Energy Link
decision power

Price Formation at 100% Renewables

Submission to the Electricity Authority

March 2022

1 Introduction

We welcome the opportunity to make this brief submission and to contribute positively to the debate over the operation of the wholesale electricity market at or near to 100% renewables. Questions on this submission can be directed to Greg Sise, Managing Director, Energy Link Ltd.

2 Responses to Questions

	Question	Page references	Comment
1	Do you agree with the broad conclusions that emerge from the simulations in relation to spot price levels and volatility, in particular: (a) significantly more spot price volatilityis likely with a 100%RE system, especially shorter-term weather- driven volatility? (b) New Zealand's sizeable hydro generation base is likely to moderate the growth in volatility to some extent, making extreme oscillations between zero and shortage spot prices relatively unlikely?	p18, p61	We agree that spot prices will be more volatile with 100%RE than they are now. We agree that the existing hydro base will have a role to play in moderating price volatility, just as it does now; hydro is a superb resource for peaking. However, this needs to be kept in context, because our reliance on hydro also creates seasonal volatility.
2	If you disagree, what is your view and thereasoning for it?	p18, p61	We note the reference to thermal being spilled, but this is not exactly the same as spilling water, wind and sun. Thermal spilling does not involve flaring unused gas, for example, whereas renewable spilling involves spilling of the 'fuel'; is it just a change in mindset that is required? Or is there a fundamental aversion to renewable spilling ingrained in the psyche of the NZ public and government? It may be instructive to look way back at how the current thermal fleet evolved, and why. If running the lakes higher with 100%RE is lower cost than building large-scale storage with 10%RE, such as pumped hydro energy storage (PHES), then why have the lakes not always been run higher, with more spill, and with less thermal capacity? Some of this could be blamed on pre-market central planning, but then most of the thermal capacity in the market today was built after 1996. If the answer is, for example, that hydro generators earn higher returns by spilling less, this would cast doubt on key assumptions underlying the reference case.

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3	Do you agree that in a 100%RE system there will be many diverse and disaggregated resources to coordinate, and that a wholesale market will be the preferred mechanism to coordinate plans and actions among all the resource owners? If you disagree, what is your view and the reasoning for it?	p18, p65	We agree the wholesale market will become more important.
4	Do you agree that these are the key issuesin relation to real-time coordination? If you disagree, what is your view and the reasoning for it?	p20, p69	There might be one missing: what audience is real-time co-ordination aimed at? For example, if a household's appliances are connected using IoT technology, solar and a battery, should it be able to interact with the market directly by offering to reduce demand at a price? Or will this continue to be managed through their retailer? A related question, is how the household can improve the value it receives from the electricity market by contracting with multiple parties for a range of services at its ICP?
5	Do you agree that these are the key issuesin relation to ancillary services with 100%RE? If you disagree, what is your view and the reasoning for it?	p21, p74	The comments in 4 above apply.
6	Do you agree that these are the key issues in relation to price signalling with 100%RE as summarised in paragraph 3.42 above? If you disagree, what is your view and the reasoning for it?	p24, p88	We don't disagree these are key issues, but (a) in particular is a huge challenge. One only has to look at the current response of the public and government to higher petrol and diesel prices to understand how embedded the "mindset" is in New Zealand. similar measures were taken in other countries, so it is not just NZ.
7	Do you agree that the preconditions in paragraph 3.38 would need to be in place for an energy-only market design to be effective? If you disagree what is your viewand the reasoning for it?	p24, p88	The question of very high prices in times of scarcity needs to be finessed. The current scarcity pricing regime is based on consumers having no choice in whose lights are turned off in the event that there is insufficient generation offered into the market to meet demand. If, in future, IoT (for example) allows consumers to be turned off at a price of their choosing, and potentially compensated at that price (in addition to not paying the high price), then maximum scarcity prices might be extremely rare. Alternatively, the scarcity pricing regime could be expanded to more progressively signal impending scarcity. We note Dr Grant Read's comments on opportunity costs and the cost of future investment, potentially tied in with prices in times of scarcity, which suggests scarcity pricing could be expanded to play a greater role in influencing water values than they do now. But we also think it is very early days and a lot of work needs to be done on the issue of water values.
8	Do you agree that we should take forward to the next stage of the process (options identification and analysis) the measures referred to in paragraph 3.43 above? If you disagree, what is your view and the reasoning for it?	p24, p88	There doesn't appear to be a 'plan B' amongst these measures. For example, what happens if 'mindsets' cannot be changed, and actually get even more entrenched (for whatever reason)? The other obvious measure not listed is the addition of large-scale storage such as PHES. This seems to be treated as a measure that will be considered if and when it happens, rather than as a measure that could make electricity supply more secure, more reliable, and prices less volatile.

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9	Do you agree that these are the key issuesin relation to demand-side flexibility with 100%RE? If you disagree, what is your view and the reasoning for it?	p25, p93	We agree that flexible demand will become more valuable in future, and we already see efforts to become more flexible in order to reduce electricity costs and to work with variable renewable generation (VRE). But why is demand not more flexible now? The answer is simply that consumers rely on, and assume supply will be available at a reasonable price. It is easy to overemphasise the amount of change the demand side will undergo, and the key question here is whether consumers want to be more flexible to the degree assumed? Consumers may be prepared to pay a premium to not be flexible. Or maybe BESS will develop at such a rate that DSF is provided by energy storage rather than by load shedding or shifting? We suggest care needs to be taken in framing these key issues so that they can work under more than one scenario for the evolution of the market as it transits to 100%RE. See also our comments in response to 7 above.
10	Do you agree that these are the key issuesin relation to contracts markets with 100%RE? If you disagree, what is your view and the reasoning for it?	p26, p98	Our concerns with the hedge markets are already on record in our submission to the wholesale market review late last year, so we won't repeat them here. But moving closer to 100%RE and more volatile prices is only going to make matters worse. The Sapere paper covered most of the issues, but we want to amplify the concerns around greater concentration as vertical integration becomes the only viable strategy for retailing. Independent power producers (IPPs) could also experience more difficulty getting PPAs, because long-term contracts tend to hold relatively fixed prices for no more than five to ten years, after which they are typically reset based on movements in the ASX futures prices. Financiers are very aware of this and could be put off by volatile returns arising from this exposure to market prices.
11	Do you agree that these are the key issuesin relation to transition to 100%RE? If you disagree, what is your view and the reasoning for it?	p28, p102	We agree that 'premature retirement' is a huge issue. Past retirements were not always signalled well in advance, because it is not always in the interests of the generator concerned to announce the retirement until they have their plans for generation expansion in place. If this continues in future, we see government intervention as inevitable. For example, e3p (Huntly unit 5) had a gas contract underwritten by the government of the day when it commissioned this unit. Notwithstanding the push to 100%RE, government will have the same incentive to ensure that key plant is kept in the market for as long as it is needed, and retired when no longer required. One only has to look at Australia to understand what mayhem sudden thermal closures create. We note the positive efforts being made by Contact, in its efforts to co-ordinate thermal exit, and by Genesis, in its efforts to repower Huntly Rankine units so they can remain in the market at 100%RE.
12	Are there any other 'lumpy' issues that warrant specific consideration in the transition to 100%RE?	p28, p102	The obvious one here is the addition of large-scale energy storage, whether PHES or other renewable technology, which we note gets a mention. But this would raise issues around stranded assets, how long thermal plant would stay in the market, and what would ensure they do stay sufficiently long? Government intervention would appear to be inevitable.
13	Do you agree that we should analyse how competition in the wholesale market is likely to be affected by a shift to 100%RE, in particular, in competition for seasonal flexibility services? If you disagree, what is your view and	p29, p104	Yes we agree. Our concern is with smaller players; retailers and IPPs, and whether they can secure contracting arrangements that are both flexible (to cope with variability in the volumes they have exposed to spot prices) and cost-effective (retailers) or investment-feasible (IPPs). Smaller players add to the market through innovation and price pressure, and their impact should not be underestimated.

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	the reasoning for it?		
14	What other key areas of opportunity or challenge (if any) will arise in the wholesale electricity market with 100%RE that are likely to have a significant impact in relationto achieving the statutory objective of the Authority, which is to "promote competitionin, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers"?	p29, p104	We observe that existing capacity of the grid, and transmission capacity generally, are already becoming more important as the grid potentially becomes overloaded in regions with high potential for VRE. The reference case does limit transfers on the HVDC link, but does not otherwise consider this aspect at all. SFT and other constraints create price volatility, which isn't considered. This would be a big job, of course, so we understand why it wasn't attempted. MDAG's report also notes that Transpower and the Authority are working on the grid in other workstreams. However, one cannot separate wholesale market and grid issues due to the potential for constraints to create price differences on the grid. Eventually, the two workstreams need to converge as one significantly the impacts the other.

3 Reference Case

We understand the rationale for using the reference case as it stands, and we've modelled it many times ourselves. We also understand that the modelling brief did not extend to looking at a wide range of contingencies such as prolonged outages of key plant including the HVDC link and large hydro generators.

But it is likely that when contingencies are investigated, especially when contingencies occur simultaneously, the reference case will either prove to be infeasible, or reliant on too many assumptions about certain events, the magnitude and probability of which cannot be accurately assessed in advance. MDAG's report itself notes in section 5.72 that "it is important to note the charts show the effect of single sensitivity cases. It is possible that multiple 'downside' (or 'upside') cases could coincide and have compounding effects on volatility." For example, recent market stress is the result of a reduction in gas supplies, but this is compounded when lake levels fall below expected levels given time or year.

There are many assumptions made to construct the reference case, some of which may prove to be unrealistic. If one looks back over the last few decades, there are good examples of this. For example, in 1992, the last time southern hydro lakes were seriously at risk of bottoming out, it was discovered that ECNZ operated the lakes on the assumption that shortage one year in 20 ("1-in-20") was economic given its estimates of the value of lost load. However, it soon became evident this assumption was unrealistic, and a key outcome of the 1992 shortage review process was that the security level increased to 1-in-N, N being 60 at the time.

Today, we have 91 years of inflow data, which seems like a much larger number than 20 or 60, yet records are still being set for low inflows, e.g. Dec-May in 2011/12 and Feb-May in 2017, suggesting that the inflow data set does not fully reflect the underlying inflow distribution. Furthermore, the inflow distribution is changing due to climate change in ways that we do not fully understand. A warmer atmosphere can hold more moisture, but it won't hold all of that extra more moisture if evaporation from the oceans does not increase

proportionately. Weather is likely to become increasingly volatile, with larger storms, but potentially also more drought.

The reference case is also diametrically opposed to two key benchmarks: the current market and the market under investigation by the NZ Battery team, i.e. it is at odds with current practice and with government's expectations.

Most demand forecasts these days, assume massive uptake of EVs as they become more affordable, range increases, and charging infrastructure scales up (both in terms of number of chargers and charging capacity). This reduces diversity in the energy system. For example, suppose the lakes are low and the HVDC link is out, resulting in calls for voluntary savings and potentially rolling outages. In today's world, cars and trucks can still distribute goods, get people to work and allow them to generally carry on a normal life. In tomorrow's world, electricity shortages will also stress transport, which will inrease the need for a highly secure supply of electricity.

Alternative reference cases, e.g. with large-scale storage in one or both islands (including green thermal generation with a much larger storage facility), could have significantly different price dynamics and volatility: by its very nature, adding storage reduces volatility.

Stated in this way, the burden of proof that the reference case is feasible and 'the right case' to test, lies with the Authority.

That being the case, it would make sense to have two reference cases, one at either end of the spectrum in terms of storage at large scale, and testing both of these with a wide range of contingent scenarios in which shortages of various energy sources and assets are tested for their impact on the market.