National Energy Research Institute

23 October 2018

Submission on: *Electricity Price Review: First Report*

Recommendations

That the Review in its final report takes account of the following three key points:

1. In the medium-term it will be storage (including increasing distributed storage with EVs) rather than DG that will the more disruptive of the electricity supply industry and have the greater impact on affordability and other social issues. Pricing will need to encourage efficient investment in it.
2. To get optimal invest in GHG emissions reductions electricity pricing needs to be not just be even-handed inside the electricity system; it needs to be even-handed in terms of alternatives outside it.
3. The current system for ensuring affordability, particularly the use of the pricing system in this, is under pressure from the changes in the electricity system and warrants a systematic bottom-up review.

Introduction

In November 2017 the National Energy Research Institute[1] published the *Energy Research Strategy for New Zealand: The Key Issues* (*the Strategy*)[2]. This identifies major beyond business-as-usual risks and opportunities anticipated in the energy sector arising from social, technical and environmental changes with a view to developing a research programme to help manage these. This submission has been developed by NERI based on this work, but may not necessarily represent members' individual views.

[1] 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, coordinating and supporting high-quality energy research and education within New Zealand. Its research members are Victoria University of Wellington, Auckland University of Technology, Scion, University of Canterbury 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.

[2] National Energy Research Institute, "Energy Research Strategy for New Zealand: The Key Issues," National Energy Research Institute, 2017.

The purpose of our research strategy is to influence the future to NZ's advantage and identifies a number of areas where in the NZ context we are likely to do able to do this. Future electricity pricing and regulation provides a means to facilitate this[3].

In three broad areas our assessment of some of the emerging issues and trends impacting the sector is somewhat different from those assumed in the Report. In what follows we have identified the areas of difference but not attempted to develop their impact on any recommendations because this will depend upon a range of other factors the Review will be considering.

If the Review would like more detail we would be happy to discuss further.

1. Technologies: Significance of DG in NZ

In assessing the impact of change there is a strong temptation to import overseas experience into the NZ context. As the Review[4] in part notes the NZ electricity system is relatively unique internationally in its capabilities; available resources and operating environment (e.g. demand characteristics, environmental pressures, even social considerations). Overseas trends need to be carefully analysed before being applied to NZ.

The Review[5] suggests "solar panel and battery advances will allow residential and commercial customers to become generators on a wider scale". While this is undoubtedly true, its significance in the NZ context may well not be great. NZ has predominantly low cost renewable electricity available from the grid, and "ample renewable generation resources to meet expected demand growth" without prices "necessarily having to go up much, if at all" [6]. NZ has a well-developed grid infrastructure because of the historic importance of electricity as an energy source.

For this reason the pressure on individual NZ consumers to deploy renewable generation to reduce emissions will be much lower than is being seen overseas. International outlooks are thus much less relevant to the NZ context.

Where NZ consumers have deployed renewable generation this has predominantly been PV systems, and as the Review notes[7], quoting NZIER: "The current structure of distribution charges is also distorting decisions about installing solar panels" because they are unsuited to meet peak load and not particularly competitive at other times. In the event that tariffs are changed to better reflect true economic cost significant growth in residential and even commercial PV is likely to be limited to situations where other factors make them economic[8].

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[3] The Review's Terms of Reference includes consideration of "The current regulatory framework and its ability to promote the potential benefits from emerging technologies." Presumably an extension to include consideration of potential benefits in the broader energy sector is appropriate.

[4] Review Page 13.

[5] In "At a glance" the Review conveniently summarises its findings including its view of the future. References that follow in this section are from that unless otherwise indicated.

[6] Review Page 13.

[7] Review Page 56.

[8] There will no doubt be significant DG growth in new demand enabled by the ability to be off-grid but the pressures won't be there where grid infrastructure exists. An example would be energy

Adding to that there are significant technical economies of scale in distributed generation and battery storage. NREL has recently published[9] the following history of the US costs components of PV since 2010 and how the balance of plant is an increasing component of cost and with that the relative advantages of scale:

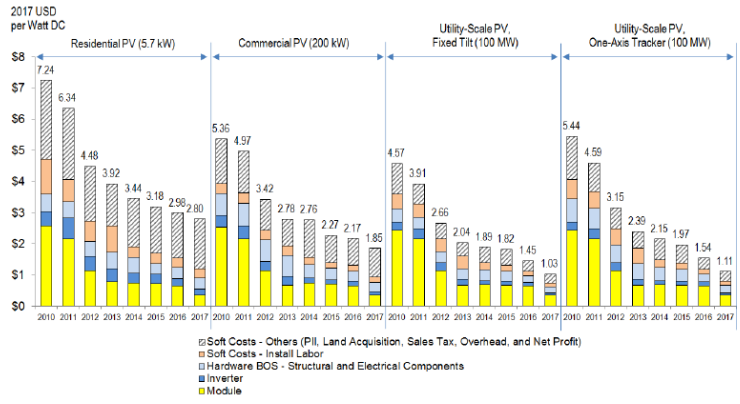

Figure ES-1. NREL PV system cost benchmark summary (inflation adjusted), 2010–2017

The inflation-adjusted system cost differences between Q1 2016 and Q1 2017 are $0.18/Wdc (residential), $0.32/Wdc (commercial), and $0.42/Wdc (fixed-tilt utility-scale). Table ES-2 shows the benchmarked values for all three sectors and drivers of cost decrease and increase.

This suggests that even where solar is available (and overall NZ is better suited to wind generation than PV) utility scale installations will be the most cost effective. This further reinforces the point that general residential PV isn't likely to be a significant medium-term contributor to meeting NZ's future electricity loads[10].

These arguments also apply to other high capital cost/low operating cost generation and storage assets. This can already been seen in wind generation in NZ, and other factors aside battery storage will favour utility scale storage systems, and these will become increasingly economic. The immediately obvious "other factors" will be EVs justifying household investment in batteries that can also contribute to residential energy management.

The implication for NZ's future electricity system is that while technology is reducing the cost of generation and storage assets, all things being equal economies of scale apply and this will favour grid connect assets. Because there is unused capacity in the network at non-peak times, storage to smooth intra- and inter-day loads and power quality will become increasingly attractive. The mismatch between load and available renewable energy resources makes inter-seasonal storage of particular interest in NZ although the technology options are limited.

In the medium-term it will be storage (including increasing distributed storage with EVs) rather than DG that will the more disruptive of the electricity supply industry and

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harvesting for new applications such as the internet of things will potentially become significant, but these will by their definition largely operate independently of the electricity system.

[9] Fu et al, "U.S. Solar Photovoltaic System Cost Benchmark: Q1 2017," National Renewable Energy Laboratory, 2017.

[10] Some commercial and industrial building with significant day time loads may adopt. But these are much less demanding to integrate into the distribution system because they are predominantly serving a local load within the context of more sophisticated onsite electricity systems.

have the greater impact on affordability and other social issues. Pricing will need to encourage efficient investment in it.

2. Environmental: Electricity system alone can't reduce its GHGs

GHG reduction is a significant environmental issue for the electricity sector[11]. In our system there are four main drivers of generation using fossil fuels, predominantly natural gas (NG):

1. Take-or-pay contracts for NG makes the corresponding generation assets highly competitive at the margin.
2. To assist with system stability and support.
3. To cover short term peak loads predominantly driven by intra-day domestic thermal loads.
4. To cover inter-seasonal variability and mismatches between renewable resources and load. The demand variability has a significant residential and commercial thermal component.

Over time take-or-pay contracts will work their way out of the system and increased storage (and power electronics) within the system will go some way to ameliorate the others. Switching coal and NG electricity generation to biofuels could also contribute.

All these require that the pricing structures within the electricity system are even handed when it comes to these types of investment decisions, and this is naturally the main preoccupation of the Review.

However the last two drivers will also require consideration of ways to reduce the demand for electricity at those times when the system would otherwise use fossil fuel generation. This will mean investments within the electricity system will also need to be compared with those outside it, and competition across the electricity/alternatives boundary will also need to be even-handed.

A few of examples of alternatives that will be in play are the use of:

- Low grade geothermal or biomass direct heating for winter thermal loads, either site specific or district based.
- Improved building insulation both retro-fitting and new builds to reduce thermal loads and variability.
- Other forms of non-electricity energy buffering.

In the case of the last example even EVs are buffering investments outside the electricity system (and in this case the Review notes the need for even-handed treatment).

The difficult issue for electricity pricing is reflecting the GHG charges in charges in a way that allows those considering making alternative investments can see the potential savings[12]. The problem is more complex than pricing other aspects of

[11] Although in the wider energy sector it represents only a relatively small proportion (~5% in PJ) of fossil fuel use.

[12] This won't always be in the interest of the supplier who would no doubt prefer the user to stay.

electricity services because attribution to specific users is required, when it is system-wide cost.

This is partly addressed by the Review in relationship to time of use charging and low fixed charges (LFC), but the GHG issue warrants more detailed consideration.

In particular it does raise the issue of whether the regulatory framework might be too inwardly focussed. As the Productivity Commission reports when discussing the low fixed charge regulations[13] the Electricity Authority concluded "the competition, reliability and efficiency effects of the LFC Regulations are not as material as has been assumed" which begs the question of what its impacts were outside the electricity system.

To get optimal invest in GHG emissions reductions electricity pricing needs to be not just be even-handed inside the electricity system; it needs to be even-handed in terms of alternatives outside it.

3. Social: Affordability is more than just pricing

The Review raises the weakness in low fixed cost regulations, and the impacts on affordability of changes that might arise from more efficient pricing and new technologies, and concludes: "Industry, regulators and government need to work more closely together to help households in energy hardship."

This is true, but it appears that the level of change going on in the system and the need to move away from some of the existing approaches warrants a somewhat more basic review.

This would start by separately considering the two issues of pricing for an efficient, adaptive and stable electricity system and ensuring affordability. This would then move to look at how best to meld the two using both electricity pricing and the welfare system, and how best to transition to that system.

In what follows we briefly highlight some of the issues and potential responses to simply show that a more systematic analysis could produce better outcomes in both domains.

Efficient electricity charging is likely to involve a significant fixed cost[14] and energy charges that should vary according to time of day and year. It would be desirable if the consumer could influence the imposition of these costs on at least some timescale.

However as Review reminds, drawing on the Lines Company's experience, there are complexity issues to be addressed in any practical implementation of such a charging regime. Notwithstanding it would be useful to have the Review explore what this might ideally look like and alongside that how to achieve affordability.

[13] Box 13.7 page 410 Productivity Commission, "Low-emissions economy" (2018)

[14] Whether this should vary with peak use or just be a capacity charge would be a matter to be determined.

For example if this kind of charging were adopted ensuring the fixed cost component was affordability is less of a problem. It is a predictable charge even if it varies by location. By way of example rents are of this nature and the accommodation co-payment supplement already provides support in a targeted way for private renters[15].

The more difficult costs to support are those that vary with consumption patterns over the course of the year[16]. The Winter Energy payment is an attempt to provide such support, and while poorly targeted does show the ability of the welfare system to deliver under these circumstances.

In both cases it could be deemed desirable for all customers to see an affordable proportion of their actual electricity costs. Again co-payments/part charges can do this[17].

Also there are the problems that occur because many of those in hardship could have their situation improved by investment in their houses and appliances. This is not going to be addressed by either the charges the tenant sees or the support they receive. That will involve more direct interventions. The Review should give some further thought to what these might be.

The current system for ensuring affordability, particularly the use of the pricing system in this, is under pressure from the changes in the electricity system and warrants a systematic bottom-up review.

Simon Arnold
Chief Executive

[15] As a complete aside a fixed capacity charge for a property could be considered like rates and charged to the owner. If this was done it would be recovered through the rental that would then immediately get covered by the accommodation supplement.

[16] The LFC has no doubt artificially exaggerated the importance of variable charges.

[17] The health system effectively caps the co-payments which could be an option for addressing extreme hardship.