Draft NZ Energy Strategy Response from the Royal Society of New Zealand

The Royal Society of New Zealand (RSNZ) is New Zealand's academy of sciences, instituted under an Act of Parliament to advance and promote science and technology, including providing expert advice to government.

The following response has been prepared with input from the Society's Sustainable Energy Panel. As such it is the official response of the RSNZ to the MAF discussion document.

Overall Vision

The draft strategy can be complimented for pointing in the right direction, towards “a reliable and resilient system delivering… sustainable, low emissions energy”. Our abundant renewable sources of supply will be a key factor in our future energy system. The NZEECS also presents a range of reasonable actions. However, the actions associated with this vision will not move New Zealand far enough in that direction to reduce our contribution to climate change. Indeed, the actions may merely allow the problem to become worse at a slightly slower rate.

Our Response

The Energy Panel's main response is contained in the report "2020: Energy Opportunities", published in 2006[1]. In that report, we recommended that:

1) Government set aggressive but achievable targets for renewable transport fuels, phase out the use of fossil fuels unless carbon emissions can be securely sequestered and put in place the regulatory and investment policies to ensure reduced carbon emission fossil fuel free targets are met by 2020.

2) Biofuels be introduced as soon as possible, to provide greater security of transport fuels, with an emphasis on developing local industries for their production.

3) The transport fleet composition be modified over time to enable the more widespread uptake of renewable fuel use and that transport systems be modified to become sustainable.

4) Our electricity sector should make the transition to renewable supply by 2020. Further fossil fuel development must incorporate a commitment to zero carbon emissions. Electricity markets and systems must deliver a balance between supply and demand investments.

5) New Zealand continues to adhere to carbon emission agreements involving the wider international community. A shift to lower carbon emission systems will enable New Zealand to become an exporter of carbon emission reduction credits.

6) New Zealand must undertake a sustained effort to drive indigenous innovation to address systemic energy and environmental issues. Substantial collaborative research and development is required and must involve the spectrum of industry, community, government and research.

[1] Available at http://www.rsnz.org/advisory/energy/

Overall Response to the Draft Strategy

Falling short on urgency, stringency and targets

The release of the IPCC's Fourth Assessment Report provides further evidence that climate change is a substantial threat to our well-being. The Stern Review provides evidence that addressing the causes of climate change will be cheaper than allowing it to occur and then attempting to cope with the impacts. In response, the EU has recently agreed 20% cuts in greenhouse gas emissions by 2020[2] through renewable energy, efficiency and biofuels. Given this, the draft NZ Energy Strategy lacks the urgency and stringency to both reduce our contribution to climate change and to keep us in touch with the global response to climate change.

Urgency
Our global emissions have increased greenhouse gas levels to 430 ppm[3], with annual increases in carbon dioxide alone of 2 ppm[4]. At 450 ppm, models predict a 40% or more chance of breaching the 2°C global temperature rise that the EU specifies as dangerous. This gives us ten years to act. Waiting another ten years, for levels to reach 550 ppm, gives at least a 77% chance, possibly a 99% chance that warming will breach the 2°C level[5].

The strategy's emphasis is on considering, not acting. For many areas, effective actions are known. The emphasis should be on doing.

Investments in energy infrastructure are inherently long term, covering many decades for housing, roading, hydro and thermal generation, and the choices we make now will set us on our emissions path. We must choose a path of low emissions.

Stringency
It is quite clear that major cuts in global emissions are necessary to reduce the impact of climate change and the likelihood of severe and adverse events occurring.

Many of our trading partners have made commitments to substantial and rapid cuts in emissions. The EU recently recognised the severity of the problem, committing to 20% cuts (from 1990 levels) by 2020, offering to make 30% cuts if other nations made similar commitments. The UK has a commitment to cutting carbon dioxide by 20% by 2010, 50% cuts by 2050 and 80% cuts by 2100. California has committed to a 25% cut by 2020 and an 80% cut by 2050[6]. We have no targets. We cannot and should not avoid making cuts on a national level, without being penalised by these nations.

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2 "EU agrees on carbon dioxide cuts", 9th March 2007 http://news.bbc.co.uk/2/hi/europe/6432829.stm

3 Stern Review, Executive Summary, page 3, 2006

4 IPCC, Fourth Assessment Report, Climate Change 2007: The Physical Science Basis, Summary for Policymakers, page 2, 2007

5 Boston, J., "Stern lessons on climate change: stabilisation targets and emissions reductions", Policy Quarterly, Volume 3, Number 1, 2007, pp 11-19

6 "California Global Warming Solutions Act of 2006",

The draft Energy Strategy offers a range of carrots and few sticks. In comparison, the draft discussion document on Sustainable Land Management and Climate Change offers mainly sticks and few carrots. This inequality between sector strategies seems unwarranted and likely to lead to inequalities in outcomes.

Inaccurate baselines
Our emissions growth path may be far worse than assumed in the strategy.
The economic baseline in the strategy assumes an economic catastrophe in the 2020-2030 decade that reduces our emissions purely because our economy gets left behind the rest of the world. In contrast, if our economic growth from now till 2030 follows the world growth rate (and we hope it does), then by 2030 our emissions may be 50% higher than the current business-as-usual case. Even if the actions suggested in the strategy are effective, then our 2030 emissions from the transport and energy sector will still increase above current levels.

(See Appendix 1 for further discussion of this point.)

The need for targets

As a general principle, a strategy without targets is good intentions and wishful thinking. Targets are needed to drive the strategy and show success or failure.

The stated goal of the strategy is: "a reliable and resilient system delivering New Zealand sustainable, low emissions energy". Therefore the targets should be constancy of service, both overall and in response to severe conditions, maintenance of natural capital, and a measure of emissions.

The first target, "reliable and resilient", is simple to define and implement. The second and third, "sustainable, low emissions", are simple to define, but harder to deliver upon.

Emissions from our energy sector are low by international standards due to our historical predominance of renewable generation, but this advantage is decreasing as coal use grows. Our national emissions are very high, per capita. In other nations, national goals for low emissions are being set at levels well below the 1990 level; our emissions are at least 22% above that[7]. Hence a goal of "low emissions" must be seen in a context where our renewables-dominated electricity system is not enough to continue to claim low emissions.

Our emissions path must turn around and emissions must fall sharply. To play our part in reducing climate change, we should aim for cuts in national emissions similar to the EU, namely 60% cuts by 2050. Given our current overshoot above 1990 levels, meaningful cuts would require a reduction of 2% per year on 1990 levels. Given that we hope to see our nation's economic growth continue at at least the historic rate then our emissions will also increase due to that growth. We therefore advocate that our emissions intensity, emissions per dollar wealth, should be cut by 4% of 1990 levels per year. This may seem a harsh target, but New Zealand is one of the few countries that could make such a commitment without unduly harsh costs.

[7] MfE, "New Zealand's Greenhouse Gas Inventory 1990-2004", http://www.climatechange.govt.nz/resources/reports/nir-apr06/index.html

We have chosen emissions intensity as the best measure for a sustainably growing New Zealand, as this measure takes into account the impact on emissions of economic growth. For a nation with a tradition of high immigration, per capita goals are not suitable.

Below this national target, sectoral targets should be in place to make clear the required levels of performance. Energy intensity targets are appropriate for the energy and transport sectors. For agriculture, the majority of emissions cuts will come when a technological solution to methane emissions from ruminants is available. However, the agriculture sector remains a user of energy and thus an energy intensity target is appropriate, although an emissions intensity target is not.

Targets should be designed to give clear incentives. Hence, they should be long-term, binding and comprehensive. The recent UK draft climate change bill provides a good example, with a requirement for published, 15-year carbon budgets and annual progress reports to Parliament[8].

Meeting these targets would require a turn-around of our emissions path and will not be achieved without marked changes in our energy supply and use.

[8] DEFRA, "Draft Climate Change Bill", http://www.defra.gov.uk/corporate/consult/climatechange-bill/

Economic impacts of a more stringent strategy

Protecting and building our export brand
As a small, open and export-focused economy, New Zealand is at risk if we do not demonstrate similar values as our trading partners. Indeed, we would argue that one of our nation's greatest strengths is our "clean, green" brand. To protect this, we must keep up with our trading partners. To strengthen this, we must lead them. Clean energy is one area where we have options that they do not, hence it is the obvious area in which we should lead.

Security of supply
Energy security is economic security. We have little control over the availability of imported fuels, nor any way to influence their price variability. Our imports of oil are a major component of our balance of payments problem.

Our electricity supply is secure against major overseas events. The technology is becoming available to utilise electricity for transport, through plug-in hybrid vehicles and electrified personal transport. This should make transport more secure, at a potential cost of requiring more overall generation.

Biofuels too will be domestically produced. The current targets will do little to ensure security of supply or price. However, if a substantial domestic industry develops, then our security of supply will be certain.

Our biofuels potential – A real opportunity
Overseas demand for biofuels is vast, growing and already unmet. The EU domestic production of bioenergy may be limited to only 15% of their needs[9].

Given EU targets and the public concern there over climate change, we expect these targets to persist even if biofuels remain more expensive than fossil fuels. Hence there will continue to be an international demand for biofuels at prices above fossil fuels.

The push for biofuels in the EU and US is matched by concern over the sustainability of its production in less developed countries. Claims that rainforests are being chopped down to grow biofuel crops do not sit well with First World consumers. Hence production from less developed nations may be limited by concerns over the sustainability of their agriculture. New Zealand can make a claim to being not just a producer of biofuels, but a sustainable, well-managed producer.

The future of aviation and the future of our tourism industry
There are no technological solutions to emissions from aviation. When global limits on emissions start to bite, as we believe they must, aviation will become curtailed.

Airlines have pushed for fuel efficiency since jet aircraft were introduced, as fuel costs have always been a substantial part of operating costs. However, fuel efficiency has only increased at 1-1.5% per year, enabled primarily by improved metallurgy

[9] European Environment Agency (EEA): "How much bioenergy can Europe produce without harming the environment?" , (Briefing, 2006) http://reports.eea.europa.eu/eea_report_2006_7/en

allowing more efficient engines. This will continue, but even if it were possible to double the rate of innovation, both Airbus and Boeing predict global air travel to increase at 5-6% per year, faster than the possible increases in aircraft efficiency. Thus emissions from aircraft will continue to increase unless the industry is constrained[10].

Hydrogen has been promoted as a replacement fuel for aircraft, the only technical problems being the larger volumes of fuel tankage required. However, moving to hydrogen fuel for aircraft may not decrease their impact upon the climate, even if the hydrogen is produced via a carbon-neutral route. Emissions from hydrogen combustion are primarily water vapour in the upper troposphere, where it acts as a strong greenhouse gas. The added water also increases contrails and affects cirrus cloud formation. These potential impacts are not well quantified, but may rule hydrogen out as an aviation fuel[11].

Biofuels look to be the only solution for reducing emissions from aviation. However, ethanol is unsuitable for use in jet engines and biodiesel is unsuitable for the very cold temperatures found in high-altitude flight. Kerosene can be made, via the Fischer-Tropsch process, from biological feedstocks and there are other possible routes to aviation fuels through algae and other sources.

Biofuels can have reduced global warming impacts in land transport, but for aviation, the advantages are lessened. The additional processing steps increase emissions from production and the effect of the emissions from combustion are more than doubled due to their emission into the upper troposphere. Hence the carbon neutrality of the growth of the feedstocks may not be enough to make biofuel-powered aviation carbon neutral.

Given that a single trip to New Zealand will have substantial emissions, possibly more than an individual's yearly emissions outside of that trip, then tourist numbers may fall dramatically. This sets us at a carbon-disadvantage when compared with other tourist destinations, which we should address by making sure that tourists, and all residents, have lower emissions once they are in the country.

In Summary

For these reasons, we believe that the initially higher cost of a more stringent strategy is entirely justified, by its longer-term payback and its lowered longer-term risk.

[10] "Growth scenarios for EU & UK aviation: contradictions with climate policy" Kevin Anderson, Alice Bows and Paul Upham, Tyndall Centre Working Paper 84, January 2006 http://www.tyndall.ac.uk/publications/working_papers/wp84_summary.shtml

[11] "The Environmental Effects of Civil Aircraft in Flight" RCEP Special Report, 2002, http://www.rcep.org.uk/avreport.htm

Education and behaviour change

The effect of science on the public debate and public action

Need for behaviour change

To avoid the worst of climate change, the required emissions reductions are large. For these emissions reductions to be met purely through innovation will require technological change at a rate never seen before[12]. Breaking the link between the growth in energy consumption and economic growth is required, and this may be difficult to deliver. There are two non-technological options to reduce emissions. The first, reducing economic growth, is not a path we wish to see. The second, increasing overall energy efficiency through behaviour change, is a path that we believe is necessary.

The current increase in awareness of the problem that climate change faces is founded upon many years of thorough and credible science. However, many of the people concerned about climate change have yet to connect that concern with their own actions. This limits political action in response to climate change. That connection will only come as the science continues to provide solid evidence about the causal links between behaviour and climate change. Thus the science creates the possibility for effective political action at a national level. Similarly, social sciences are required to inform the design of policies that aim to change behaviour.

Need for better information for energy users

Enabling individuals and households to take energy use into account in their buying decisions is a necessary step. It is not enough to provide pricing signals through a carbon charge. For many purchases, the energy use of the product is not known in advance, and it should be. Labelling on appliances and motor vehicles at point of sale is a good first step, but this should be extended to all high energy use products, from dryers to houses.

Similarly, information should not just be provided at point of sale, but should aim to be available to consumers when considering purchase. All new car advertisements in the UK are required to state the fuel consumption and carbon emissions per mile of the vehicle. This information should be available to New Zealanders.

Linking personal/household/industry electricity use with national use – demand side response to price/scarcity signals

For electricity use at a personal and household level, stronger or more fine-grained price signals are a weak driver, as household spend on electricity may be small, or the effects of changes of individual appliances limited. Substantial behaviour change may be difficult to deliver upon. A more effective approach may be through improved minimum energy standards for appliances which will have an effect without behaviour change. Similarly, for many low-energy intensity businesses, energy costs

[12] "To achieve [decoupling of emissions from economic growth] will require actions that are quite literally without historical precedent."
Tooze, A., Warde, P., "A Long-run historical perspective on the prospects for uncoupling economic growth and CO2 emissions: Submission to Stern Review", December 2005
http://www.hm-treasury.gov.uk/media/E2B/58/climatechange_drjatooze_1.pdf

are a sufficiently small component of overall costs that minimum energy standards for equipment would be more effective.

For large industrial users, energy prices will be a stronger driver, but many processes are uninteruptable, resulting in potentially unresponsive demand. This is an area where response to government interventions is poorly understood, hence applied and social research is needed before effective policies can be developed and certainty provided around outcomes.

Incentives in research, development and deployment

Capability in energy research

The draft strategy's focus on research is a positive step, as is the recognition that coordinated capabilites are needed for that research. We believe that government should take a strategic view of providing energy research capabilities, through a long-term focus on the tertiary education sector to enhance not just research capabilities, but to provide the energy professionals needed to deliver on this strategy. We should recognise and support our existing expertise and leadership in specific niches, in particular geothermal generation. Government should play a stronger role in areas where public good plays a strong part, such as demand side management and energy efficiency.

Development and deployment

The government's consideration of tax support in the Business Tax Review is welcome. However, R&D tax support is more relevant to existing businesses in existing sectors. It thus supports evolutionary R&D, not revolutionary innovation. Innovation in new technologies or sectors (such as for biofuels) requires other forms of support. These are precisely the technologies required to make transformational changes in our energy system. The government's development of the NZ Venture Investment Fund is one such positive example of providing seed funds to innovative new businesses. However, the barrier between research and commercialisation is still strong. Many options exist to address this barrier, from increased pre-seed funding, support for pilot and demonstration plants, incentives for investment in production facilities, and financial support for technologies in use, whether biofuels or energy efficiency. We believe all of these tools will be needed to enable our innovative capabilities.

New Zealand-specific opportunities

Energy efficiency actions

The measures proposed for improving energy efficiency (in Section 3.4 of part 1 of the draft NZES) are not actually policy measures, but outcomes that the strategy aims to promote. What are not described are the policy changes that will be put in place to achieve these outcomes. In other sections of the "From vision to action" part of the NZES, the role of the government in changing policy settings to achieve actions is clearer. Nevertheless the NES and NZEECS are short on policy in this area and this is a significant weakness of the strategy. As an example (p29, NZEECS) the use of an electricity levy to fund incentives suggests that the authors are aiming to compensate for market impediments, rather than overcome them. This is likely to be expensive and inefficient. The proposals put forward in the draft NZEECS suggest an attempt to set up a high degree of detailed management of energy decision making, rather than establish clear market based processes, and clear lines of responsibility with effective accountability measures. In addition, the NZEECS document overemphasises DIY, rather than policy, actions. The efficiency targets appear to be reasonable and the responsibilities for delivering them have been allocated, but it is unclear whether those assigned these responsibilities are really committed to achieving them. It is also unclear whether they have the tools to deliver the required results. In addition, in the event that the required efficiency gains are not achieved, the policy should indicate how the costs of failure will be allocated. The possibility of placing efficiency obligations on industry players could be explored as a way of dealing with these concerns.

We need to ensure electricity end use efficiency issues are addressed with the same vigour as new supply, using the same incentives. Institutional issues should be clarified to ensure efficiency is better integrated into the strategy. Possibilities implemented elsewhere (e.g. efficiency obligations for electricity suppliers, white certificates) should be explored. This would assign responsibility to agents with the resources and capability to act. Effective accountability measures could be implemented. By placing an obligation on generators, distributors and retailers to ensure that their consumers were meeting specified efficiency targets, then present public concerns about the imbalance between the supply and efficiency options would be addressed. It would also help to mitigate public concerns that expansion of supply and transmission capacity often has significant local impacts which can not be compensated. An efficiency obligation would also produce important gains in corporate, institutional and public awareness and understanding of the efficiency options, their costs and benefits.

Demand

Our management of housing, premises and commercial and industrial equipment results in many energy efficiency opportunities being left untaken. Our knowledge of the drivers for energy efficiency practise is poor and correspondingly, our efforts to improve energy efficiency are ineffective. Social research is needed to understand how to change consumer behaviour and the impacts of that behaviour.

One way to bypass the problem of poor energy efficiency decisions is through the use of minimum energy standards. While some standards have been introduced for some product categories, these standards should be greatly improved, both in terms of their strictness and the width of their application. This should be done rapidly, before the 2010 deadline in the NZEECS for the existing product categories.

Supply

Transport futures, biofuels and electric vehicles
It is not yet clear which technological route will be taken to make transport sustainable. Options include plug-in hybrid vehicles, electric vehicles, bioethanol, biodiesel, biobutanol and other possibilities. However, we suggest that the scale of the problem implies that all routes will be taken, and many of those will be complementary. Plug-in hybrids can be charged overnight by renewable electricity and fuelled by biofuels for longer journeys. Advanced batteries will increase the range and performance of hybrid and electric vehicles for both private and public transport. Hence the strategy should be looking to push all of these routes.

While battery-powered automobile technology is still developing, the rest of the world is seeing a rapid growth in lightweight electrified personal transport (electric motorbike, scooters, cycles and electric assist for mainly human-powered bicycles). Currently, electrically-powered or assisted bicycles are illegal to ride on NZ roads unless they are registered as if they were motorbikes. This presents a clear impediment to their uptake.

Biofuels potential
Basic research is needed in the growing, conversion and processing of cellulosic feedstocks. This is an area where New Zealand can best use its strengths in agricultural science and wood processing technologies and this research can be carried out by existing research organisations.

Enabling biofuel choice
There are no strong incentives for users to enable their own vehicles to take biofuels, nor for importers to bring in enabled vehicles. Government should resolve this chicken-and-egg situation by requiring all imported vehicles to be biofuel compatible, enabling choice in fuel use and growing a potential market for biofuels.

We have changed our fleet capabilities before, with the conversions to CNG in the 1970s, and we have certified changes before, with the introduction of standards and

testing for towbars. These steps can be taken quickly, to rapidly increase the potential to use biofuels. Our vehicle fleet turns over roughly every ten years, so this action could future-proof our vehicles in roughly the time it may take to grow a substantial global biofuels industry.

Marine

Our marine generation potential is vast. The contestable grant fund for the deployment of marine energy devices is a step towards realising the benefits of this resource. However, given the potential scale of the resource, support should go towards developing a vibrant marine power industry in New Zealand, through much stronger support at this early stage of commercialisation and continuing support along the commercialisation and deployment path. Given the global push for new energy sources and the lessons learnt from the development of utility-scale wind power, marine generation may advance from its current pre-commercial state to a substantial source of power in a shorter time than wind did.

Coal and carbon capture and sequestration

Much overseas research is directed towards using coal without releasing carbon dioxide emissions from combustion. However, much of that research may not be applicable to our coal supplies, as our coal reserves are of poor quality. Hence the adaptation of clean coal technologies to our coal reserves is a topic of relevance to New Zealand. Similarly, overseas research into carbon sequestration and storage focuses on geologically stable areas. New Zealand does not have that luxury, so our research should focus on the additional risks of storage in our geology.

Appendix 1 – Assuming that an economic catastrophe saves us from climate change?

Modelling, openness and confidence

Investments in energy and transport are inevitably long-term, as will be the effects of climate change, so policy must be guided by modelling. However, this is modelling substantially missing from the current debate. The discussion papers did not even present predictions, just "illustrations". Further in-house modelling work may inform the next policy steps, but opening the models[13] used by MED to wider scrutiny and use will bring two benefits:

Firstly, with closed models, the modelling presented has to be taken as given. There is no way for any party, outside of MED, to make an informed judgement of the credibility of the models. There are many areas where assumptions and predictions of the models may be open to question, one in particular is discussed below. Opening the models would allow this discussion to take place and should result in more credible predictions.

Secondly, opening the models would allow other parties to inform their own positions and apply their own experience and perspective to the models, resulting in a more informed policy debate.

Incorrect baselines - GDP growth rate

The transport emissions path presented in the draft strategy is based upon the GDP growth rates in the "Energy Outlook", themselves taken from the Treasury's 2005 budget forecasts. These assume a linear decline in real GDP growth rates to 1.5% by 2028. This stands in stark contrast to New Zealand's recent growth rate of 2.5%[14] current world growth rates for the last half-century of 2.3% and the government's expressed intention to increase our nation's worth, relative to other rich nations.

This decline is said to be driven by "a levelling-off of the working-age population", but if that were the case, any government would be under pressure to allow the obvious solution – substantial immigration, such as New Zealand has enjoyed throughout history.

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[13] We are indebted to Simon Terry of the Sustainability Council for first raising this matter.

[14] From 1998-2004, Budget 2005, Fiscal Strategy Report

"The Role of R&D in Productivity Growth: The Case of Agriculture in New Zealand: 1927 to 2001", Julia Hall and Grant M Scobie, New Zealand Treasury Working Paper 06/01, March 2006

[18] Maddison, Angus, "World Population, GDP and Per Capita GDP, 1-2003 AD" http://www.ggdc.net/maddison/

In effect, the modelling hopes that an economic catastrophe will keep our emissions from sky-rocketing. Instead, assuming that New Zealand follows the Treasury predictions for the next three years, then matches a reasonable world growth rate of 2.3%, our wealth and thus our emissions in 2030 will be 15% greater than the strategy assumes. If New Zealand matches its historical growth rate over the last 100 years, of 3%[18], then our wealth and emissions will be 60% greater than the strategy assumes. In that case, even if all the proposed improvements in the draft strategy come to pass, our emissions will continue to increase.

Modelling and GDP sensitivity – Does the Transport Model underestimate future emissions?

The sensitivity of emissions from transport to economic growth was not discussed in the three recent discussion papers and only lightly touched upon in the "Energy Outlook" predictions. It is possible that the models used greatly underestimate the likely growth in emissions from transport, for two reasons. Firstly, the GDP growth rate may be unduely conservative, as discussed previously; secondly, the connection between GDP growth and emissions growth make also be conservative.

Sensitivity to growth

The high GDP growth case in the "Energy Outlook" assumes that an additional 19% increase in GDP by 2030 results in an increase of 3% in oil use, mostly for transport[19]. No evidence is presented to justify this low elasticity. If GDP growth is higher than expected, then more discretionary and luxury activities are likely to take place, with an increase in the trend for larger vehicles and more kilometres travelled. Thus the sensitivity of emissions to growth may be underestimated and it may increase as growth increases.

Hence, if wealth is substantially above the strategy's baseline, and the sensitivity is more realistic, then the baseline emissions by 2030 from transport may be substantially above current predicted emissions. This presents a major risk for the strategy.

However, given the publicly available information, we cannot form an opinion on the validity of our growth rate projection, nor can we assure ourselves that the Ministry's assumptions are trustworthy. Hence we cannot give a guide to how much of a risk really exists.

[19] This puts elasticity at 0.15. This is at the low end of the estimates in the "NRTF 1997 Working Paper No 2: Car Use: Modelling & Forecasting" and below the aggregate figure for the UK. Elasticities depend upon household makeup, but may be as high as 0.43. In that case, an additional 19% growth of GDP results in an increase in oil use three times greater than predicted in this model. Changes in the makeup of households are also predicted to increase this elasticity, as more people choose to live in a single adult household.
UK Department for Transport, "National Road Traffic Forecasts 1997 Working Paper No 2: Car Use: Modelling & Forecasting", available at:
http://www.dft.gov.uk/pgr/economics/datasources/nrtf1997/

Appendix 2 – Responses to specific questions in the NZES

Questions on resilient low carbon transport

On energy security:
How important is it for New Zealand to be more self-reliant for transport fuels, for example, through the development of local biofuels and electricity as a transport fuel?

The age of easy oil is over. Oil supplies are increasingly concentrated in unstable regions of the globe, easily-accessible supplies are depleting and climate change sets carbon constraints on fossil fuel use. All of these factors raise the importance of self-reliance, both in terms of the likelihood of increased or variable prices and the chances of supply interruptions.

On biofuels:
While the government has agreed to introduce a minimum biofuels sales obligation, should New Zealand aspire to reach a higher level over time? If so, how could this be achieved?

Driving a biofuels industry
New Zealand has the land and water for a biofuels industry capable of meeting all domestic transport fuel demand. However, the incumbent fossil fuel industry has existing economics of scale and market dominance.

Government action will set the size of the domestic biofuels industry. The current obligation to produce biofuels from waste tallow is a step in the correct direction, but a 3.4% obligation will not reduce emissions when our transport fuel use is growing at 4% per year.

Government should set targets and timescales and financial incentives that will drive investment in a more substantial, second generation, biofuels industry. These would include an increased sales obligation over a longer time period. We suggest a target of fossil-free transport fuels by 2020.

On public transport:
Do you agree government spending on public transport should continue to increase, recognising the wider benefits this brings?

Yes, but to have the optimum impact, spending should be guided by a clear vision. Public transport must be linked to urban design, reorganisation and integration to create liveable cities with a high quality of life.

On emerging technologies:
How much priority should New Zealand give to monitoring the latest transport technologies? Should we have a role in developing these, or are we better to wait until the technologies become available and then import them?

In some niches, New Zealand organisations have the potential to be world leaders. It is government's role to nurture innovation in these niches.

More broadly, we are not just passive consumers of the options that the rest of the world makes available. We can pick and choose between those options. When it comes to our vehicle fleet, at present, we choose to import low-quality, inefficient and polluting vehicles that are disposed of by richer nations. We can set standards at our borders and receive the benefits of doing so.

On improving fuel economy:
Should the government take steps to improve the fuel efficiency of the vehicles on our roads? If so, what tools (regulation, incentives, information) should be used? If so, how stringent should these measures be?

Yes, and government should use all of these tools to both improve our carbon dioxide emissions, local air quality and dependence upon overseas oil producers. These tools should include vehicle class-based minium efficiency standards, differential road licensing fees, strongly enforced emissions testing as part of the Warrant of Fitness and on import, carbon taxes on fuels, and information for consumers and browsers. Removal of the diesel road user change and its replacement with a tax on diesel fuel would remove the market distortion affecting the competitiveness of small and efficient diesel vehicles.

On electric powered vehicles:
Do you agree with a policy to encourage early uptake and use of hybrid plug-in and full electric vehicles? If so, what should these measures be?

Yes. These measures should include financial incentives on the fixed costs of ownership, such as licensing fees, support for locations that provide charging facilities, enabling standards for home charging facilities, provision of an electricity transmission grid that could support rapid growth in overnight charging, specific training for emergency workers in the potential hazards of battery vehicles and regulations supportive of battery recycling. The government should also provide a clear and supporting cost differential between electrically powered vehicles and fossil fuel powered vehicles.

On freight:
A number of factors limit our ability to increase significantly the amount of freight being transported by trains and ships. Should the government be doing more, and, if so, what? Do you agree with the need to develop a New Zealand Shipping Strategy?

Given that our freight volume is growing 50% faster than our economic growth, a comprehensive freight strategy is needed, integrating road, rail and shipping. A number of factors may limit our ability to transport freight by road, not least potential increases in fuel price, limits on carbon emissions or interruptions or scarcity of supply. Government should prepare for a future without abundant, low cost fossil fuel, even if the risk of that outcome is unknown.

Another possible outcome is that, in the long range future, the amount of freight may decrease in general, as the economy becomes more service based and products

become less physical and more virtual. Long range planning needs to be supported by good transportation research.

On urban design and kilometres travelled:
Should the government be more active in influencing decision-makers to take into account transport energy and infrastructure cost considerations when making land-use decisions? If so, what tools (regulation, incentives, information) should be used? How can government best encourage individuals and businesses to make sensible changes to the way and distance they travel?

Yes and this will be a way to lock-in low emissions behaviour over the long term. We have no comment on which policy tools are most suitable for this.

On responding to changing vehicle technologies and fuels:
Do you agree that, in the long term, there is merit in changing to a distance-based charging regime in order to ensure adequate land transport funding, irrespective of which fuels vehicles use?

In the very long term, this may be the case. If we did eventually provide for our transport needs through renewable, carbon neutral technologies, then our funding could be based on a mixture of distance and weight based charging to account for wear and tear on roads, and on specific regions and times to account for congestion[20].

However, in the short term, the more pressing problem is the complete dependence of our transport system upon fossil fuels and the climate change impacts that follow. In this situation, distance-based charging, such as the diesel road user charge, are not helpful. Charging should be based on emissions. This is most simply placed on fuel.

[20] Road damage generally depends upon the fourth power of the axle weight of the vehicle. Single axles on heavy goods vehicles may carry up to 7.2 tonnes, producing over two hundred times the wear of a car or light good vehicle, with 3.5 tonnes between two axles. Thus charging on the basis of road wear would place the vast majority of road use charges on heavier weight vehicles, as is the current intention behind diesel road user charges.

Questions on security of electricity supply

On security of supply:
How should New Zealand balance the trade-off between the consequences of supply being interrupted and the consequences of spending slightly more to further reduce the risk of interruption?

The cost of electricity not supplied is not equal to the price paid for electricity supplied. The value to users of not having their electricity supply interupted is far more than they pay for that supply, by a factor of up to one hundred[21]. For most businesses, no electricity means no business. Hence the emphasis should be on the lights remaining on, at all times.

On wind generation:
In terms of security of supply, wind generation cannot guarantee firm capacity to meet loads and is less able than other types of generation technologies to provide contingency services. However, it is a promising technology that offers many benefits. How great a part should wind play in our generation mix?

While wind can be inconstant, it also provides carbon-free energy and meshes well with the rapid response possible from hydro generation. MED's modelling suggests that wind may be limited to 35% of our generating peak power. However, despite the rapid growth in wind generation at present, we will not reach that level of generating capacity for at least ten years, potentially twenty. At that point, the economics of storing energy or controlling variable generation may have changed substantially, with storage at or close to end-users, or at a grid level becoming viable. This would enable continued rapid growth of wind power. Hence wind should play a major part in our generation system.

On public confidence:
Does more need to be done to improve consumer and investor perceptions of security of supply?

Yes. Perceptions follow performance and our supply performance has been poor in recent years. Hence more needs to be done to improve security of supply. Perception will follow improvement.

On demand-side response:
The level of demand-side response currently provided by the market is thought to be well below its potential. What, if anything, should be done to boost levels of innovation and institutional arrangements to promote demand-side management?

As discussed in the Royal Society of New Zealand's "2020: Energy Opportunities" report, there are many such actions. The most important, at a system-level would be the setting up of an Energy Security Market, to provide an optimal level of reserve generation while providing a balance between demand and supply investments. At a

[21] Rutherford , J.P., Scharpf, E. W., Carrington , C. G., "Linking consumer energy efficiency with security of supply", Energy Policy, Volume 35, Issue 5 , May 2007, Pages 3025-3035

user level, the most important would be strong and broad minimum energy standards for appliances and goods. To drive innovation, these standards should ramp up in a clearly stated, long-term manner.

On the gas market and availability:
Are any more measures needed to encourage more exploration for domestic gas supplies? Are any new initiatives required to minimise the impact of a potential national gas outage?

Existing measures may be sufficient, given the risk to the industry from increased carbon charges by the time new discoveries could come on stream. However, it is important to classify the role of gas, oil and coal in the NZ energy mix, in the context of our goal of carbon neutrality.

Questions on low emissions power and heat

On meeting future electricity requirements:
What are the key drivers for deciding which energy resources New Zealand should use to meet its future electricity generation requirements? What sort of electricity generation mix do we want over the next five, 10, 15, 20 and 30 years? What is the future role of fossil-fuel-based electricity generation over the same time period? Is it possible to meet future annual electricity load growth with renewables only?

The drivers are those expressed in the strategy, but the emphasis should be placed more strongly on the sustainable and low-emissions targets. The Energy Panel has expressed its desire to see a zero carbon emission electricity system by 2020, through use of efficiency, demand-side management, wind, geothermal, marine power and direct solar heating. Coal should only play a role in this mix if carbon sequestration can be assured.

On the Resource Management Act:
Does the RMA have a role to play in providing national guidance to help meet the strategy's objective of maximising renewable generation? How should greater use of renewable energy and reducing greenhouse gas emissions be reconciled against local environmental effects?

Within the draft NZES, there is acknowledgement that there are local impacts from energy initiatives (such as from hydro or wind generation), but no suggestions as to how the balance between these impacts and electrical demand growth will be managed. This will be an increasingly challenging public issue and deserves more consideration in the strategy. The intention of the final action point on page 49 of the draft NZES, regarding the consolidated consideration of RMA consent application, is unclear. It needs to be born in mind that the generation industry is, understandably, focussed on maintaining generation capacity, and expanding it, as the primary way to secure a reliable high-quality electricity supply. The industry argues that national needs should take precedence over local and regional concerns for the local impacts new generation and transmission projects. This view would have more merit if the option of increased consumer efficiency were given equal weighting to supply expansion, to the extent that it confers electricity system benefits in an economically competitive way.

On distributed and small-scale generation:
How important is distributed generation to achieving a low emissions energy future? What can the government do to reduce barriers to distributed generation? To what degree should "smart meters" be supported by government? How do you see the future role of small-scale generation in the electricity and heat sectors? What are the main barriers to the greater uptake of small-scale generation? Are current incentives for small-scale generation sufficient?

Distributed generation has the potential to reduce emissions, but not until a substantial carbon charge is in place. Key barriers are the capacity and reach of the microgeneration industry, structural problems with the electricity market, the cost of acquiring resource consents, and connection protocols and charges. Current incentives

are not sufficient, and Government could begin by developing a vision for micro-generation development, removal of unnecessary regulatory barriers, implementing fair protocols, standards and costs for network connection, support for research on both technology and implementation, support for energy engineering as a profession and the promotion of ways to meet energy services with less or no use of energy.

The Energy Panel produced a response to the PCE's questions on microgeneration which covers these issues in detail, entitled "The Energy Panel of the Royal Society of New Zealand's response to the Parliamentary Commissioner for the Environment's questions on barriers facing microgeneration"[22].

On energy prices:
Should energy prices reflect costs and include environmental externalities? How should cost-reflective pricing be balanced against the issues of affordability and fairness?

Yes. However, this involves a decision on discounting of future costs. Given that the environmental externalities are a national matter, this discounting should be made by government on a long term basis, resulting in a low discount rate.

Affordability and fairness are social questions and should be dealt with outside of the energy strategy.

[22] This report can be obtained at:
http://www.rsnz.org/advisory/energy/pcemicrogenresponsev5.4final.pdf

Questions on using energy more efficiently

On priorities:
How should energy efficiency measures be evaluated and compared, both against other energy and climate change actions and against other types of energy efficiency measures? Specifically, do you agree there is a need to compare different forms of energy in terms of their potential to reduce greenhouse gas emissions?

There is a clear need to compare different forms of energy on the basis of their potential to reduce greenhouse gas emissions. This should be done on the basis of a carbon charge, but the comparison should also include considerations of resilience to extreme events and interruptions (possibly through a market mechanism such as an energy security market) and flexibility to meet changing demand patterns.

A key principle should also be low lifetime costs for users and low cost ways to implement the energy strategy goals. For example, the government is committed to significantly increase the use of solar water heating. The level of uncritical enthusiasm for domestic solar water heating displayed in the NZEECS is a concern and that the analysis underpinning this policy appears to be incomplete and lack rigor[23]. It is unclear whether the solar water heating initiative supports the overarching policy objectives (protecting security of supply and using the lowest cost ways to support the strategic direction of the government) given the potential implications that large scale solar water heating would have for unfavourable changes to seasonal electricity demand. There are other established technology options for delivering equivalent savings in domestic hot water energy demand such as heat pumps. Currently hese are economically competitive with solar and are less likely to skew the seasonal demand profile.

On capital stock:
What actions should be taken to increase energy efficiency in capital stock (buildings and appliances)? How urgent and stringent should these actions be? What barriers exist presently to further measures to increase energy efficiency in capital stock? How could these be removed?

Minimum energy performance standards should be implemented, along with better information for purchasers.

Government is a substantial holder of capital stock, in the form of state housing, schools and hospitals. The upgrading of these buildings could dramatically improve both our national energy efficiency and the state of the energy efficiency industry.

On institutional issues:
Should energy suppliers have an obligation to carry out energy efficiency activities with their customers? If so, how should the obligation be implemented and targeted at customer groups?

[23] For example the claim (p24 of the draft NZEECS) of annual savings of 0.19PJ from 15000-20000 solar water heaters appears to be excessive. To achieve this, the average installation would have to produce unrealistic savings of 86% of average domestic hot water energy demand, based on HEEP data.

Yes. Tools such as efficiency obligations for electricity suppliers should be explored. (See comment on energy efficiency actions on p12.)

Questions on sustainable technologies and innovation

On private and public sector leadership:
How could private/public working groups best be structured to provide ongoing sustainable energy leadership and direction? Are there any particular areas of work the taskforce needs to address?

We need top-quality research-based foresight to inform our policy development. For this, New Zealand needs to build its capacity for energy systems modelling and scenario-building to anticipate its future on a 50 year time scale, with models available to all and open for discussion. This capacity should be supported by research in relevant engineering, scientific, resource, economic, health and social disciplines.

On increasing capabilities and improving coordination:
How can capabilities and coordination be improved? What would encourage non-government partners to contribute to research activities led by government?

The Panel is pleased to see this section focusing on the need to foster research in issues linked to sustainable energy. The MoRST roadmap acknowledges the need to build and maintain a broad suite of critical energy research capabilities. Given the long term nature of these concerns, it is important to deal with the educational implications. This can be done by efficiently by leveraging existing educational capability, recognizing the link between research activity in the tertiary education sector and the development of relevant teaching programmes. An appropriately supported research network, as suggested here, would be an effective way to seed this process. With suitable accountability and governance arrangements the risks would be small and manageable. At present there are no effective support mechanisms with a suitable strategic focus to support such initiatives. Simply, research informs tertiary teaching, so if an increase in research funding is to improve capability, then that research funding must also be well connected with teaching.

To ensure renewable energy and economic security progress we recommend that an Energy Taskforce be set up, with a budget to drive the development and implementation of efficient and renewable energy technologies. The Taskforce must ensure our capacity in energy research, development and deployment. Universities need support to seed that capability; CRIs need support to develop and apply that capability. The Taskforce will also drive the analysis of the behavioural changes that face society and the analysis of what sustainable energy sources imply for society, issues often ignored in developing and implementing significant technological change.

On strengthening international linkages:
What skills and resources would be needed to forge improved international research links that would enable new energy technologies to be rapidly introduced into New Zealand?

Funds for international linkages and exchanges of researchers have a proven record in boosting relationships between NZ researchers and large overseas research

organisations. More linkages like these are needed so such resources need to be increased. Even with the best intentions, long distance relationships are tough, and the overseas labs need incentivising to want to work with us. Hence a flexible and responsive system here is needed to fit with larger overseas partners.

On expanding support for innovative activities:
Are there are other important areas the government needs to look at to provide a strong operating environment for energy innovation in New Zealand?

Innovation will not occur without innovative people. Substantial changes in the energy sector will require a greater capacity in energy engineering and systems and this will be founded on the tertiary sector. The recent return of a tertiary capability in geothermal education is an important first step along this road, but far more is needed if we are to deliver the large amount of innovation required.

Questions on affordability and wellbeing

On access to services:
Are additional measures required to reduce unavoidable disconnection? Are regional heating costs an important factor in differing access to energy services?

The problem is the spiralling cost of generation and transmission of a system based on the old paradigm of trying to keep supply ahead of demand. What is needed is a two-tier system. The "low hanging fruit" or the common goods which were developed at the lowest cost should be available at a reasonable cost for basic services. More premium services (e.g. greater quantity and demand during peak times) must be at a higher cost. An advanced tariff structure would incentivise distributed power, co-generation, and solar energy development. This could be achieved through an energy securities market.

On underlying causes:
Do you agree that further initiatives are required to help low-income households by targeting underlying causes of high spending on electricity, such as inadequate house insulation? If so, what should these be?

Yes. The Energywise home insulation refit scheme is an example of a successful intervention, with co-benefits of reduced electricity demand and improved health. However, at its current rate, it will have only reached one-third of inadequately-insulated homes by 2016. This scheme should be expanded.

On the provision of information:
Do consumers have adequate access to comparable information about energy options? If not, what further measures are required?

No, they do not. In many cases, they have no information. Comprehensive and clear information about energy costs should be available to all in the energy services market. This should include mandatory fuel efficiency labelling on cars and appliances, and on advertisements for both.