National Energy Research Institute

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The Productivity Commission
Wellington

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Initial submission: Low-emissions economy

Thank-you for the opportunity to have input into this inquiry.

We have had some discussions already on this matter. In this submission we have taken the opportunity to summarise for the record the issues that have come out of those discussions and the material we have shared, and then to more specifically address the questions raised in the Issues Paper in so far as they relate to the energy sector.

By way of background The National Energy Research Institute (NERI) is a Charitable Trust incorporated in New Zealand. Its primary purpose is to enhance New Zealand's sustainability and to benefit the New Zealand community by stimulating, promoting, co-ordinating and supporting high-quality energy research and education within New Zealand.

Its research members are Victoria University of Wellington, Auckland University of Technology, Scion, and the University of Otago, and its industry association members are the Bioenergy Association, BusinessNZ Energy Council, and the Energy Management Association of New Zealand. This submission has been developed in conjunction with the membership but does not necessarily represent their individual views.

NERI's focus is on the energy sector and unless explicitly stated otherwise these comments relate to reducing emissions from that sector. At present, as we discussed, we are in the process of finalising an Energy Research Strategy for New Zealand to be published in November. Its scope is wider than the sector's GHG emissions, but this is a significant consideration. Among other things the Strategy directly considers the support the science and innovation system could give in achieving a low emissions economy, particularly when it comes to medium-term public good science. This should help inform the Commission's specific requirement to inquire into this matter.

Summary of discussions and draft Strategy

The following is the summary of the points made in our earlier discussions and/or contained in the draft Strategy.

1. All the New Zealand reports and scenarios on the transition to a low emissions economy (including the Issues Paper) start with our Treaty obligations, thereby excluding the external economy. In practice however the biggest risk for New Zealand and driver of the transition would be a negative market reaction to what we produce. The food and tourism sectors are particularly vulnerable because their offerings are personal to consumers and fossil fuels feature large in their production and delivery. Therefore our view is the external economy (at least transport) needs to be in-scope, and that the risks from Treaty compliance, while important, are less pressing. The Issues Paper is framed almost exclusively in terms of the latter risk and unless reconsidered will produce suboptimal outcomes for New Zealand.

2. In managing the risks we need to be mindful of where these are largest (i.e. where we currently use the most fossil fuels) and target these – many areas of use are not particularly significantly. Transport, Industrial Processing and Electricity Generation cover over 80% of our fossil fuel use. That is where NERI is focussed in its work, and we'd suggest that the same logic applies to the Commission's work. It is strongly suggestive of a targeted approach to any interventions.

3. Taking each of these high use sectors in turn (with emphasis being given to where R&D is indicated to aid the transition), we have:

    a. Transport (including international servicing in and out) uses around 300PJ of fossil fuel p.a., and in the case of international transport New Zealand is particularly exposed by our remote location to the GHG emissions risks in this sector.

        i. EVs might over time shift 90PJ of our light duty cycle land transport to EVs requiring ~30 - 40PJs of new wind and geothermal. While there will also be demand growth to cope with, there are likely to be significant productivity gains, particularly in vehicle use (e.g. ride sharing etc). By-in-large we have reached the view that this shift is likely to occur under business-as-usual (but with some policy adjustment) and has limited need for medium-term R&D;

        ii. 90PJ is heavy duty cycle land transport - mainly diesel used in road, rail - and growing. Currently the most cost effective pathway will be to improve logistics and use offsets. Modal shift from road to rail and sea is possible (but we lack population densities to make many investments worthwhile). IEA's "*The Future of Trucks Implications for energy and the environment*" (2017) usefully sets out the options. On today's numbers alternative fuels and power trains are considerably more expensive than offsets outside some low volume niches where feedstocks are cheap (e.g. waste) or where electrical charging possibly (inductive charging, very fast charging, battery swaps). New Zealand will depend on international developments, but <u>R&D needs to be done on local opportunities for efficiency and improved logistics, the appropriate vehicles for local conditions, potential local fuels supplies and other potential to increase our options over time</u>;

        iii. 90PJ is aviation (avgas/kero) and growing. There are some efficiency gains and ability to avoid travel (e.g. telepresence) but otherwise offsets are the cheapest solution available as of today, although this might not satisfy our

international markets for food and tourism. R&D is a priority on clean aviation fuels (including importation) and the willingness to pay a premium for these (both freight and passengers). On 2030 timescales regional hybrids will potentially halve emissions and fossil fuel demand for domestic and regional aircraft. New Zealand has recently funded a research programme in this area;

iv. Marine 30PJ (marine distillates and fuel oils) is pretty efficient. The shipping industry is more focused on low sulphur at present. Various alternative fuels are being considered but new engines are not likely to be rapidly adopted. This is likely to be an easier target for biofuels than the other modes because the industry is being forced to more expensive distillates to get low sulphur, but their engines will use less refined fuels. R&D is a priority to produce a bio marine heavy fuel oil from local feedstocks to replace a more expensive low sulphur marine distillate. Willingness to pay will also be a relevant consideration in shipping.

b. Industrial processing uses 100PJ. Food (dairy) 35PJ and Chemicals (methane) 35PJ represents the bulk of use. (Steel uses coal for coking but this isn't included as part of the energy sector). In this sector you can virtually name the companies.

i. Renewable plant appears to be increasingly competitive in the Food processing sector and if true there will be a medium-term decline in emissions. While the larger companies are moving in this direction further R&D into new low emissions food products and processes could assist the wider sector to grow. Existing emission should decline as old plant is retired but in the interim R&D to make drop-in substitutes for coal and gas more attractive, along with improving understanding of the barriers to adoption.

ii. Methanex's methanol plant's future will lie with how it sees the relative economics of meeting the cost of GHGs. However this raises a more general issue around the petrochemicals industry. New Zealand has significant fossil fuel resources and R&D into how this could be used without producing emissions will be of value, at least to the extent required to demonstrate viable longer-term uses for our resources that can then attract private interest.

iii. While the wood, pulp and paper processing industry is a high energy user it is a low user of fossil fuels because it makes use of its waste as an energy source. On a longer-term basis bioenergy is only likely to be cost effective if it can be a co-product from an industry producing a portfolio of higher value products. We need to be developing potential options for transport fuels particularly, and thus R&D into a bio-chemicals industry incorporating bio-refineries warrants scoping and, if indicated, early risk reduction, to attract private interests.

c. Electricity uses around 30PJ p.a.. Despite all the attention given to 100% renewable electricity it is responsible for only 6% of our fossil fuel use. Coal and natural gas (NG) are the most cost effective fuels for peak loads, aspects of system stability and dry year support, and once in the system they create a barrier to entry for other generation assets. Peak loads are growing faster than average so new NG generation is being planned. The main driver of the peaks is residential morning and evening loads and these are predominantly thermal (cooking, heating). There are a wide range of potentially cost-effective alternatives, centralised and decentralised, including biofuels, storage, insulation, thermal intra-day buffering etc. The relative economic value of these alternatives can be hidden

because of the current structure of electricity tariffs. Opportunities exist for domestic biomass, district CHP solid and gas, use of waste, industrial load shaping, even possibly biomass peaking. This is a subject that warrants further R&D. Dry years need fuelled generators or a discretionary load and this also requires more work on the risk and how to manage it to minimise the use of fossil fuels.

4. The remaining fossil fuel use in our economy is predominately diesel in the Primary sector (with similar considerations to on road), Commercial sector gas and diesel, and Residential sector gas use. But none of these are particularly significant when compared to heavy duty cycle transport, food and chemical processing industries or even the limited use electricity generation makes. We also have some fugitive emissions in the gas industry (that would reduce if gas use diminishes) and geothermal (and this needs further R&D).

5. Because of the extent to which the more difficult areas of energy use mentioned above rely on offsets (at least on current technologies and use patterns), the energy sector has an interest in having a competitive low cost supply of these.

Specific questions from Issues Paper

Q1 How can the Commission add the most value in this inquiry?

In the list of ways the Commission considers it can add the most value it has not given emphasis to what is the central problem we face as a country. We are looking out to an evolving set of risks[1] and the Commission's value will be in identifying the things we need to do to help manage those risks. In general this will mean increasing the ability of our economy and wider society to adapt.

Without going into the detail the elements of what will be of greatest value are:

- Risk identification and quantification. Among other things providing tools to assist others to do this in an ongoing way will improve our capability to adapt. The Issues Paper addresses the quantification, but is largely silent on the identification.
- Where the risks appear material and negative, identify the information, policies and institutions required to lower those risks, and where these are lacking identify this with recommendations for change. We need to be satisfied that:
    - The well understood risks are being addressed at a level appropriate to the costs and benefits;
    - Improved understanding of the uncertainties and consequences is being appropriately invested in;
    - Options to respond (and adapt) where the uncertainty is high are being developed.

Q2 Chapter 3 of this issues paper mostly looks at ways to reduce emissions directly at their source. What other approaches would help identify opportunities to effectively reduce emissions?

Consideration of the source of emissions is essential to risk identification. However it will be unusual if the management of the risks on the scales and timescales we are discussing is able to be handled by just considering the emission source. The solution will need to look at

[1] Consequences – positive or negative - weighted by likelihood, uncertainty lies in both.

the complete value chain, particularly the needs that are being addressed by the emitter and the emitter's customers etc and how these otherwise might be met.

For example heavy duty cycle transport emissions may be partially addressed by drop-in clean fuels (i.e. addressed at source) but the analysis required to assess potential interventions needs to work back from the direct needs of the transport operator to the shipper and their value chains and alternative ways to address the various needs of the parties involved in those.

Q8 What are the main barriers to the uptake of electric vehicles in New Zealand?

Q9 What policies would best encourage the uptake of electric vehicles in New Zealand?

We have noted some of the issues involved in our Research Strategy, particularly the desirability of EV buyers to benefit from the low cost of the current surplus network off peak capacity, and the general need to improve the availability of low cost clean dispatchable electricity (e.g. Geothermal) to service the switch.

Q10 In addition to encouraging the use of electric vehicles, what are the main opportunities and barriers to reducing emissions in transport?

This has been discussed above, noting that this is the main GHG emissions risk in the energy sector. In part the answer is that this is an area where we need better understanding of both the risks and options. The Commission's concern should be to ensure that the sector and the research community have adequate arrangements in place to ensure this is happening and follow–on actions will occur. At present there is very limited public investment going into this area and this is a situation NERI is seeking to improve with our Research Strategy.

The fall back options will be greater efficiency in transport use, willingness to pay, and increasing use of hopefully low cost offsets. These options require development, along with de-risking of the potentially less certain technological options (e.g. alternative fuels and vehicles).

Q11 What are the main opportunities and barriers to reducing emissions from the use of fossil fuels to generate energy in manufacturing?

As noted this is largely confined to the Food and Chemicals processing sectors and a small number of firms in those. Again we have identified key areas where research is required to identify future pathways and to increase our options.

Q12 What changes will be required to New Zealand's regulatory, institutional and infrastructural arrangements for the electricity market, to facilitate greater reliance on renewable sources of energy across the economy?

Again as noted above, the key issue is around reducing the growth in peak demand seen by the grid. Not noted earlier is the issue of affordability that arises with greater exposure to cost reflective tariffs, and the limited ability of renters to change aspects of their home's energy performance. We have identified this as an area that requires particularly attention independent of the issues GHG emission risks raise.

Similarly the impact of greater storage on the electricity system will occur regardless of changes associated with GHG emissions risks (see Transpower's recent report on

batteries). These could be significant for the sector and again we have identified this as an area that will require attention regardless.

Q13 What evidence is there on the possible physical effects of future climate change on sources of renewable energy in New Zealand, such as wind, solar and hydro power?

We understand that the capability to model these kinds of regional impacts with reasonable error bounds is still limited and further work is being undertaken here by NIWA.

Q14 Apart from the regulation and operation of the electricity market, what are the main opportunities and barriers to reducing emissions in electricity generation?

In our earlier comments we have suggested that a focus on reducing the peaks seen by the grid is what is required to reduce emissions from the sector (plus reducing emission from geothermal generation). As we've noted in many cases that won't involve the electricity sector, but making the true costs of peak generation and transmission transparent will be part of the solution.

Q16 What policies and initiatives would best promote the design and use of buildings that produce low greenhouse gas emissions?

This is an area we have identified as requiring research into the options, but not just limited to the risks from GHG emissions. Wider considerations are general affordability, the issue of the efficiency of the rental stock, and the need to manage domestic thermal loads to reduce the use of fossil fuels for electricity generation. As the Commission notes building performance per se is not a significant issue in terms of the energy sector's total GHG emissions, but is much more important to addressing these other matters

Q17 What are the main opportunities and barriers to reducing emissions in waste?

We have only looked at waste as a potential energy source. Waste in various forms is the low hanging fruit for increasing the availability of biofuels, however it requires large accumulations at specific locations to offer any scale. Often at that point the feedstock becomes more valuable for other uses. To the extent it will be useful it will be in thermal loads and gaseous and liquid fuels, most likely on a district basis because of the costs of transportation. For the foreseeable future we are not facing constraints on the availability of low cost renewable electricity so it is unlikely that waste will be a significant contributor outside some specific niches.

Q18 Policies to lower emissions from particular sources, technologies and processes can have interactions with emission sources in other parts of the economy. What are the most important interactions to consider for a transition to a low emission economy?

Analysis that focusses more on the value chain within which the emission source sits, rather than the source itself, helps overcome some of these barriers. Many of the linkages become obvious once this is done. For example the additional benefits of an EV battery might initially be lost on a potential owner, but definitely not the sales person ("But wait there's more").

Q19 What type of direct regulation would best help New Zealand transition to a low-emissions economy?

This is not an issue we have directly considered. However on the timescales involved, the relative opportunity for innovation to have a material impact on managing the risks and the

limitations of our current knowledge base all suggest direct regulation should be treated with circumspection. If rushed into the potential to incur unnecessary costs are high.

Q20 Acknowledging the current review, what changes to the New Zealand Emissions Trading Scheme are needed if it is to play an important part of New Zealand's transition to a low-emissions future?

Q21 What type of market-based instruments would best help New Zealand transition to a low-emissions economy?

The ETS has been adopted to manage the Treaty risks, and is much less appropriate to manage the more pressing potential market risks. They will have their own market dynamic that is already encouraging change (i.e. the extent to which those most obviously exposed – e.g. Air NZ, Fonterra and Methanex – are taking steps to include sustainability in their brand offerings). In fact the ETS may work against the management of those risks by distorting investment and attention away from them.

In the case of the Treaty risks the policy objective is to target net emissions and a cap and trade scheme (with a reducing cap) is no doubt the most economically efficient instrument to do that. The fact that it is having little short-term impact beyond encouraging offsets could be seen as appropriate to the stage of evolution we are at.

If the market participants have limited options with which to respond then the outcomes of the application of market-based instruments are similarly constrained. The main game is to increase the availability of options to allow better outcomes, particularly where doing that is beyond the capability of individual market participants to achieve in the timescales involved. This is where added information and de-risking from R&D will assist.

Q22 What type of support for innovation and technology would best help New Zealand transition to a low-emissions economy?

Q23 How can New Zealand harness the power of financial institutions to support a low-emissions transition?

Our work has focused on R&D that: will have a significant national impact; is beyond the capacity of individual businesses or sector groups to address; requires medium-term research investments (5+ years) with impacts well beyond this; and that are relatively unique to New Zealand and not likely to be solved by overseas research or where they are sufficiently important to us that we should be working with those teams.

Based on this we have identified the priority areas set out earlier. In some cases the need for the research is reasonably clear cut (the case for improving geothermal generation would be a case in point), in others the need is to understand the area better. From that further needs may or may not be identified.

We'd note that this is applied directed research.

This is an important component in New Zealand's portfolio of research investments that is lacking in energy beyond work on resource identification and extraction. It sits alongside the investment that is going into nearer to market activities (business investment, Callaghan Innovation) and needs to be informed by this and feed it. In New Zealand financial markets have difficulty even banking the close-to-market innovations and are unlikely to consider New Zealand specific longer-term opportunities until risk reduction has occurred. The latter

is the role of the more medium-term R&D (see for example our comments on a Bio-chemicals industry).

The problem of determining where to invest raised in the Issues Paper is largely solved by having wide agreement over the strategic opportunities and risks to be addressed and then focus the particular research investments on these. This gives a basis for assessing priorities and evaluating performance. The MBIE *Strategic Science Investment Fund Programmes* is designed to perform this role, and as the name implies it is driven by a strategic analysis of where science can contribute to the sector's needs. This is what we have undertaken in our Energy Research Strategy.

There are other government instruments that could be used to speed up innovation without too much risk from the downsides of picking of winners. One significant barrier to innovation is the extent of commitment to current technologies - for example replacing dirty plant early incurs both a write-off and a new investment. Reducing the barriers to disposal of old technologies amounts to picking losers and this is easier than picking the winners when there is a clear policy objective in mind (reducing GHG emissions).

Q24 What type of alternative approaches (such as voluntary agreements or support for green infrastructure) would best help New Zealand transition to a low-emissions economy?

The more immediate market risks of GHG emissions are very amendable to these kinds of incentives, and we would suggest the Commission shift the balance of its considerations much more strongly in the direction of how pathways can be facilitated that explicitly include both these risks and these techniques.

We are of the view that a high priority is better information on these risks, the potential technological and solutions that could address them, and people's likely reactions to them.

Q25 In addition to "core" climate policies and institutions, what other changes to policy settings or institutional frameworks are required to effectively transition New Zealand to a low-emissions economy?

The comments made in respect of Q24 apply here. The Issues Paper notes the role that early adopters (e.g. government via procurement) can play in risk reduction. This and other direct interventions to reduce the risk should be available, where justified by the analysis.

Q26 What are the main uncertainties affecting New Zealand businesses and households in considering investments relevant to a low-emissions future? What policies and institutions would provide greater confidence for investors?

This has been discussed earlier. The critical point to take is that there are a very limited number of areas of investment by either businesses or households that are likely to be material, and we should focus on those rather than get lost in the detail.

Q27 What approaches, such as regulatory frameworks or policy settings, would help embed wide support among New Zealanders for effective reduction of domestic greenhouse gas emissions?

A medium-term approach focusing on key outcomes and realistic assessments of the risks will allow greater consensus. The idea that every bright idea needs to implemented today stands in the way of that consensus. A more measured evidence-based analysis is required. We need to establish where the GHG risks lie, identify the important ones and our

options for managing these, start work where it is obvious, and otherwise improve our understanding and ability to respond. Research will contribute at each stage.

Q28 Is New Zealand's current statutory framework to deal with climate change adequate? What other types of legislation might be needed to effectively transition towards a low-emissions economy?

Q29 Does New Zealand need an independent body to oversee New Zealand's domestic and international climate change commitments? What overseas examples offer useful models for New Zealand to consider?

This is not an issue we have considered specifically, but would again note that in the case of energy the risks are highly concentrated in a small number sub-sectors with their own distinct drivers. There are some inter-dependences but these are reasonably well defined. Therefore it is unlikely that any additional independent body would add much. A further risk in such a body is the current preoccupation with Treaty risks to the exclusion of others. As described, the independent body would simply institutionalise this bias.

Q30 How can adaptability best be incorporated into the system supporting New Zealand's low-emissions transition?

This is essential and we have discussed this in outline in response to Q1.

In respect of the comments on the ETS (and limiting these comments to Treaty risks) we have noted that even with a cap in place it may well be delivering exactly what is appropriate to New Zealand's circumstances at this stage of the evolution to a low emissions future.

The Motu proposal for the government to set a price pathway is flawed because the relevant players are by in large significant organisations and the government is in less of a position to insure these risks than the market participants, particularly when it comes to assessing the cost and benefits of compliance on which this market turns. Risk sharing should naturally evolve to cover extremes of prices, and if it doesn't and it is deemed necessary, direct intervention to facilitate this should be preferred over the government acting to manage the risk.

Q31 What types of analysis and underlying data would add the greatest value to this inquiry?

Again we have addressed this in outline in response to Q1, but the greatest value will become from first identifying the major risks and their drivers.

Q32 What should be the mix, and relative importance of, different policy approaches (such as emissions pricing, R&D support, or direct regulation) in order to transition to a low-emissions economy?

This flows from the risk identification and assessment. In the analysis we have undertaken of the energy sector there is a significant role for public good R&D to deal with the more intractable GHG emissions sources in heavy duty cycle transport and in food, but in the light duty cycle fleet and electricity there is less need.

An effective ETS working to help manage the long-term Treaty risks is needed to drive the reductions, but equally it needs to be sensitive to the other risks we face as a country.

Q33 What are the main co-benefits of policies to support a low-emissions transition in New Zealand? How should they be valued and incorporated into decision making?

The need to analyse co-benefits is most likely to arise when there are government decisions to be made over where to invest/incur cost during the transition. It's not clear that the simple fact that GHG emissions are involved makes this any different from other similar decision making within our political economy.

Q34 Who are the most important players in driving forward New Zealand's transition to a low-emissions economy?

In the case of the New Zealand energy sector (and contrary to comments cited in the Issues Paper) there appear to be a limited number areas of the economy that will need to adjust. These have been identified above.

Q35 What measures should exist (and at what scale and duration) to support businesses and households who have limited ability to avoid serious losses as a result of New Zealand's transition to a low-emissions economy?

Q36 What are the essential components of an effective emissions-mitigation strategy for New Zealand that will also be economically and politically sustainable?

We have noted that affordability (and the wider goal of all New Zealanders having warm and dry homes) is an issue that needs attention regardless of the changes that might come from reducing GHGs.

Direct household impacts are unlikely to be great beyond issues around the need for more cost-reflective electricity tariffs. These will be best dealt with as an income adequacy issue. Indirect impacts (increased costs of logistics and long distance travel) will evolve over time, and we have had recent experience of the rapid doubling of fuel costs and the evidence is that an adaptive economy and society can cope. Businesses directly impacted will likely suffer, but our objective should be to minimise this by these adjustments occurring on decadal timescales within a flexible economy.

These comments reinforce the point that a systematic assessment of the specific risks is the essential starting point, and while the current best options for managing them may not be attractive, we should be working to ensure that over time the adjustments are manageable.

Two important points to keep in mind is that New Zealand isn't the rest of the world, our risks are relatively unique, and the only risks aren't the Treaty risks.

Q37 Should New Zealand adopt the two baskets approach? If so, how should it influence New Zealand's emissions reductions policies and long-term vision for the future?

Methane isn't particularly significant in the energy sector (mainly fugitive emissions from NG use), and CBA etc should be able to take into account the differences in the impact of various GHGs.

Q38 How should the issue of emissions leakage influence New Zealand's strategy in transitioning to a low-emissions economy?

Our competitive advantage is a critical issue in risk assessment, and not just because others' may not be addressing their GHG emissions appropriately. It could be that because

of their economic structure they have chosen other pathways, or they have structural advantages over New Zealand (e.g. being much closer to markets).

This reminds that we too have structural advantages. In the energy sector we should be concentrating early effort on those areas (light duty cycle vehicles, electricity emissions) while investing in how to better handle the more difficult areas. This has the effect of giving us more room to manoeuvre when we get to the tougher issues (e.g. more resources to apply to them).

Q39 What do you see as the main benefits and opportunities to New Zealand from a transition to a low-emissions economy?

We have noted a number of benefits from good management of the GHG emissions risks in the energy sector.

Q40 What does your long-term vision for a low-emissions economy look like? Could a shared vision for New Zealand be created, and if so, how?

We have found that addressing the specific risks and opportunities leads to much more productive consideration of how to respond than trying to deal with the issues at a whole of country level.

Simon Arnold
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