Submission from Wind Quarry Zealandia on "Price Discovery under 100% Renewable electricity Supply – Issues Discussion Paper"

Keeping an open mind:

We note the observations made in:

- The Foreword to the Discussion Paper:

  "This process is genuinely a journey of discovery in which we need to remain open to revisiting our intuitions if robust analysis points us in a direction different to that which we may have assumed."

- Section 3.5 of the Executive Summary

  "To achieve 100%RE supply a great deal of new generation and storage (e.g. batteries) will be required to meet projected demand growth and replace fossil-fuelled stations. The simulation results show an average investment requirement equivalent to 400-500 MW of new supply or demand response capability every year until 2050. The projected pace of development is much faster than experienced in living memory. As a comparison, net supply growth averaged around 60 MW/year between 1990 and 2020."

Over the past 30 years New Zealand has had requirements for an incremental increase in generation capacity. The regulatory and investment environment has delivered what was required.

That time has passed.

The Government's goals and mandates for decarbonisation are well documented and have been widely publicised. However, in actual practice, there is little actually being done now by Government to support its plans and to ensure that New Zealand will achieve its clean energy goals. New Zealand now needs much more new generation capacity per year if it is to achieve its net zero ambitions. The regulatory and investment environment needs to change. Internationally, large generation projects are now being implemented, most notably from offshore wind generation. New energy export industries, involving Power to X products such as green hydrogen, are being developed concurrently.

We argue in this submission that the New Zealand regulatory environment, including how the electricity market operates, needs to change, so that the opportunity for similar large-scale projects can be enabled in New Zealand. By not taking affirmative action now, New Zealand is making the defacto choice to not compete for the massive amount of investment and high paying jobs (in both the domestic energy industry but also the rapidly growing global energy export industry) that will accompany the global transition to cleaner energy sources.

We suggest that the implications of the development of large-scale offshore wind electricity generation projects in New Zealand and the accompanying opportunities for an energy export industry have not been fully considered to date. The development of single-point gigawatt-scale offshore wind generation is fundamentally disruptive to the status quo which encourages multiple smaller-scale sources of new renewable generation principally from onshore wind and solar.

We trust the Electricity Authority remains open to considering the implications of such developments including the accompanying development of Power to X manufacturing in New Zealand. This includes the associated large-scale demand-side response capabilities of Power to X manufacturing, and the international energy trading opportunities for Power to X products (likely to be mostly export but also potentially import).

In particular we encourage the Electricity Authority to consider the opportunity and market implications for New Zealand from having an electricity system which has over 100% renewable electricity with the balance exported. This overproduction and export model is being considered in several other countries including Australia. It is attracting genuine commercial interest, will help the country become energy independent, and should be enabled in New Zealand.

In our submission we will respond to the specific questions asked in Appendix B of the Issues Discussion Paper. These responses can be found later in this submission. First, we wish to provide some context to our comments.

Introduction to Wind Quarry Zealandia

Wind Quarry Zealandia Limited (WQZ) is intending to develop New Zealand's first offshore wind power facility in waters off the Taranaki coast. It will be larger than any current onshore wind project in New Zealand.

WQZ believes the development of the wind farm and the associated industrial development will be a major economic growth opportunity for New Zealand and a significant contributor to reducing New Zealand greenhouse gas emissions. It will also be an important contributor to the achievement of 100% renewable electricity.

Several other offshore wind farms will likely follow.

The current market structure provides disincentives to such a large development compared to smaller onshore wind farms and solar developments. The key disincentive is that the market dominant gentailers are encouraged to restrict the supply of new generation to keep electricity prices high. This gives an excellent return on investment for them but the relatively high prices discourage investment in the various opportunities for using renewable electricity to decarbonise the economy. It is acknowledged that those investments in decarbonisation are being gradually encouraged by the increasing cost of carbon units. But those investments in decarbonisation could occur much faster if New Zealand had more plentiful and cheaper electricity. One lever influenced by Government (the ETS) is encouraging decarbonisation while another (the Electricity Market structure) is holding it back.

Offshore Wind

We note there is no specific mention of offshore wind in the Discussion Paper. While "wind" gets plenty of mentions, as one of the two main expected sources of new generation (the other being solar), we suspect most readers would assume the focus is on onshore wind. Offshore wind is significantly different from onshore wind both in terms of:

- The much larger scale of production from individual wind farms. Current international offshore wind farm developments are typically 500MW-2.5GW.

- The higher net capacity factor. This is likely to be around 50% in the best offshore sites compared to up to 40% in the best onshore sites in New Zealand.
- The inherently less significant impacts to the many beautiful landscapes and cultural resources in Aotearoa New Zealand.

We suggest the Electricity Authority should acknowledge offshore wind as a distinct form of renewable generation.

The current electricity market

New Zealand's current electricity market has operated over the past 25 years in a manner that encourages:

- The large gentailers to directly or indirectly (though offtake agreements) control most new generation builds.
- Those new generation builds to be relatively modest in scale (most under 200MW) providing incremental increases in total generation capacity. Larger builds would oversupply the market and reduce prices. The current market is essentially constrained by gentailers leveraging captive demand. This creates an inability to incentivise and support large scale increases in clean resources. As a result, the cost of electricity is assured to increase over time.

This market structure has nevertheless, operated reasonably effectively during that 25-year period while:

- Growth in demand for electricity was minimal.
- Hydro generation provided around 60% of New Zealand's electricity providing a combination of baseload supply and dispatchable storage.
- Thermal generation has been available to balance the supply with demand.

These factors are all changing:

- There will be strong growth in electricity demand from electrification of sectors currently using fossil fuels. To avoid upward pressure on prices, large scale new sources of clean electricity supply must be developed.
- Solar and onshore wind will increase, offshore wind will be developed, and the proportion of hydro generation will decline. New storage methods will be needed because of the increase in variable renewable generation.
- Fossil fuel powered thermal generation will need to be eliminated (though thermal generation powered by green hydrogen or biofuels may continue).

WQZ suggests that achieving the 400-500MW of new generation per year until 2050 from onshore wind and solar will be very challenging. While theoretically doable from a scale perspective there will be major impacts on land-use and landscapes across New Zealand and pushback from various communities, including iwi (as has already been the case in some locations recently).

WQZ suggests that offshore wind will be required to achieve this volume of new generation. As noted above, changes to electricity market structures will also be required to encourage the development of large-scale offshore wind generation. WQZ expects that offshore wind generation costs in New Zealand will be well below the average actual market price of electricity for the past 5 years.

Large-scale renewable generation and Power to X

WQZ also notes that New Zealand is a country with potential to generate considerably more renewable electricity than it needs for domestic electricity consumption. This provides opportunity for electricity to be used to manufacture Power to X products that can decarbonise the otherwise hard to decarbonise sectors while also providing opportunity for energy exports. We note the possibility of "green" energy exports was mentioned in the Foreword (1.4) but the concept was not explored any further in the Discussion Paper.

Solar and onshore wind will be important parts of this increase in renewable capacity but have limitations of scale and capacity factors. Offshore wind is a leading candidate to provide the large-scale surplus electricity needed to stimulate Power to X production and an energy export industry. New Zealand has a very large exclusive economic zone allied with world-class offshore wind resources. Several companies, including WQZ, are exploring the offshore wind opportunity.

Creating large scale new sources of clean offshore wind generation provides an opportunity for Power to X products, such as green hydrogen, ammonia or methanol, manufactured using renewable electricity. These products are strong candidates to help hard to decarbonise sectors, such as heavy road and rail transport, shipping, and aviation achieve net zero. There is also opportunity for these products to provide the long-term energy storage (allied with green thermal generation sites) necessary to address New Zealand's dry year issues. We note this forms part of the current NZ Battery Project and is mentioned in several places in the Discussion Paper (3.17, 5.13, 5.24). Production of surplus electricity and manufacture of Power to X products also provides opportunity for New Zealand to develop a significant energy export industry.

The Power to X industries also provide opportunity for demand response systems where production of Power to X products is curtailed in times of electricity shortage with electricity released to the New Zealand market to balance supply with demand. We note this potential was mentioned in Sections 1.5(d), 1.11 and 5.19 of the Discussion Paper.

We note the opportunity for a Power to X based energy export industry may also provide the infrastructure for a Power to X based energy import industry where New Zealand may occasionally import energy products to balance the local market e.g. in dry years.

While the development of an energy system where there is overproduction of electricity for domestic needs and export of the surplus is not guaranteed, it is attracting genuine interest. WQZ urges the Electricity Authority to ensure that the New Zealand electricity market is capable of operating in a way that enables, and even incentivises, such opportunities to be developed.

As noted earlier the current electricity market encourages incremental development of new generation. This means the current electricity market discourages the development of large-scale single point generation sources such as offshore wind which are necessary for supplying the scale of electricity needed for Power to X production.

WQZ's response to the questions posed in the Discussion Paper

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 volatility is 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?

Conclusions will always be dependent on the assumptions underpinning them.

If New Zealand develops a 100% renewable electricity system without investing in new storage and systems for re-generation of electricity from the stored energy there will be more spot price volatility.

We agree that the country's sizeable hydro generation capacity will play an important role in moderating volatility, and curtailment of variable generation may be required in the near term until sufficient battery storage is added to the transmission grid.

To the extent new sources of renewable generation are completed prior to the systemic load growth "catching up" to act as a sink for the clean generation, this will exacerbate volatility in spot markets. Extreme volatility is harmful to both consumers as well as to the efforts to finance new sources of renewable generation.

2. If you disagree, what is your view and the reasoning for it?

We do not disagree with the conclusions from the simulations. However, we suggest that there should be different simulations involving New Zealand which model the country producing more than what is required for 100% renewable electricity for the domestic market, with the overall balance being exported (in the form of Power to X products such as green hydrogen or ammonia).

In this simulation there will also be seasonal surpluses within New Zealand which can be stored and used to balance short term shortages. We note the opportunities for green peakers running on fuels such as hydrogen were recognised in the Discussion Paper (e.g. 3.17). Further, there is significant interest in increasing battery storage in the grid, (ie Lake Onslow proposal) and this will require large amounts of electricity to charge up these systems once they are brought online.

There will also be annual variations in supply and demand which will require different balances in the mix of storage for the local market and for export. The occasional opportunity for energy imports in the form of Power to X products should also be considered.

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?

The current electricity market encourages incremental development with new generation coming from "diverse and disaggregated resources". This incremental development is a natural outcome of a system that encourages gentailers to limit supply to the market to keep prices high enough to sustain the profitability needs of gentailers without regard to the material benefit to the nation of encouraging Power to X investment and job creation on a large scale. The Discussion Paper also suggests distributed generation as an answer, but this is difficult to regulate and will not provide the scale of generation required to phase out fossil fuel use to meet the 2030 and 2050 decarbonisation goals.

While this system has worked to provide a reasonably reliable system it keeps prices higher than they should be and discourages innovation and larger developments of new generation of the scale that is necessary for investment in accompanying Power to X production and associated energy storage systems. These higher prices are stressing current users of electricity, both industrial and residential, limiting growth in the economy and stressing whanau.

We agree there should continue to be a wholesale market – but there should also be greater use of mechanisms such as Contracts for Difference (as provided by the UK Government) or Power Purchase Agreements (PPAs), with major industrial, government or gentailer loads) to encourage investment in larger generation projects and associated manufacturing and storage projects. These trades outside the wholesale spot market will likely become increasingly important.

4. Do you agree that these are the key issues in relation to real-time coordination? If you disagree, what is your view and the reasoning for it?

We note the key issues highlighted in the Discussion Paper. Real time coordination can be achieved with a spot market that has sufficient liquidity and price discovery. However, such a spot market cannot effectively be the clearing house for all electricity supply needs. In other markets the majority of load is contracted to be serviced with PPAs and the spot market is used almost exclusively for real time coordination.

While outside the remit of the Electricity Authority we note that real time coordination also requires a transmission grid with the capacity to balance the varying points of generation and demand. In the future the flow of electricity will vary and the grid needs to be able to handle this. Transpower is using a model to plan new generation sources that always chooses the cheapest generation source, and this precludes transmission planning from considering the benefits of offshore wind since it is not currently cheaper than onshore wind and solar. This model must be changed if offshore wind is going to play a role in helping New Zealand make its goals for decarbonisation, industrial growth, and reasonable prices to consumers. Otherwise,

the grid will be upgraded in such a way that increased transmission is not built in advance of large offshore power generation projects such as proposed by WQZ.

As an example, at the moment the inter-island link is primarily designed to send electricity northward from South Island hydro sites to North Island consumers. While electricity can be sent south, capacity is limited. In future with increasing North Island solar and wind generation (including offshore wind) there will be increasing opportunity to curtail South Island hydro generation and send North Island generated electricity southwards. This will allow storage in the South Island reservoirs to increase and be available when wind and solar are not generating at capacity.

5. Do you agree that these are the key issues in relation to ancillary services with 100%RE? If you disagree, what is your view and the reasoning for it?

This list appears reasonable.

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?

We suggest these are the key issues only if the electricity market were pure and operating in isolation from the rest of the economy. It is not pure, and it does not operate in isolation from the rest of the economy.

The current model and the price signalling that comes from it encourages limited incremental additions of new generation. This will lead to suboptimal outcomes for the country with productive land being used for generation purposes with the accompanying landscape and community impacts. Incremental generation also does not lead to sufficient point source supply of electricity for the Power to X manufacturing which is essential for the country to achieve net zero. Currently, NZ hosts over 580 wind onshore wind turbines to generate about 1045 MW. This same amount of capacity and about 20% more energy would be accomplished by about 70 offshore wind turbines[1].

These landscape and community impacts are already apparent in many countries where there is resistance to productive land being used for solar generation and concerns over the landscape impact of onshore wind in rural communities. New Zealand has largely avoided these concerns until now as the large hydro base has meant New Zealand has not had the same growth in onshore wind and solar as many other countries.

Rather than relying on the private sector to respond to pricing signals to justify incremental investment in new generation we suggest there needs to be Government-encouraged

[1] From: New Zealand Wind Energy Association as of year-end 2021, https://www.windenergy.org.nz/operating-&-under-construction, and based on assumption that offshore wind turbines implemented will be 15 MW/each. 20MW offshore wind turbines are currently available for order into new projects.

investment to develop the electricity and overall energy system the country needs. As noted earlier this could be via mechanisms such as Contracts for Difference or, tax incentives as are widely practiced by governments around the world. We also note the underwriting process the Government has used via Crown Infrastructure Partners that lead to the roll-out of the country's fibre network and rural broadband network ahead of demand, and this has been a resounding success.

We also note that for such a model to be adopted it requires political commitment and the involvement of other agencies in addition to the Electricity Authority. Such a model is anathema to the gentailer dominated electricity market that has operated in New Zealand over the past 25 years or so. A different spot market structure is, however, the reality in many other electricity markets around the world where there is active Government intervention to deliver the electricity and energy systems required in a net-zero world.

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 view and the reasoning for it?

We suggest these preconditions would need to be in place for an energy-only market design to be efficient. They will lead to apparently sensible investment and an electricity system that will work. They will not however, be effective as the resulting electricity and energy system will be sub-optimal. As noted above:

- Productive land will be used for generation with accompanying landscape, agricultural, and community impacts. Please note that onshore wind requires a much larger footprint than offshore wind.
- The large-scale single-point generation needed for Power to X production and associated energy storage will not be encouraged.

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?

If you assume the market structure is right these measures make sense. We think that the market must have an appropriate balance of contracted (both for load and generation reserves) and "readily available" capacity. The readily available capacity should be traded in a spot market.

If instead we have a market where there is over-production and energy is stored at scale – either for export or for local use – then these issues will be much less important or irrelevant.

9. Do you agree that these are the key issues in relation to demand-side flexibility with 100%RE? If you disagree, what is your view and the reasoning for it?

WQZ believes that large-scale demand side flexibility is a very important component of an efficient and effective New Zealand electricity market and is actively exploring the opportunities for Power to X production in association with the development of offshore wind.

Bearing this in mind we argue that the key issues for demand side flexibility are having an electricity market (that is not simply comprised of only a spot market) that enables large-scale generation rather than just incremental scale generation.

Without large-scale generation it is unlikely New Zealand will get Power to X production of the scale required to make a significant difference from demand-side flexibility. The two are linked.

10. Do you agree that these are the key issues in relation to contracts markets with 100%RE? If you disagree, what is your view and the reasoning for it?

WQZ believes that contracts will be an increasingly important part of the electricity market moving forward. It is certain in WQZ's view that significant PPAs will need to be a key part of the commitment of capital to major new generation sites such as offshore wind and accompanying Power to X manufacturing and storage sites.

11. Do you agree that these are the key issues in relation to transition to 100%RE? If you disagree, what is your view and the reasoning for it?

The issues highlighted are important. We do not agree that spot market price signals should be used to prevent premature retirement of thermal resources. We believe it should also be noted that as well as retirement there is potential for refit of existing thermal sites, including peakers, to run on Power to X products such as green hydrogen. We would prefer the Authority use energy planning outcomes and energy contracting strategies to manage the appropriate timing of thermal resource retirements.

12. Are there any other 'lumpy' issues that warrant specific consideration in the transition to 100%RE?

The electricity market in New Zealand will be integrated with the wider energy market in a greater manner than at present. For example, transport fuels will be produced using electricity. Perhaps there should be an Energy Authority rather than an Electricity Authority?

The potential for overproduction of electricity and energy exports plus occasional imports will also create opportunity for integration with international energy markets. We expect that this will provide greater energy security for New Zealand while also providing increased reliability at appropriate cost. It will also enable New Zealand to contribute at an even greater scale to international decarbonisation efforts and encourage new industry to the country with a more predictable price for long term power supply.

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 the reasoning for it?

While acknowledging that competition is vital, WQZ has already noted areas where new market structures or incentives will be required to achieve the best outcome for New Zealand. We also note the comment in the Discussion Paper (7.142) on the potential for competition for seasonal flexibility services is expected to decline due to the retirement of thermal plants and increased focus on the use of hydro storage. Steps may need to be taken to ensure competition in this area.

These matters require political commitment and/or inter-agency commitment.

WQZ also notes that while existing thermal generation will be retired in a 100% renewable scenario there is room for thermal peakers to continue but using Power to X products such as green hydrogen as a fuel. Converting to biomass fuel is another common path for aging thermal resources to remain relevant. Refueling of thermal plants will provide one avenue for providing flexibility of supply in a 100% renewable environment. Power to X production also provides opportunity for demand side response when production is curtailed and electricity is released to the market.

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 relation to achieving the statutory objective of the Authority, which is to "promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers"?

We suggest a key challenge is the conflict between the Authority's statutory objective and another statutory objective of net zero carbon emissions by 2050. We also believe that to date the objective of promoting genuine competition in the market has not been met.

As we have highlighted in our submission, there is currently conflict between these two objectives that has driven the historic evolution and operation of the Authority and its market.

We have argued that:

- The electricity market is designed and operated in a manner that encourages incremental development of new generation by individual companies and is heavily influenced by the large gentailers. Indeed, the market and even the broader central Government is not taking the steps it should be, to ensure that Aotearoa remains relevant in the global competition for clean energy investment, job creation and emission reductions.
- The most efficient achievement of net zero by 2050 requires larger scale generation and coordination between multiple companies and sectors.
- The market must evolve to include mechanisms for the required large scale clean generation to be incentivised and financed. Relying on a spot market structure will not be helpful.

We suggest that achieving the goal of long-term benefit to consumers needs to incorporate recognition of net zero by 2050 – and the market needs to be operated to encourage that outcome. At the moment it is not.