3rd June 2015

To the policy team at the Ministry of the Environment

Let’s take a lead in Paris

Thank you for preparing this discussion document.

These issues and solutions are complex. They require not only public debate, but also leadership from engineers in the energy sector who understand the challenges we face in scaling up the deployment of clean disruptive technologies.

You have a difficult yet responsible task for society to get it right for future generations of New Zealanders.

I offer my help to brief your policy team about why I would like to see New Zealand stand up and take a lead in Paris, through an ambitious contribution of positive action.

As a small country, New Zealand has an increasingly important role to play in demonstrating how a renewable electricity market-led economy can reduce carbon emissions.

You should not under-estimate our place in the world to take such a lead.

My chemical engineering career

In my 35 year chemical engineering career, I have made a major contribution to reducing New Zealand’s carbon footprint. Reducing emissions to targets is the basis of chemical engineering design and good practice. Scaling-up solutions from Research and Development through to Demonstration and Deployment to commercial business cases is also what chemical engineers are trained to do.

I have worked with both government and business. I started with the Rotorua Geothermal Task Force. I then pioneered pinch technology to improve the heat recovery in the process industries. Next, I helped demonstrate key electro-technologies to make industrial unit operations more energy efficient (like evaporation) and use far less fossil fuels in manufacturing processes. This background enabled me to manage Fonterra’s energy efficiency project to achieve a 10% energy savings over their largest 10 manufacturing sites. More recently, I have helped scale-up from a 0.2MW pilot in Wellington in 2008 to a 200MW aggregated portfolio of interruptible load in 2015 in our instantaneous reserves market. This is providing cost and reliability benefits to our security of supply and will help under-pin our progress towards a 90% renewable market in the future. I am on the Smart Grid Forum and I have just been appointed to the Wholesale Advisory Group by the Electricity Authority.

1 The Economics of Climate Change, The Stern Review, Cambridge University Press, Chapter 16: Accelerating Technological Innovation
I have also contributed internationally to the Institution of Chemical Engineers (IChemE) who now has members in 100 countries including New Zealand. IChemE asked me to represent them in November 2013 at a meeting with DECC in London to talk about our New Zealand interruptible load project\(^2\). IChemE launched in March 2015 a virtual energy centre which has been set up to help governments around the world with their policies and strategies going forward, (see www.icHEME.org/energycentre). I am an advisor to this group and met the chairman in London a week ago to discuss how we are going to help our members around the world understand the impact of smarter electricity use.

**The challenge we face**

Today’s electricity supply chain from generation stations to end-use, forms a complex interconnected system. It all has to be carefully balanced in real-time to maintain system stability. This is going to become increasingly complex as customers connected to the system either at the distribution or transmission level change from being passive to active customers. This includes reacting to price signals as well as installing more distributed energy generation and energy storage. This trend has been building up since our competitive market started almost 20 years ago, but it is going to accelerate and potentially happen at scale and in clusters or communities on networks. The cost competitiveness of solar panels, batteries and sensors is improving very fast as mega-manufacturing starts around the world\(^3\). Avoiding unintended interaction between more and more automatic control systems is a matter of priority for system security and quality of supply. If we get it wrong, the system will cascade and collapse, our lights will go out, possibly for days. This security issues is just one of the issues we have been discussing as part of our work on the smart grid forum.

**Some key points for policy making**

I will just focus on 3 important points to try and keep my message quite simple:

Our short-term future in New Zealand is clearly to build on our market-led renewable energy economy and using electricity more smartly in Electric Vehicles for transportation, for more precision irrigation in agriculture, in our cleaner industrial processes eliminating the burning of fossil fuels and in community renewable energy schemes and in our homes making use of integrating solar panels with hot water and our vehicle batteries.

But, how do we get there?

1) We need to consider the “whole system” in our thinking and policy understanding. The big question is who is responsible for making sure that this happens and is accountable for the security and reliability of our more integrated energy sector.

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\(^2\) The meeting with the Department of Energy and Climate Change in London was a result of my article in the chemical engineer, issue 856, October 2012, called “smart and now more stable”

\(^3\) Tony Seba’s recent lecture in Wellington to the smart grid forum provides a good introduction to the rate of change for these clean disruptive technologies - [https://youtu.be/j97Rh6DMcJg](https://youtu.be/j97Rh6DMcJg)
2) The rate of uptake of new clean disruptive technologies will not be linear. It will at a point in time, tip, and accelerate. We need to be ready and be prepared for this to happen with open systems allowing for future flexibility but still maintaining system operability.

3) We will need more engineers and scientists working on the implementation of these technologies. New career paths are needed for young people to keep going in technology education. Professional careers in sustainable solutions engineering will be needed by business. We need to increase the numbers of graduates in key engineering areas as part of a policy initiative to keep New Zealand internationally competitive.

Answering your specific questions

I will provide a brief reply to your five questions to help develop your discussion paper:

Q1. (a) Do you agree with the above objectives for our contribution?

I agree that these are reasonable objectives, but I would like to offer some points of clarification:

1) A fair and ambitious contribution should be matched by wanting to take a lead to grow New Zealand business and competitiveness.

2) Costs and impact are part of getting the trilemma of “security of supply-affordability-emissions” right for our small country. Our balance will be different for much larger interconnected grids so be careful in your country comparisons. We have to manage a light islanded grid with long transmission and changes in generation mix due to changing weather patterns. The resilience of our energy infrastructure has to meet severe weather as well as earthquake risks.

3) Guiding New Zealand over the long term requires a strong partnership with business and our key exporters.

(b) What is most important to you?

Most important is getting our “security of supply-affordability-emissions” balance right using a mix of technologies that fits our unique situation here in New Zealand, for example with fast response reserves like interruptible load, energy storage from our hydro lakes from processes like iron melting, distributed hot water, our cold chain and irrigation and from new batteries in EVs and in buildings and on networks and the automation associated with their charging.

Q2. What do you think the nature of New Zealand’s emissions and economy means for the level of target that we set?

The opportunities in the smart electricity sector are far more achievable in the short-term, for example the infrastructure to fast charge EVs around the country to get around people’s anxiety over their adoption and running out of fuel even though they could plug-in into any 10A supply.

Q3. What level of cost is appropriate for New Zealand to reduce its greenhouse gas emissions? For example, what would be a reasonable reduction in annual household consumption?
Business and cost models are changing fast because of the anticipated reduction in costs along with performance improvements in solar, batteries, sensors and third-party financing. It makes more sense to show savings to households in adopting clean technology than a cost. For example, I own a plug-in EV (one of the first privately owned LEAFs in Wellington) and my running costs are 10% of an equivalent petrol internal combustion engine car plus I have much lower maintenance costs. Some households are getting free sunshine on their panels to charge their hot water and EVs each day which starts to make the cost model very appealing indeed.

The challenge is keeping everyone network-connected to be able to contribute to system security at times of stress. This does need some new regulatory thinking and cost models for the distribution businesses.

**Q4. Of these opportunities which do you think are the most likely to occur, or be most important for New Zealand?**

The most important opportunity is smarter electricity use in the process industries, in smart cities, in transport, in our communities and homes. Water use will also be an issue and this needs to be part of a climate change policy because water and energy and emissions go hand-in-hand in New Zealand.

**Q5. How should New Zealand take into account the future uncertainties in technologies and costs when setting its target?**

Look at what is happening in those states and countries also leading the way, for example in California, Norway and Denmark. Uncertainty can be significantly reduced if there are more demonstration projects (not research) like we have seen in the UK through the Low Carbon Networks Fund initiative. The learnings and experience must get transferred to everyone to help de-risk decision making. These demonstration projects should be business-led because technology is changing and progressing very fast going down the cost curve.

**How you can contact me**

Thank you for reading my submission.

Stephen Drew