



16 June 2023

Note on future electricity system pathways for New Zealand

Eliminating fossil fuel emissions from New Zealand's economy involves a systemic upheaval. No sector of the economy will remain untouched given our pervasive reliance on burning fossil fuel. The electricity generation sector is no exception. Despite having enjoyed a high share of renewable (mainly hydroelectric) generation for decades, fossil fuel – either coal or gas – has been a crucial part of the equation. It has enabled us to meet peak demand and compensate for reduced hydro power during dry years when the lakes are low.

Both peak demand and dry-year cover will, in future, need to be found from renewable sources. That will be challenging, given the variability of solar and wind resources. There are basically three ways we can meet future demand in a world without fossil generation:

- overbuild renewable capacity to compensate for intermittency¹
- incentivise consumers to reduce their demand, particularly at peak times
- seek to store renewable energy harvested at times when it is plentiful.

A mix of all three is likely. Together with the upgraded transmission system that will be needed, building this decarbonised generation system will require very significant investment. For over three decades New Zealand's electricity generation system has been expanded by companies responding to market signals.² Of course, those market signals are generated within a highly regulated market overseen by the Electricity Authority and the Commerce Commission.

The Electricity Authority's main objective is "to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers."³ The authority is also required to protect the interests of domestic and small business consumers in relation to their dealings with industry participants. There is no getting away from the fact that the way the electricity generation sector develops is a matter of significant public interest. This is scarcely surprising given that the foundation of the system relies on water for which no rents are paid. In those circumstances, sensitivity to the exercise of market power is likely to be particularly acute.

¹ Wind and solar generation would need to be supported by options like geothermal and biomass to overcome the problem of still, cloudy weather.

² While the largest gentailers are in fact in majority public ownership, they are run like any other business and make their investments to deliver a return to shareholders.

³ Electricity Industry Act 2010, s 15.

Faced with the challenge of decarbonisation, a raft of potential investments are being floated by both generation companies and the Government – many of which could have system-wide impacts. These impacts inevitably raise the question: will this be to the long-term benefit of consumers? I have already urged the Government to bring forward its plans for an overall energy strategy to ensure that significant investments are made with a full understanding of their system-wide impacts and do not unduly limit options that may well offer greater long-term benefits to consumers.⁴

To get a better understanding of how different options might be evaluated, I commissioned modelling to determine the economics of four future electricity pathways for New Zealand. The alternative pathways chosen were based on some of the key alternatives that are currently being debated, namely:

- closing Tiwai Point aluminium smelter
- using renewable energy to manufacture hydrogen, with the option of reducing production when demand is high and renewable energy is scarce
- building pumped hydroelectricity storage at Lake Onslow
- a business as usual baseline option for the purposes of comparison.

The results of this exercise are in themselves interesting enough. They cannot, by themselves, form the basis of a decisive view in support of one pathway over another. It is, after all, a modelling exercise and is only as good as the assumptions on which it is based. Furthermore, there are many important issues that are not addressed, such as the possible economic benefits of a significant hydrogen export industry or what any number of technological breakthroughs could do to the cost of currently expensive options like off-shore wind or chemical batteries.

Similarly, the environmental consequences of operating a large pumped hydro storage facility have not been addressed. The modelling focuses purely on the price of electricity paid by consumers and the associated system wide costs under different future electricity pathways. As such it attempts to shed some light on the benefits to 'New Zealand Inc' as distinct from the individual projects.

It might reasonably be asked why the Parliamentary Commissioner for the *Environment* should be asking this question. There are three reasons. Firstly, and most obviously, each of these electricity pathways will have different environmental impacts. We need to understand how they compare with one another.

Secondly, different pathways raise different risks along the way to eliminating fossil emissions. A legacy gas generation industry is understandably interested in prolonging its existence in the transition. Energy-intensive export industries want access to scarce renewable energy. The legitimate advocacy of these players can affect our system-wide emissions. That advocacy needs to be carefully scrutinised.

⁴ See <https://pce.parliament.nz/publications/letter-to-minister-woods-regarding-system-wide-energy-strategy/>.

Finally, the huge new investments that will span the next three decades have to be paid for by consumers. The very fact that the Electricity Industry Act nominates “the long-term benefit of consumers” as the overarching objective of the system we have constructed makes clear the political economy realities that attach to anyone investing in energy generation. While there are good reasons to debate the balance to be struck between providing power supply and curtailing demand to ensure reliability, it is certain that a failure by private generators to meet demand will become a matter of *political* accountability. As Parliamentary Commissioner for the Environment, I have an interest in the affordability of future energy because a transition to zero emissions will not occur if it has been made *unaffordable*.

It is here that the tensions of a publicly regulated but privately delivered electricity generation system are most clearly revealed. Generators are there to provide shareholders with a sound return. A competitive market is supposed to ensure that that return is not excessive. Given the very significant rents attached to particular generating sites, the guarantee of competition is very important. Achieving it in the face of the inevitable asymmetry of information between market participants and regulators is always a challenge.

For that reason it is *critically important* that major investments and supply agreements with system-wide implications are scrutinised using the same assumptions and criteria. This applies to both private participants and any government-sponsored activities. My interest in this topic was in part sharpened by a range of claims about the wisdom of developing a major dry-year insurance facility at Lake Onslow. The Onslow project has generated a string of claims from generators that cannot all be simultaneously true.

It would appear, from the strength of some reactions, that the possibility of dry-year storage on this scale would undermine key elements of existing business models that are valuable to their owners. These are perfectly legitimate concerns – in the same way that New Zealand citizens should be prepared to question the risk involved in a single project like Onslow whose cost will ultimately weigh on the economy in just the same way as the combined effect of some of the proposed large commercial investments. Understanding the costs and benefits – and associated risks – of all these options is essential if we are to achieve a sustainable transition to a zero emissions generation system.

Claims that Onslow, for instance, would be ‘a white elephant’ or ‘unaffordable’ are not a substitute for serious analysis. Being told that it represents ‘analogue technology’ in a digital age tells us next to nothing. Just as unhelpful are advocates who talk about Onslow as ‘a nation-building project’. We can and must do better than this.

The modelling I have commissioned is a contribution to the serious analysis and informed debate we need to have. In releasing its results, I am *not* seeking to suggest that any particular pathway should be privileged. But having learnt what I have from the process of asking the modelled question and then subjected the answer to some analysis, I *am* calling for a better way of weighing up the options as we seek to chart the way forward.

Specifically, I am recommending that the consideration of all major investments with potentially system-wide impact should endeavour to use similar assumptions to allow for apples to be compared with apples (or at least clarify any assumptions that might lead to different conclusions). During this exercise I have found the following assumptions are particularly important:

- the degree of demand response that is possible without undue economic and social upheaval
- use of a realistic long-term carbon price. In my view current prices are too low due to the use of unlimited forestry offsets
- use of a discount rate and cost of capital that appropriately recognises the value of long-term investments and the rights of future generations
- the life of long-lived assets
- the extent of grid upgrade that would be required across the electricity network
- the most important costs and benefits, for example, the:
 - price effect of market volatility
 - economic costs of supply interruption
 - economic benefits of supply security
 - capital cost of building new renewable generation
- uptake of alternative stationary battery technologies and how they will interact with the electricity grid
- the level of renewable electricity coming online.

Once we are using common assumptions we should be able to fairly compare the options on the table. The Ministry of Business Innovation and Employment has already come up with a useful set of criteria for the multi criteria decision analysis that accompanied the business case for the NZ Battery Project. On the basis of this modelling I would add the following questions to MBIE's list:

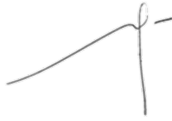
- What is the impact on electricity price volatility and the bills faced by households?
- What is the impact on the competitiveness of the electricity market; particularly in encouraging the entry of new renewable generation and the operation of the market during periods of scarcity (this is closely related to the previous point as lower levels of competitiveness in the market could lead to greater price volatility)?
- Does the option provide a level of predictability for the market?

As a young man, fully a generation ago now, I witnessed a seriously flawed debate about the energy sector projects that erupted in the wake of the oil shocks of the 1970s. The fortuitous (as it was then) discovery of vast offshore gas resources sparked a rush to invest in energy security. Many of those investments were controversial, some of them proved to be extremely costly. All of them had system-wide consequences that created a path dependency from which New Zealand must now extricate itself. The absence of publicly available information to expose the 'Think Big' era projects to proper scrutiny was widely lamented at the time.

Today's decarbonisation challenge is every bit as significant, and the scale of investment required even greater. We are already seeing significant public subsidies being extended to technologies that are claimed to be part of the future. There are hard choices to be made. There is no perfect solution and none of us can predict the future of technology or the shape of the economy in a warming and climate-disrupted planet. The most we can hope for is high-quality decision making based on even-handed treatment of the options.

The release of this modelling should invite debate and criticism. I will welcome critiques that point to the shortcomings of the approach we have taken. All I ask is that officials and private sector participants alike hold everyone to the same standard. Decisions of this nature demand openness and transparency about the assumptions and analysis that we are presented with.

In putting its energy strategy to bed, the Government should commit to a process that enables industry participants, the consulting and academic sectors and the wider public to test the claims being made that key investment decisions made with either regulatory or fiscal support are indeed "for the long-term benefit of consumers".

A handwritten signature in black ink, consisting of a series of connected loops and a vertical line extending downwards.

Simon Upton

Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata