

Engineering Leadership Forum

Submission to the Productivity Commission's Draft Report 'Low-emissions economy', April 2018

8 June 2018

Introduction

1. This is a high level commentary from the Engineering Leadership Forum on the Commission's Draft Report on a Low-Emissions Economy (the Report). The Forum comprises the CEOs of New Zealand's professional engineering associations, including Engineering New Zealand (formerly the Institution of Professional Engineers New Zealand), the Association of Consulting Engineers New Zealand, Water New Zealand, Civil Contractors New Zealand, the Institute of Public Works Engineering Australasia (New Zealand Division), the Electricity Engineers' Association and Concrete NZ. These organisations represent well over 30,000 professional engineers. We would appreciate the opportunity to meet the Commission to discuss our comments.
2. This commentary focuses on managing technology change, the requirement for strong leadership and on the need to improve the science and innovation system. However individual members of the Forum will be offering their own submissions on the Report in the areas they have particular expertise. We suggest to the Commission that expert perspectives could still inform many sections of the Report and ensure it has a sound technology foundation.
3. Much of the Report summarises well understood issues. We agree with the following comments paraphrased from the report:
 - Transitioning to a low-emissions economy calls for directed technical change in New Zealand's energy and transport systems, land use, buildings and industrial processes.
 - Much more investment in low-emissions technology innovation and development is required.
 - New Zealand's poor productivity performance relates to weaknesses in its innovation system. The imperative is to use the transition to low emissions as an opportunity to boost innovation and achieve better economic performance and higher incomes more generally.
 - Government will need to exploit the "engine of innovation" and the "technology diffusion machine" to tackle the important and urgent need to lower New Zealand's GHG emissions.
 - Well-designed and implemented support for low-emissions innovation is likely to have payoffs for New Zealand's wider economic performance and its international reputation.
 - There is a disconnect between standard commercial decision making and the public interest in avoiding dangerous climate change. The direct role of government is therefore likely to be higher at the beginning of the transition.
 - New Zealand has abundant unused sources of renewable energy, particularly wind power and geothermal. More responsive management of electricity demand and integration of distributed energy resources into the system will complement grid-scale renewable energy generation to contain the need for thermal generation.
 - Most opportunities to reduce emissions from heat processes are for medium- and lower-temperature heat needs (eg, drying milk powder and wood pulp, heating glass houses).
 - New Zealand has the highest waste emissions per person, and is the most waste-emissions intensive economy of all members in the OECD.

- The emissions embodied in buildings can vary significantly depending on the materials used and the construction technique.
 - Creating an independent expert advisory body (a Climate Commission) to provide objective analysis and advice to the Government.
4. We propose that the Report could be expanded to better cover managing technology change, the requirement for strong leadership, and on the need to improve the science and innovation system – to summarise:
- Transformational change, as this is, can only be implemented by central Government.
 - The process will require new, autonomous, and technology-rich organisations to steer the process, as implemented successfully in Australia and the UK.
 - The science and innovation system is currently focused on delivering excellent science. Significant changes in how the system operates and is funded will be needed to undertake the targeted *technology* development and innovation that the transition to a low emissions economy will require.
 - New collaborations amongst businesses at a sector by sector level will be needed to identify and agree on sector specific strategies, the technology development required, the transition pathways, funding and commercialisation processes.

Technology Development

5. Implementing transformational change requires strong technology-based leadership, targeted innovation and development, and a commercial framework that enables businesses to make investment decisions without undue commercial risk. Thus transformational change needs to be designed and led by central Government with the support of industry.
6. The transition to a low emission economy will involve both the commercialisation of existing knowledge and the development of new technology and its progressive commercialisation. This is not about new science. These changes will involve transformational step-changes taken willingly by commercial organisations. Some will require significant new investments that have considerable risk. It is essential that these complex processes are planned and implemented by Government working with business leaders and the technology community. It is vital to ensure transition pathways are designed properly, and that commercial risk is defined and if necessary mitigated.
7. This process will apply quite differently to each of the sectors of the economy where emission reductions are sought – for example in manufacturing industries, mining, food and processing industries, electricity, construction and transport. Each sector will have its own issues and approach, and an ability to access relevant international experience and knowledge.

Role of Government

8. The decades long ‘hands free’ approach by previous Governments to economic development will not deliver the transition to a low emission economy. The transformational step-like transition pathways to a low emission economy requires leadership from both central and local Government.
9. New and improved Government backed institutions with leaders with proven engineering and technology capability will be required to design and implement the transition to a low carbon economy. They will need to be supported by collaborative relationships between central

Government, local Government and the manufacturing, ICT, agribusiness sector, biotech and mining sectors, and the universities.

10. We suggest that the Government can learn from the positive Australian experience with the Australian Renewable Agency (ARENA). ARENA is an Australian Government agency established to 'improve the competitiveness of renewable energy technologies and increase the supply of renewable energy in Australia'. ARENA has been operating since 2013 and is spending more than \$200m each year on technology development and commercialisation programmes. We promote the ARENA model as being especially relevant to NZ and we urge the Productivity Commission to promote this type of governance model with its clear separation from central Government.
11. We reference in support of these views especially (amongst many) the work of Professor Mazzucato who has documented the critical role that governments play in delivering innovative economies. See *Building the Entrepreneurial State*, , 2014, and also www.marianamazzucato.com/wp-content/uploads/2014/09/MOFI-2014-PB-01-Mazzucato.pdf

The Science and Innovation System

12. We agree with the Commission that weaknesses in our science and innovation system significantly contribute to our low rates of business R&D investment and labour productivity.
13. Our science and innovation system is based on untargeted science investments, selected by scientists for scientists. Consequently, we produce world class scientists across numerous fields of endeavour, especially in medicine, materials, physics and photonics, but we lack institutions that deliver technology solutions for businesses. Contributing to this technology vacuum is the commercial business model imposed on the Crown Research Institutes, which led to the collapse of the manufacturing focused CRI Industrial Research Limited.
14. The disconnect between our manufacturing and technology-based businesses and the Universities and Crown Research Institutes was discussed in detail in 2011 in the 'Powering Innovation' report. However, knowledge and capability in technologies relevant to the development of business (including the development of a low emissions economy) remain scattered in small pockets across the fifteen Universities and CRIs without coherence, focus or collaboration. The ten large Centres of Research Excellence are locked into six or more year funding programmes producing excellent science, and the few multi-year funded Endeavour programmes struggle to target technology development within a largely science-focused framework. We reference in support of these comments the following documents:
 - Powering Innovation, Ministry of Science and Innovation, 2011. <http://www.mbie.govt.nz/info-services/science-innovation/funding-info-opportunities/funding-agencies/document-image-library/poweringInnovation.pdf>
 - 2025 Taskforce, 2011 www.treasury.govt.nz/publications/reviews-consultation/2025taskforce
 - Standing on the shoulders of science, 2009; Plugging the gap, 2010; A goal is not a strategy, 2010, NZ Institute.
 - Trans-Tasman Business Circle — Mission to Israel Report, 'Unleashing New Zealand's Potential — Faster! Post Mission Report, 2016. Also see the accompanying Appendix Three NZ R&D Expenditure Summary at www.buscircle.com
 - Innovate! Transforming New Zealand's technology-based economy, Richard Bentley, 2017.

- Innovation and Research Strategy for Growth, UK Department for Business and Skills, 2011
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/229028/8239.pdf

Implications for Business

15. We assess that NZ can progressively develop a larger and more sophisticated and growing technology-based export sector and a diversified hi-tech economy with low emissions and minimal environmental impact. This can be achieved by tapping into our world class science system as proposed by Sir Paul Callaghan eight years ago, and by the Government focusing more resources on the needs of the manufacturing and technology-based business sectors, and in the context of this Report, on the identification and development of commerciality viable low emission technologies.
16. Important sectors of the economy face their own challenges in staying competitive and efficient. The introduction of a programme to transition to a low emission economy with all its dislocations and costs must therefore take account of the wider perspective of each of the economically important sector's situation and their future development pathway. For example, completely new collaborations at a business sector level (such as milk drying, food processing, construction, waste management) will need to be designed, nurtured and managed by Government to ensure the coordination required between businesses to enable agreement on sector specific strategies to a low emission future, the transition pathways, the technology development required, and the funding.
17. The University of Auckland based and led Accelerator programme is a good example of how these collaborations can be achieved. This programme has a core focus on material science for business development and involves most NZ research organisations in a collaborative environment. The programme format is centred on weekly and monthly multi-firm briefing and innovation sessions, now involving over 300 firms. These are excellent environments for sectors to work together on industry development. (See www.nzproductaccelerator.co.nz/en.html)
18. Recently the Accelerator programme has extended its umbrella to include CRIs and several Universities and especially the engineering department at Massey University, which is the NZ centre for process engineering research and development. As the focus shifts to low emission *technology* development, new funds will be needed that sit alongside the existing science funding programmes. The Accelerator programme provides a framework to deliver this technology development with its proven management, its streamlined innovation development processes, and its business based culture. The programme could readily sit under a NZ version of ARENA, and provide the innovation and technology development needed for the business community.

Green Export Opportunities

19. The transition to a low emissions economy can create opportunities for NZ to develop and export new technologies. These will need to be nurtured by Government in the short term.
20. Geothermal energy: NZ has been a world leader in geothermal technologies for nearly five decades starting with the Wairakei development and most recently the construction of many new power plants in the south Waikato/Taupo region. Despite this leadership, which extends across wet steam electricity generation, geothermal-based aquaculture, geothermal-based

horticulture, and commercial and domestic geothermal heating schemes, there has been minimal government support to position NZ scientists and engineering providers to export these technologies. Most of the developing world including Africa, the Middle East, China and South America has wet steam and low energy geothermal resources ripe for development. Our experience provides New Zealand with the opportunity to develop an internationally focused and self-funding Taupo based Geothermal Institute which offers education and technology training for officials from developing countries. The original and highly successful Geothermal Institute (which ceased following its transfer to Auckland University) provides a model for this development. The initiative could be funded initially by Government until it became self-funding, run by a business/science collaboration, and staffed by GNS Science and the Universities with geothermal science and technology capability. The institute would provide the platform and catalyst for the much more extensive export of geothermal engineering and construction expertise than currently.

21. Green mining: New Zealand geology is unusual being so geologically recent and there is a widely held view that there are many mineral deposits yet to be properly investigated that could be mined sensitively and exported for manufacture into renewable energy-technologies including solar cells, magnets and batteries. These include a wide variety of rare earths, lithium, cadmium, cobalt, copper, tin, molybdenum, tungsten, and neodymium. For example, the tailings from gold mining stored within the Macraes mine boundaries (in Central Otago) contain tungsten as wolframite with a value of many billions, and rising as the world supply becomes increasingly controlled by China (now 70%).
22. Process engineering: The focus here is mainly on the food industry and especially on the energy intensive drying of milk to powder, where is increasing interest in using solar energy to replace coal and natural gas. New solar based systems could heat brine solutions and provide a 24 hour energy delivery through sophisticated heat exchange systems and turbine design. This is an example of a technology that needs to be tested and commercialised, but it could evolve into a significant export opportunity for NZ businesses. However such demonstration projects at commercial scale could cost many \$millions, and existing funding programmes, as noted are wholly inadequate.

Conclusion

23. New organisations and frameworks that are technology focused need to be created to undertake the innovation work to deliver a low-emission economy that increases productivity, incomes and wellbeing. New Zealand needs to transform its approach to innovation to transform the economy.

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