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Comments on targeted consultation on NZEECS

Introduction

NERI is an independent trust that advocates for high quality energy research in NZ. Its members are primarily energy research providers. It has recently been developing an NZ Energy Research Strategy focused on medium-term applied research to address the key issues faced by the sector. The comments that follow are in part informed by that body of work.

In what follows we comment on the questions raised seriatim.

Questions 1 - 3: Content

There is a degree of confusion around the terms used in the discussion document.

On the one hand we have Fig. 1 that sets out a hierarchy moving from targets to strategies (NZES, NZEECS) to policies and actions. Later in 5.2, Objectives for the NZEECS are introduced, and then “Actors” is used as a subdivision of the economy, each of which attracts its own strategy.

On the other hand we have Section 10 (2) of the *Energy Efficiency and Conservation Act 2000* that requires:

> The strategy must state—
>
> a. the Government's policies in relation to the promotion in New Zealand of energy efficiency, energy conservation, and the use of renewable sources of energy; and
> b. the objectives to be pursued to achieve the Government's policies in relation to the promotion in New Zealand of energy efficiency, energy conservation, and the use of renewable sources of energy; and
> c. targets to achieve those policies and objectives, being targets that are measurable, reasonable, practicable, and considered appropriate by the Minister; and
> d. means by which those policies and objectives, and any such targets, are to be achieved; and
> e. such other matters as may be necessary to achieve the purpose of this Act.

The latter would be the more usual way to think of these things, the Strategy is the overall document that contains a hierarchy of the policies (the guiding principles, perhaps the goals), the objectives (in this case promotional in nature), targets (being measurable etc things to achieve these) and finally the detailed means (e.g. what, who, how). Actors would be part of the last group ("the who").

The above is not the only approach adopted in Government documents (e.g. NZ Coastal Policy Statement under the RMA has Objectives and then Policies). Our point is that a consistent framework should be adopted and described. Under the circumstances it is difficult to go past the structure of Section 10[1].

Returning to Fig. 1 with this in mind, if the government wishes to set longer-term (10 - 25 year) targets they will need to be derived from policies and objectives to have much meaning. In so doing it has basically then created a longer-term strategy. In practice doing this shouldn't be a problem since the policies contained in the NZES are not time dated and are sufficient to support the proposed longer-term targets.

Thought of in this way the NZES then sits at the top (10 – 25 years), and has policies objectives and targets (the "Energy Targets") as part of it.

Turning to the NZEECS (and satisfying Section 10 (2)), it then sits within the NZES and we have three Policies (a.k.a. Goals) as per 2nd para 5.2:

- To reduce waste in the use of energy (efficiency/conservation)
- To get more out of the energy we do use (effectiveness/productivity)
- To reduce the level of GHG emissions from our energy use

We consider these are an excellent set of policies/goals, appropriately reflecting both the move to focus on productivity and the increasing importance of GHG emissions, while retaining acknowledgement of the ongoing need for efficiency.

Next we need to consider the objectives in respect of promoting these (as per Section 10 (2)(b)). Here the discussion document adopts across-the-board

[1] Notwithstanding Section 11 of the Act requiring consistency with any RMA National Policy Statement.

economy-wide objectives using a broad individual/consumer, business, public sector/government framework (pps 8 & 9). However the development of this framework in the document directly follows a discussion on pps 6 – 8 about the barriers to change (i.e. what needs to change in order to give effect to the polices/ goals). These, in contrast, are based on a mix of *sector of use* and *energy type used*.

This is confusing. If the barriers are sector and/or fuel related why are we using the across-the-board framework to address them, with no discrimination in respect of *sector* or *energy type*?

There are three observations we would make about how to approach this task of deriving objectives from goals:

- It generally makes sense to concentrate effort on where the returns will be high. This allows priorities to be established between objectives, particularly when resources are limited;
- It similarly makes sense to concentrate on where the chances of success are high (or to distinguish between short-term and long-term);
- The move to thinking about productivity suggests both the energy value chain, and the value chain within which the energy is used become more significant in deciding what to do.

These provide a useful starting point to derive objectives. The areas to look for are those that use a lot of energy, the conversions in the value chain are wasteful and/or there are opportunities for greater value-adding to the energy being used within them, and there are reasons to believe change is possible. More difficult areas require a longer-term approach.

In our work in identifying prospects for R&D effort we applied this thinking using the NZ energy balance tables by sector. We found (to give three examples that roughly align with the three main target areas in the discussion document's barriers analysis):

- The transport sector has high GHG gas emissions, has relatively low but improving conversion efficiency, but cost effective alternatives will only slowly evolve and uptake will be constrained by vehicle replacements. There are however some interesting low cost substitutes for trips (e.g. telepresence) that could have more rapid uptake and hence impact[2];
- The electricity generation sector has high GHG emissions in peak, mid-merit and dry year generation, and there are potentially cost effective ways to address this. We are lucky that geothermal has lower emissions and with effort and alongside wind it may well cost effectively cover base load and mid-merit growth and even perhaps dry years. Other approaches could reduce the need for fossil fuels for peaking;
- Major consumer product exporters (specifically food) are efficient producers, but relatively high GHG emitters. The straight economics of change are not attractive, but the threat of a consumer backlash could make the difference. There are also significant opportunities to add more value to the energy used

[2] There are other developments that could reduce trip kms, but we judge them to be within the ambit of current commercial activity and therefore were out of scope for our exercise.

in food production – the subject of a much wider debate in NZ[3] - and to the extent we can add more value and clean energy is part of the package, then this could cover the additional processing cost.

This kind of analysis allows the development of much more specific objectives and targets, and, rather than generic actor groups, allows the specific groups who have the ability to make change to be identified. In each case, within each value chain, these would include representatives from business, consumers (both here and abroad) and the government, but in each example they will be a much smaller group, have specific needs and be quite distinct from each other.

Questions 4 – 6: Focus

The previous discussion covers these questions. The sector/value chain approach with a bit more detail should deliver more targeted and therefore useful results.

Each sector will require a more nuanced analysis looking at each particular value chain. However we very much doubt that matching the result with generic "actors" approach will be useful.

In terms of ambition we do think we need to think beyond business as usual.

Much of the forecast scenario work in energy is based on projections on various assumptions of how the world will evolve. Instead we would recommend thinking about our desired future as a nation and then look at the investments we need to make to achieve this. Done well this leads to a more ambitious, but hopefully still realistic, agenda with the risks in the ambition being managed by making them explicit and giving time to progressively and adaptively address them.

This approach will lead to a portfolio of investments with different risk/reward characteristics. The research community's particular contribution will be in assisting to transfer technologies and practices in from overseas research, helping to address the longer-term more intractable problems, and ensuring we have the human capability to service these needs long-term.

Questions 7 – 8: Strategic and policy directions

Again there is confusion in terminology in terms of the legislation when referring here to "strategic and policy".

In response to questions 1 - 3 we have endorsed the high level policies/goals for the strategy around efficiency, productivity and reduced GHGs. We assume that this section is asking about the *specific programmes* (e.g. Section 10(2)(d)) the government should pursue.

The government already has a variety of initiatives promoting good practice energy use; requiring the public sector to adopt best practice as an exemplar; requiring minimum information on products and services; and seed funding valuable new initiatives.

[3] I.e. the extent to which we export food commodities

Based on our work on where NZ needs to be heading we can see the need to extend these programmes into new domains (and more detailed work on key sectors could well suggest other areas for attention).

The general public policy problem is that achieving the proposed goals requires the adoption of cleaner/more efficient fuels and technologies, and the more material opportunities require significant investment[4]. If novel any investment also face the risks of early adoption, and, in the area we have a particular interest in, they will require significant R&D investment beyond the capability of the private sector to fund.

We see at least four programmes that will be required to help lift private investment in cleaner, more efficient and productive energy use. The objective should be to help increase new investment[5] by sharing a quantum of the risk appropriate to the public benefits involved:

- Continued contribution of funding to help underwrite investigations of qualifying investments and pilot studies. This should include a specific linkage to Callaghan Innovation grants for projects that require close-to-market R&D, with special recognition given for the contribution to the NZEECS over and above the more generic benefits from growing business R&D;
- Aggressive adoption by the public sector of the technologies, requiring explicit recognition to be taken of the public good elements when evaluating their investments;
- Assistance to help firms monetarise the market value of NZ products (particularly sensitive consumer products) that have clean energy embedded in them. The approach of using marks is something EECA is familiar with (ENERGYWISE) but these have traditionally been used to shift consumer behaviour in NZ rather than help NZ producers create additional value in their products so they can afford to invest in cleaner production technologies. Because the big opportunities lie in export markets, in our view food particularly, and servicing these markets inevitably involve some fossil fuels in getting to market (if only international transport) this will require consideration as part of a wider marketing effort. The potential of doing this should be explored with the industry, in conjunction perhaps with the NZ Way Ltd[6]. It may prove that direct consumer marketing is not the best way to achieve this, e.g. government certification of clean energy content is another option that producers may find useful;
- Public investment into the R&D required to address the medium-term opportunities and risks that are beyond the normal investment horizons of the private sector. NZ through MBIE has investment instruments designed to encourage high quality R&D (primarily the Endeavour Fund) but here we are talking about investments to specifically contribute to achieving the

[4] This is true in general for the replacement of plant before its natural life ends, but many of the low GHG technologies tend to be high fixed, low variable cost. This increases the perception of risk.

[5] As we noted in our first round submission on the ETS, when it comes to significant capital commitments reducing the barriers to investment for those planning to invest is to be preferred over imposing costs on all users of the current technologies.

[6] In passing Section 10 (2)(b)

NZES and NZEECS. In other similar situations there is specific Vote funding to undertake an agreed programme (e.g. MPI) or funding has been earmarked for this purpose within Vote: Science and Innovation (e.g. National Science Challenges). Perhaps understandably we consider that NZ will not be able to achieve the goals of the energy strategies without specific directed R&D funding to achieve specific outcomes in support of it.

Questions 9 – 11: Impact on energy research sector

Again this has been partly addressed in our response to the previous questions. The energy research community is going through a process with stakeholders developing a view of the more intractable medium-term (5 – 10 year) barriers to energy efficiency, productivity and low GHG emissions in NZ, and developing R&D programmes to address these.

This process is a work in progress, but is at the point where the key issues that need to be addressed have been identified. This research agenda covers the wider energy sector, but we have attached the current draft that consists of ten areas (with some high level rationale), and we have highlighted those that we consider are specifically mission critical to meeting the goals of the NZEECS.

The next steps are to finally confirm these areas and get multi-disciplinary teams developing specific research programmes within them.

Questions 12 – 13: Collaboration on delivery

NERI's role is to facilitate the development and delivery on the R&D activities to allow the more difficult, longer-term opportunities and risks from the NZEECS to be managed.

We have initiated our work in this area because we have seen a gap in the way this was being addressed, and because the current science and innovation funding was unlikely to be able to respond to this without some such strategy.

We trust that the work we have done so far will help MBIE in its ongoing work in refreshing the NZCEECS, and we would welcome the opportunity to have ongoing discussions to ensure that our work is consistent and supportive of yours.

Yours sincerely

Simon Arnold
CEO

Appendix: Target areas for proposed NZ Energy R&D strategy

1. To support economic growth we need to shift to greater use of electricity, and reduce the electricity sector's GHG emissions and contain price increases.

We are fortunate that wind and geothermal are the least-cost baseload generation at the margin[7]. Natural gas and coal gas turbines are least-cost for new investments for peak, mid-merit and dry year loads. We have identified two areas of R&D to help to reduce reliance on fossil fuels and to hold the costs of electricity:

a. Slow the relative growth of winter peaks by a combination of supply and demand side, and decentralised and centralised responses. The peaks drive the current investment in natural gas generation. Policy and commercial responses will impact on this but there are longer-term technology and behavioural issues that will need to be part of any solution (e.g. improved intra-day supply and demand shifting).

b. Reduce the cost and emissions of geothermal generation and improve its flexibility. Lower cost geothermal has the potential to drive down the cost of wind (where we are a technology taker), and coupled with greater flexibility start to compete with natural gas (and coal) to service seasonal variations (mid-merit) and, alongside hydro, wet/dry year demand. Geothermal is an area where we have good international capability and a significant component of the cost of geothermal is in areas that have had limited attention internationally. Initiatives will need to further explore more efficient prospecting, extraction and conversion, co-products (e.g. thermal and minerals), greater flexibility of production and reduced GHG emission.

2. To future-proof the security of our electricity system and market we need to better understand the impact of emerging technologies on it, particularly storage and power electronics.

The impact of intelligent devices with improved communications capability on our electricity system has been well studied (the "smart grid"). The move to introduce storage throughout the grid (particularly at scale) and power electronics will have more disruptive impact, changing both the function of the grid and the way in which power quality is delivered. Being islanded, with a market based regulatory framework, our situation is likely to be relatively unique, and these changes may well be disruptive of the current system, its regulation, its business models and the way consumers interact with it. NZ also has some capabilities (both commercial and research) in the use of power electronics in these applications and these and other capabilities way lead to international commercial opportunities.

We have identified the need for initial R&D to assess the significance of these changes to our electricity system, the speed with which they might occur, and to realise any opportunities and mange any risks that might arise.

[7] PV in NZ is counter-cyclic in terms of its generation profile so will make limited medium-term contribution, if anything making some of the profile management issues more difficult.

3. To compensate for our distance to the world and our long skinny shape we need to be amongst the leaders in energy use as it applies to future transport.

We rely heavily on long-haul transport for both people and goods. The move to a greater services economy will reduce the importance of transport to our economy, but that will require suitable new infrastructure. In the physical economy new fuels and fleets are coming but we are largely dependent upon imported technologies. Their rate of adoption is projected to be decadal (e.g. EVs) and normal commercial and policy initiatives will suffice. We have however identified two areas of R&D to help maintain our competitive position in energy use in transport:

a. Scoping and targeted pilot studies of emerging fuels and propulsion to prepare for future longer-haul road, marine and air transport. For much of this we are likely to be a technology taker, but there are quite likely areas where we may or do have opportunities to contribute to international efforts (e.g. bio avgas, hybrid aircraft), have reason to be first movers to cleaner fuels (e.g. possibly our fishing fleet in the EEZ), or there will be unique supply chains or infrastructure required to support the international developments we are exposed to.

b. Development of tele-presence, virtual and augmented reality business systems and possibly 3D printing-based logistics as energy efficient substitutes for transport. NZ has capability in these areas (less so 3D printing and logistics) and more rapid advances will be possible here than with physical travel/transport technologies because there are lower barriers to entry for businesses and homes. Behavioural issues, community impacts and responses to these technologies, and any infrastructural constraints (e.g. bandwidth) will all need to be addressed. The scope will include short distance as well as long distance trips.

4. To support economic growth we need to protect our major consumer industries (first priority food) from adverse market reaction based on perceptions of the quality of its embedded energy.

The cost of emissions trading will have limited impact on producers even when contemplating changing the fuels they use. The current cost of the alternatives are too high. On the other hand the potential impact of market reactions to their fuel use (or even perceptions of it) will be much more significant.

NZ's food producers are particularly exposed to this risk as they are one of NZ's highest users of fossil fuels (their main use is in thermal loads, and within that drying). Increasing this risk further many trade off a "clean green wholesome" image.

Major food producers are by in large efficient users of energy, and they generally understand lower GHG fuel options (electricity, biomass, solar and geothermal). In the absence of market pull the lifetime cost of adopting these generally appears uneconomic for the foreseeable future. In many cases gas is seen as the preferred option to replace dirtier, less efficient fuels like coal.

Notwithstanding this, potential consumer reactions are a medium-term market risk for NZ[8], and precisely because of this market risk the food sector has good potential to be some of the first to adopt cleaner fuels despite the added cost.

We have therefore identified the need for R&D to anticipate the market risk of dirty fuel use in the food industry. It will help better understand consumer behaviours and attitudes, understand the potential of the various fuels and, where possible, develop food related technologies that will allow cleaner energy to be cost competitive in the face of a shifting market. The most sustainable approaches are likely to involve increasing the value-added from cleaner energy by reducing waste and developing both higher value by- and end products as ways to compensate for the higher cost of energy used.

This research will also be able to be applied in other industrial sectors with high fossil fuel use.

5. To retain options for fossil fuel infrastructure and make the best use of our resource endowments we need to seek out alternative non-GHG emitting uses for our fossil fuels.

We have valuable endowments of oil, natural gas, gas hydrates, lignite and coal, and they make a significant contribution to our economy. We have therefore identified the need for R&D to expand clean ways to add value to these resources both to retain energy options and, to the extent possible, create economic value out of them. We are most likely to import technologies to add value to these resources, but there may be characteristics of them or potential local uses that require local R&D.

6. To support all NZers to have warm, dry, energy efficient homes we need low cost ways to retrofit houses.

This area needs further input to better define (particular from the building science community), but so far we have identified the potential need for R&D to further understand the behavioural aspects, develop materials that improve building performance, particularly those that facilitate easy retrofits (e.g. thin smart insulation materials, tuneable glazing) and further work on improving the performance of major energy consuming devices. The extent to which NZ requires or can contribute unique solutions in these areas is unclear, although our housing stock is relatively unique in construction. This is a matter to be clarified as part of this process.

7. To support the evaluation of the performance of the energy sector.

Considerable research already occurs in this area but we have identified the potential need to undertake a systematic stocktake of what is being done and for R&D to fill any gaps, particularly in light of the changing circumstances anticipated by our energy future.

8. To support economic growth through high value-added exports we need to support the growth and internationalisation of NZ's world class energy R&D activities.

[8] Not to mention being an issue for NZ in meeting its GHG emission targets.

NZ has a limited number of teams with critical mass, world class linkages and internationally recognised capabilities. In some case these are predominantly commercially, in other cases research. These are in geothermal, bioprocessing, power electronics particularly in inductive power transfer, augmented and virtual reality, superconducting power systems equipment, and emerging capability in behavioural aspects of energy. The strategy sees some of these variously applied in NZ, but others are mainly focused on international markets. We have identified the need to ensure we are undertaking R&D to maintain and grow our capability in these areas, to attract international investment to support, and to grow our export earnings from them.