – but subsidies distort markets and do not lead to stable policy.

“Electricity efficiency” does not count efficient substitution of electricity by other fuels

The Electricity Commission has so far not extended its activities to alternative fuels that can improve the efficiency of electricity use. When demand approaches winter peaks, substitution of natural gas or wood burning for electricity improves the utilization of power lines and generators, and reduces losses. It enables deferral of investment in new transmission and distribution lines and even power stations.

The background report for the Commission’s upcoming review of wholesale and retail electricity markets gives information only on electricity itself, despite the fact that Section 3(1A) of the Commerce Act defines a market as:

“... a market in New Zealand for goods or services as well as other goods or services that, as a matter of fact and commercial common sense, are substitutable for them.”

Investments in both energy efficiency and customer-based renewable energy (solar water heat, passive solar design and efficient wood burning) do substitute as a matter of fact and commercial common sense for electricity, especially by domestic customers. Effective demand-side participation in electricity markets requires that consumers be able to switch between electricity and alternative fuels. They need urgently to be integrated into the Electricity Commission’s energy efficiency work stream.

Imbalance of risk between large energy companies and small businesses – boom-bust cycles

Energy service providers, of both energy efficiency and small-scale renewable energy, find themselves overwhelmed with work for short periods, followed by periods when business falls away and they have to lay off staff. Often these have related to power shortages, especially in 2001 and 2003; sometimes other funding sources lead to a

⁴² E. Vine et al, “Public Policy Analysis of Energy Efficiency and Load Management in Changing Electricity Businesses,” *Energy Policy* 31 (2003), 405-430.

rush of work. This is a true boom-bust industry – far more difficult for a small business whose pockets are shallow, so loss of income could put them out of business altogether.

Transaction costs add a further burden, which has proved especially onerous for businesses that seek funding from EECA. EECA has required projects to negotiate funding from other sources – often more than one – to qualify for its own funding. Sometimes many months have been spent trying to organise funding partners, not always with a successful outcome. This is a contrast to the situation that Transpower faced under the electricity governance rules after 2000, when it was required to fund transmission upgrades by finding a “coalition” of customers that would benefit from them. The whole system failed because the coalitions were seldom if ever found, and the upgrades simply did not take place. As a result the Rules were changed, and the Electricity Commission was tasked with approving upgrades on the basis of cost-benefit tests.

Here is a true double standard. The supply side faced risks such that transmission investment ceased until a system of public funding of transmission upgrades was devised. In contrast, small-scale energy businesses, which also create public benefit, are left to their own devices to face the massive risks and transaction costs. Yet it is the large business with deep pockets that can better weather a boom-bust market.

2.3.4.1 A Note on the Electricity Commission’s Market Design Review

The Electricity Commission’s just-announced Market Design Review project intends to address issues of recent concern including price increases to “some consumers”, recurring concerns about hydro shortages, increases in fuel costs, climate change issues, changes in technology, and changes in scale and scope of some market players. It intends to recommend changes in market design if any beneficial ones are identified, and to gain improved stakeholder support,

The Review is to be from the consumer’s perspective, but the Commission has not explained how that perspective will be represented or researched. Overseas experience indicates that all consumers benefit when those consumers who can do so are given incentives to reduce their use when costs are high. So far the Commission has excluded this “price responsive demand” from all their considerations. As a regulator, they believe it can best be left to the market. But almost all the issues listed by the Commission could be mitigated to some degree by encouraging price responsive demand, and new smart-meter technology will make this possible. It is to be hoped that the Review will be conducted in close consultation with consumers, and address a wide range options for price-responsive demand.

Appendices

Appendix 1: 100% Renewable Electricity by 2025?

Steve Goldthorpe

This simple target as proposed by Greenpeace represents a basic guide to energy strategy. However, something more considered is necessary to provide a workable foundation for a robust energy strategy. For example, 99% is very much more achievable than 100% and virtually as effective. Also, the term “renewable” has some grey edges, particularly as regards the greenhouse impacts of geothermal generation.

This supply side objective is complimentary to separate demand side reduction objectives. But it must be recognised that overall electricity demand may actually increase if a substantial transfer of transport load to electricity can also be achieved by 2025.

Firstly, the reasons for wanting an essentially renewable electricity supply in New Zealand should be spelled out. The principal objectives for the supply side of the future electricity system are:-

- Reduction of routine CO₂ emissions to minimal levels;
- Avoidance of reliance on imported energy sources;
- Maintaining a robust and resilient grid electricity supply system; and
- Demonstrating to the world that “minimal-CO₂ electricity” can be a reality.

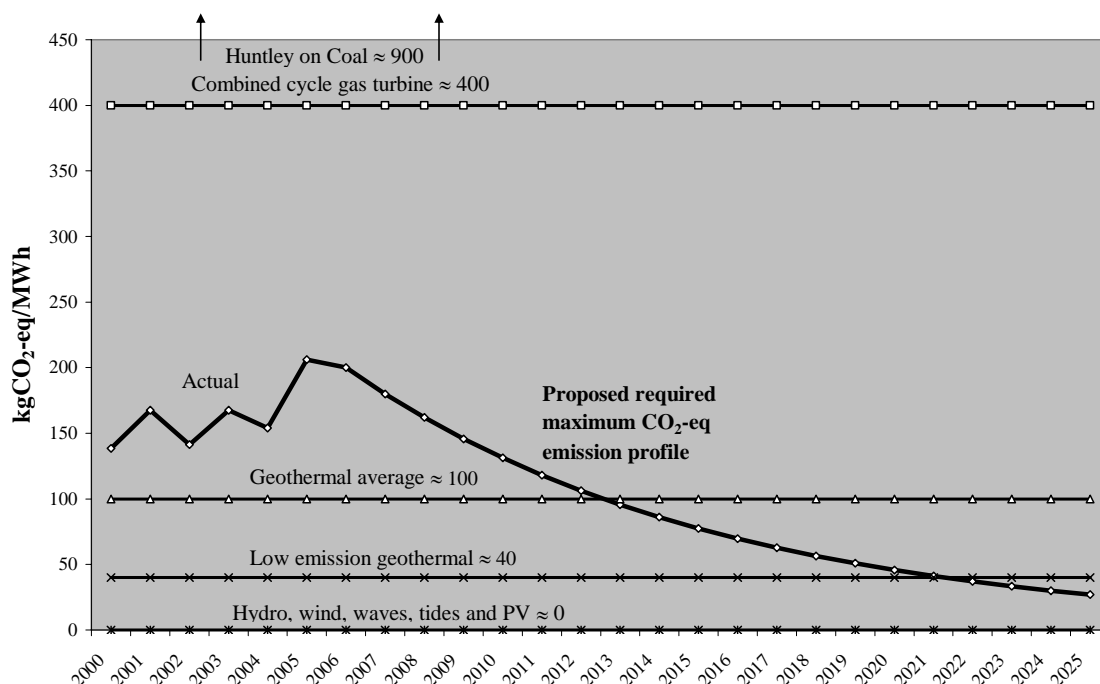
Generation of electricity from renewable resources is an essential means to these ends but should not be an end in itself.

A headline objective of “minimal CO₂ from electricity by 2025” is more appropriate than “100% renewable”. They are not quite the same thing. Implementation of a minimal-CO₂ objective can be defined as a progressive reduction of the actual CO₂-eq emission factor for electricity generation on a year by year basis.

The NZ electricity generation emission factor in 2005 was about 200 kg CO₂-eq/MWh. The 2006 value is not yet published. A reduction in that CO₂ emission factor by 10% every year would reduce the emission factor to 15 kg CO₂-eq/MWh by 2025. That low emission factor would correspond to 20% generation from geothermal resources with low associated CO₂ and CH₄ emissions with 0.5% generation from diesel or gas fired backup emergency generators and 0.5% generation from Huntly to maintain its ultimate dry-year reserve capability; i.e. 99% renewable generation. In practice, there would need to be a tolerance on this number to accommodate the use of Huntly in an exceptionally dry-year. However, the variations in hydro inflow are very well understood. An appropriate dry-year margin above the required maximum CO₂ emission factor would need to be determined.

Such an achievable profile should be defined to quantify the NZ Energy Strategy. Implementing a progressively reducing annual average electricity generation CO₂ emission factor within the current electricity supply system is simple.

It requires the Government to INSTRUCT the Electricity Commission to deliver a specific reducing CO₂ emission factor profile.

Figure 3: Potential CO₂ Emissions Profile for the NZ Electricity Industry

The EC has the authority, the expertise and the mechanisms to achieve that outcome. If the EC is instructed to achieve a specific reducing CO₂-eq emission factor profile for electricity generation then the consequences of that requirement would be:-

- Encouragement of investment in non-CO₂ renewable capacity;
- Provision of more certainty for planning electricity generation capacity and infrastructure;
- Evolution of mechanisms, such as feed-in tariffs, for favouring dispatch of non-CO₂ generation;
- Ensuring that sufficient short term load-following capacity is available in the hydro schemes to accommodate the inherent short term unpredictability of high volumes of electricity generation from wind and waves;
- Elimination of market opportunities for new ordinary coal fired power plants;
- Diminishing market opportunities for gas fired power generation;
- Encouragement of changes to the transmission infrastructure to link large renewable sources to the large demand centers;
- Encouragement of low-CO₂ geothermal opportunities and maybe CO₂ capture and storage for high-CO₂ geothermal resources;
- Encouragement of demand side efficiency and renewable distributed generation;
- Discouragement of distributed diesel generation; and
- Transition of Huntly power station from base load to dry-year reserve generation status.

Focusing directly on the principal desired outcome should provide a direct and therefore efficient means of achieving that outcome. Focusing on incidental objectives, such as “more renewables” risks being inefficient. Focusing on financial incentives, instead of direct action, runs a severe risk of short-sighted perverse outcomes.

Appendix 2: Outline of issues in NZES-NZEECS treatment of the residential sector

Molly Melhuish

1. Data issues:

New Zealand Energy Outlook 2006 is the factual basis for NZEECS (p. 61). Therefore any problems in identifying trends are likely to translate into potential policy error. Data issues include

- CO₂ emissions from residential sector portrayed as 1.8% of energy sector emissions, by counting fuel-only emissions [data sheets attached to Outlook]. When residential electricity is included, this rises to 9.1%.
- Outlook's graphs of energy consumption by end-use sector "models" domestic wood consumption as zero (Why?).
- Accounting for wood energy at the level found by HEEP will bring the 9.1% down.
- But domestic marginal emissions (from peak-time generation) come mainly from Huntly coal; this may bring residential emissions back up close to, or even higher than 9%.
- Residential electricity prices are forecasted in Outlook to rise by 1%/yr on average, less than the rise of wholesale prices. Why? Data from EDF show 5.5%/yr rise from 2000 to 2005, and I believe that is being maintained. New meters will only add a new layer of costly investment (to whose benefit?)

2. Methodological issues:

- The original NEECS was effectively a "cap and populate" system – set the targets and find the most cost-effective measures to fulfil the target. This was effectively a "funder's perspective", which was exactly how Treasury treated the original Energy Saver Fund). The replacement NZEECS focuses on bottom-up analysis, but does not make it clear whether, or what, overall targets will be set, and whether measures will be constrained once they meet some target point.
- Consumers would prefer to identify all technologies that are cost-effective to them (cheaper than retail electricity prices) but inaccessible due to barriers. They would describe NEECS as being from the "funder's perspective" not the consumers'. Today power bills are high enough to suppress economically efficient demand – so there's an actual loss of wealth in high power prices. Taking the consumer's perspective is not about transferring wealth, but preventing loss of wealth.
- Choice amongst different measures: No alternative heating fuels are included in NZEECS, or NZES – not natural gas, LPG nor firewood/ pellets. Why? Wood is generally the cheapest household heating fuel. (save passive solar)

- Definition of “cost effective” varies between documents: “Powering” says cost effective” means “less than LRMC plus externalities.” Covec says it means less than the spot price plus ½ network costs. Consumers would prefer cost-effective to mean less than retail price (which is implied in statements in the documents that say “cost-effective to the consumer”. How can an analyst compare outcomes from these varying definitions?

3. Transparency:

- I had to dig deep into the Outlook base tables to find contribution of residential sector to CO₂ emissions. A macro disabled the file, even when I “enabled” it.
- One of the critical residential breakdowns was further hidden in “Other tables”, requiring some data-matching to come up with actual CO₂ emissions.
- The continuation of the old target, 20% + 30 PJ, doesn’t seem to be mentioned in NZEECS, only in Covec’s CBA, which is not publicly available. [note it was completed before Government decided to replace the original NEECS].
- Documents give no rationale for the selection of particular residential “measures” to a much smaller number than in earlier studies.

4. Consultation issues

- The use of Electricity Levy funds is determined after consultation with “those who pay the levy” – entirely made up of wholesale market participants. Small consumers’ interests are represented only by retailers – an expectation of “proxy” that is simply wrong.
- This is acknowledged in Mighty River Power’s submission on the 2007-8 appropriation: “liable participants have an important role to play in reviewing the Electricity Commission proposed appropriations, on behalf of consumers, to ensure that the monies sought are justified.”

5. Analysis:

- The pervasive demeaning of firewood as a significant energy source is a common thread.
 - Firewood also comes out as “expensive” in the background report to the PCE’s “Local Energy” report, because of the assumption that people must purchase new wood burners and all their firewood
 - Cost benefit analyses that supported ECan’s clean air plan, and the NES for air, had a number of strange assumptions: CO₂ “emissions”

from wood were quantified but not emissions from electricity used at peak times.

- Health and particulate studies (HAPINZ and its predecessors) treated PM₁₀ as leading to early deaths – but not cold houses. (Simon Hales told me it would be possible to differentiate the two effects.)
 - COVEC's Strategic Value Project II, in Appendix II, analyses the “cost of premature deaths” analyses, and concludes “cost of loss of life expectancy” is a better description – and that that cost comes out much lower.
 - Funding for improving efficiency of domestic wood burning is as far as I can tell strictly controlled by MFE – independent designers have got nothing,
 - FIDA funding for efficient, cost-effective collection of residues from forest landings is insufficient for any work on the ground – only desk-top studies. Yet using landing residues in biomass boilers could lead to far, far more efficient manufacture of pellets from the displaced, clean, sawdust, especially where geothermal heat can dry the sawdust.
- Prejudice against any fuel alternative to electricity is clear, and has been apparent for years in the Electricity Commission's work.
 - This can only amount to conflict of interest, with the Crown's interest in the profitability of its gentailers, who send big dividends back to the Crown from household electricity (Also GST).
 - Similarly, the Electricity Commission has parceled off domestic issues into separate silos – the Retail Market Advisory Committee which is not allowed to discuss price levels, only terms and conditions, and a little about fixed charges. The Value-Price load management group, which must not consider consumer-driven load control, only supplier-driven. No advisors provided for consumer representatives.

6. Policy response:

- Clean up the data so residential energy use and prices are accurate.
- Clean up and make clear modelling assumptions, so different documents can be compared.
- Bring in strong policies to promote residential alternative fuels, including wood burning, which needs much development of clean pellet and wood burners.
- Develop and demonstrate more efficient gathering of landing and forest residues, and more competitive manufacture of pellets and pellet burners.

- Ensure the Electricity Commission does not promote Crown's interest in SOE profits.
- Ensure the Commerce Commission study of retailers' excess profits does not require the separate companies to meet and overtly collude to prove the case – the market system itself enables excess profits over and above those needed to maintain investment.
- Ensure the rapid development of “not-so-smart meters”, initiated by Arc Innovation, is tempered by a proper stakeholder consultation on what is wanted from truly smart meters, and the developments within distribution networks, and billing systems, to support their potential for true domestic demand side management.
- Discuss the Minister's Electricity Review with a range of stakeholders including domestic consumers.
- Open up the Electricity Commissioner's advisory system to small as well as large consumers, and properly fund independent research so they can participate actively.
- Ensure the Electricity Commission meets the needs of energy service companies who advise domestic consumers.
- Consider schemes such as developed in Massachusetts, where excess profits taken from domestic consumers, when proven by the regulator, are re-invested in household energy audits with access by auditors to efficiency upgrade products at wholesale rather than retail prices.

Appendix 3: Institutional Barriers to Demand Side Management

John Irving

The justification of the draft energy and energy-efficiency strategies focus primarily on technical and economic issues that are expected to be addressed during implementation. Most of the technologies proposed are well understood, and were even considered previously by NZ policy makers in response to earlier energy crises. However the detailed plans for implementation then, as now, have overlooked the significant institutional barriers to the uptake of demand side management (DSM) systems that exist in NZ. They do not recognize that most publicly owned power utility incumbents are by nature conservative organisations and resistant to change. This behaviour is typical of energy sector monopolies internationally; the incumbents in NZ are no exception.

It is generally recognized that DSM and Distributed Generation (DG) investments can often be more economically efficient than conventional supply-side solutions and will demonstrably reduce line network losses, increase competition in the power market and defer network investment. However as noted in the MED September 2006 paper “Facilitating Distributed Generation (DG)” there are important barriers to entry by DG/DSM investors, particularly those put in place by incumbent NZ gentailer and network operators that essentially preclude competition in the power market. Probably the most important barrier is the unwillingness of gentailers to permit time-of-day and two-way power pricing that is vital to enable a DSM/DG market to develop.

Part of the institutional resistance to change is due to regulatory disincentives faced by NZ’s largely publicly owned network monopolies; even if the lines companies (LCs) were willing to support DG/DSM initiatives. The Commerce Commission’s CPI-X regulation, used in conjunction with Optimised Deprived Value (ODV) techniques, perversely penalizes LCs from reducing demand in their networks that would otherwise be served by DSM, fuel switching or DG with backup connections to their lines. The problem is exacerbated by regulations that allow LCs to pass through to all customers the cost of losses regardless of whether these are technical (e.g. overheated lines) or commercial (e.g. unread meters).

The role of Electricity Trusts (ETs) in supporting Government Policy also needs to be revisited. Although ETs were established to maintain the perception that local line assets are publicly owned, in effect their only function is distribute dividend payouts to consumers who have little power to influence their policies. ETs could be made to be far more supportive of Government policy if they were mandated to invest in DSM support programs that demonstrably reduce the overall cost of energy to consumers while also prolonging the life of the assets of the line companies that generate the dividend flow.

Thus this paper addresses the wider context of promoting the greater uptake of both DSM and DG in NZ drawing attention to the perverse barriers to investment by new entrants that are in-effect enforced by NZ regulatory agencies. This response proposes a way forward by among others facilitating a paradigm shift in the way NZ distribution network monopolies, together with their Trust owners in particular, should be mandated to help meet the Government objectives for making best

advantage of DSM and DG facilities without disrupting their other electricity and gas service obligations.

Adverse Affect of Regulation on DSM development

In its determination of the revenue bases for NZ LCs, the Commerce Commission (CC) uses the concept of Optimized Deprival Value (ODV⁴³) methodology to assess the efficacy of electric network assets. The current methodology is based on the traditional concept that LCs are essentially one-way energy service providers taking power from centralised generation/substation facilities and distributing it locally. For example the current regulatory methodology thus mitigates against the successful the take-up of solar water systems under the Government planned program. This is because LC assets that used to deliver power [that has otherwise been displaced by solar energy or other DSM initiatives], will be assessed with a lower ODV of the network asset under consideration used by the CC to determine the tariff base. This creates an obvious disincentive for LCs to reduce loads; or more importantly a conflict of interest for their Trust owners to support prudent DSM investments that would otherwise prolong the life of their LC assets.

Furthermore under the existing retail charging structure, any consumer who installs a DSM facility such as a solar water heater will find that, after it is put into service the proportion of his (variable) energy costs to (fixed) line costs will significantly increase. Despite his investment in lower cost energy for his hot water use he will be frustrated to see that his average energy charge for the rest of his power increases from typically about 15c/kWh to upwards of 25-30 c/kWh.

Related Issues for Implementing Distributed Generation/Storage projects

The recommendations for implementing DG (as well as Distributed Energy Storage (DS)) do not recognize that the national economic benefits of a “kW or kWh saved” versus having to invest in new KW generation, transmission and distribution facilities. The benefit are much the same as for DSM as DG/DS. DG/DS covering many applications – including solar photovoltaic generation systems and DG supplied by combined heat and power generation and/or renewables. While DS is simply a variation of DG, it’s role will be increasingly important in NZ to enable increased uptake of renewables. An expanding DS market, coupled with the increased use of the internet, will expand the capacity of storage facilities to retain power generated intermittently for use when it is needed.

In NZ the slow uptake of DSM/DG/DS is largely due to the barriers by Electricity Retailers (understandably because their generator owners fear increased competition); but also and not-so-understandably, barriers by the Line Companies (LCs) that are not only disincentivised by regulation (as explained above); but with few exceptions⁴⁴

⁴³ [http://www.comcom.govt.nz/IndustryRegulation/Electricity/ElectricityLinesBusinesses/ContentFiles/Documents/Commerce%20Commission%20ODV%20Handbook%20\(30%20August%202004\)0.pdf](http://www.comcom.govt.nz/IndustryRegulation/Electricity/ElectricityLinesBusinesses/ContentFiles/Documents/Commerce%20Commission%20ODV%20Handbook%20(30%20August%202004)0.pdf)
para 2.27. and:

[http://www.comcom.govt.nz/IndustryRegulation/Electricity/ElectricityLinesBusinesses/ContentFiles/Documents/ODV%20Handbook%20Companion%20Report%20\(31%20August%202004\).pdf](http://www.comcom.govt.nz/IndustryRegulation/Electricity/ElectricityLinesBusinesses/ContentFiles/Documents/ODV%20Handbook%20Companion%20Report%20(31%20August%202004).pdf)

⁴⁴ Several LCs (notably Orion and Vector) reportedly have what seem to be fair and reasonable DG connection packages, especially for DG under 1MW.

also suffer from the lack of initiative to invest outside of the comforts of their regulated lines business. Many LCs also resist the entry of private DSM/DG operators in DSM/DG (possibly in competition with their own wishful planning), by flagging red herrings such as safety and complex metering issues; and by applying unfair backup charges, sale and purchase agreements etc. No NZ LC has transparent standard distribution connection policies that will encourage small retail or medium sized commercial customers to connect wind, PV, biomass or energy storage systems to the grid.

Unfortunately it appears the Government is now committed to allow LCs to persist with the view that they can develop their own (generally larger scale renewable) DGs, which they believe they can operate more profitably than NZ Gencos (that have much more experience in the commercial operation of modern generation plant). On the other hand similar publicly owned LC monopolies in Australia, UK and Ontario have moved on from such antiquated thinking and are much more involved in supporting their own national programs for implementing DSM/DG programs⁴⁵. If NZ LCs were mandated to support Government policy, they would in fact discover that it is more profitable to manage an “intelligent” network distribution systems⁴⁶ charging fees to coordinate the operations of other investors in DG/DSM plant

Rather than persevere with legislative changes to permit LCs to invest in distributed generation (often in unfair competition with their customers), it would be better for the Government to require LCs to increase the capability of their networks to realize the wider goals of sustainability offering transparent and open access to a diverse sources of DG/DSM and DS applications. A model for policy change can be quickly developed for both gas and electricity distribution networks based on successful approaches overseas adapted to suit NZ situation. Given the right incentives LCs will soon recognize that their networks are sufficiently extensive to be able to support energy efficiency solar heating and insulation programs, provide time-of-day and net-metering to increase competition among existing energy retailers and to develop a market for short-term electricity storage to increase the evacuation of renewable energy.

Time-of-Day Pricing and Intelligent Two-Way Metering Systems

The development of the future "intelligent" electricity systems should be a key Government strategy for expanding DSM, DG, DS facilities to 2030. Beyond the successful implementation of solar hot water systems new applications like plug-in or all-electric cars are already on the horizon⁴⁷. Intelligent systems will allow consumers to respond according to market prices and even buy power at night time rates and sell power back into the system at peak rates. This will of course require incumbent NZ LCs to revolutionize their way of doing business: either by incentivising them to do so; or changing their licenses to require them to operate their generally publicly owned network monopolies to facilitate greater inter-connectability of their localized energy supply and delivery systems.

⁴⁵ See: <http://www.indeco.com/www.nsf/papers/regframeworkdsm>; <http://www.efa.com.au/dsmdocs.html>; <http://www.dti.gov.uk/energy/energy-sources/renewables/Publications/Distributed%20Generation/page24117.html>

⁴⁶ http://en.wikipedia.org/wiki/Advanced_Distribution_Automation

⁴⁷ See <http://www.calcars.org/economist-plugfuture-june06.pdf>

Two-way metering for small consumers is necessary to minimize the cost to consumers of installing alternative generation by avoiding the need to procure and maintain expensive battery systems. Although there are no insurmountable technical or safety problems such arguments are often used to discourage consumers from paralleling a local electricity generation source (e.g. Photo voltaic systems, combined power heat plant etc).

Intelligent metering systems and time-of-day pricing are increasingly being recognized as the key to the development of a successful demand side market. Notably such facilities are being installed on a widespread basis in Italy, UK, Canada and Australia. Recent initiatives by NZ gentailers indicate that they too are considering the implementation of a billion dollar project which will help them gather information from consumers to better optimize their generation supplies; although there is a suspicion that the gentailers may introduce a form of smart metering that will not provide consumers with the ability to invest in their own DSM initiatives. Although gentailers activities are largely unregulated a coordinated approach to the introduction of such smart meters could in fact be construed as a cartel behavior if indeed the gentailers simply pass on the costs of metering to consumers.

Use of Negawatt Contributions to amend ODV Guidelines.

The main disincentives for LCs to encourage DG/DSM development is the Commerce Commission's methodology of computing the ODV of NC assets. This has largely been developed in consultation with NCs with little input by other stakeholders. As such it reflects the traditional views of the radial functionality of network distribution systems.

To overcome the inherent problems with existing ODV methodology and reward LCs properly the commonly used concept of "shadow energy" or "shadow power" could be used as a measure of the "Negawatt" value⁴⁸ of any DSM/DG contribution in valuing the asset base. A simple amendment to the current ODV Guidelines could be implemented very quickly without otherwise changing the overall regulatory structure that has developed over the last few years. The change would be made to ensure effective Negawatt contributions be added to actual power carried on LC networks thereby ensuring their assets are not undervalued in providing backup to DSM/DG facilities. (e.g. if consumers in a given area install solar hot water systems that typically saved 10 MWh in a year, then the associated LC should be able to claim that its line enabled the equivalent value of negawatthours to be generated more efficiently by other sources).

The application of a negawatt contribution would enable LCs to claim a higher ODV value of lines associated with connected DSM/DG facilities without having to make any significant change in the regulatory system. It would also allow LCs to optimize the increased capability of their networks more efficiently without incurring additional investment within the CPI-X regime. Bearing in mind the adage that "a kW saved is more valuable than a kW made" the pricing of DSM generated shadow

⁴⁸ See: http://www.rmi.org/images/other/Energy/E90-20_NegawattRevolution.pdf#search=%22negawatt%20incentives%22

power/energy should therefore be higher than the price of the gas or electric energy it displaces. This more enlightened approach to valuing LC regulated assets is also likely to incentivize LCs to offer unregulated ESCO services (in competition/or cooperation with local plumbers) to increase their profitability further by sharing the benefit of the lower energy charges with consumer, billing them for the ESCO service in their normal monthly bills.

Appendix 4: Sustainable Technologies and Innovation

Dr Susan Krumdieck

The NZES fails to address the current state of the art in sustainable energy research internationally. International experts are reaching a consensus that sustainability cannot be achieved through technology fixes nor can we consume our way to sustainability. The NZES fascination with some mythological technologies which will be sustainable is a serious failure of this draft document. Cutting-edge research and policy development (e.g. NZPCE) emphasize that sustainability is a systemic aspect of all technology and infrastructure projects. In the 1800's our safety practices were primitive. The economics, morality, principles of practice and regulations relating to safety were not yet established, and safety engineering was not part of every project. Sustainability will emerge as a regulatory system based on best practice, and it will not be optional just like safety. There are not some technologies that are inherently safe, all technologies must be made safe. Sustainability must be recognized to be just like safety, in that consideration of emissions, environmental impacts, and long-term wellbeing are not optional at any level of decision making. By focusing on research into saviour technologies and on finding more resources to exploit, the NZES research and innovation strategy does nothing to bring New Zealand into line with international cutting edge discoveries. The discoveries and innovations necessary for charting the emergency action plan for curtailing carbon emissions and leaving something to future generations other than catastrophic problems will come from integration of research silos and new ways of thinking, developing policy, and carrying out business and engineering projects to deliver services within our natural limits.

Remedies:

- Strict efficiency and emission standards set at the level of international practice will drive the necessary innovation in New Zealand as they have in all other countries.
- Fund high quality engineering and science consultation to investigate realistic technological, operational, economic, and sustainability feasibility of every one of the saviour “sustainable technologies” which the NZES is now proposing to fund, support or encourage. (e.g. hydrogen economy, wave electricity, biofuels, carbon capture and storage, batteries, fuel cells, coal-to-liquids, and other un-named “sustainable technologies”)
- De-emphasise the “low cost sustainable technologies” and technology innovations as the source of our sustainable, safe, and secure future, and focus on the real issues of research and innovation: new engineering capabilities to deliver infrastructure systems and services within our resource and environmental limits at a viable cost.

Agreements:

6.3.2 Increasing capabilities and improving coordination

The NZES calls for new kinds of research based on new collaborations and linking together New Zealand's relatively sparse capabilities in energy and sustainability. The strategy also recognises that the major changes facing society will require capable people to deliver energy services, in particular energy system management, efficiency

retrofit of buildings, solar system design, installation and maintenance, demand side management, and distributed energy systems and grid network re-design and management. Tertiary education and coordination with polytechs and industry will be essential in providing this capability.

The methods and practice of considering sustainability in energy system engineering and in engineering the infrastructure and technologies that use energy are not currently known. This is the cutting edge of international research. Just as safety design and practice were learnt by doing, a major initiative in engineering-based energy research for sustainable systems should be a priority for the government strategy. The National Energy Research Institute (NERI) is a cooperative organization of New Zealand's top energy experts with keen interest in working on developing the keys to sustainability by conducting interdisciplinary research on the country's most critical problems: Efficiency, Renewables, Transport, Behaviour and Policy. NERI is a self-initiated and self-organized group who have no profit motive in any particular technology or energy source. NERI has members from all tertiary institutions, CRI's, and has links with industry. NERI has developed from the drive and expertise of its members, not in response to any MoRST RFP or any promise of funding for people who are willing to do research on problems defined by Wellington.

Recommendation:

The New Zealand Energy Strategy should include strong support for the NERI initiative and not undertake to produce a redundant sustainable energy research and education centre.