Energy Resources Aotearoa
POWERING A BETTER NEW ZEALAND TOGETHER

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Electricity Authority
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Submission on Market Monitoring Review of Structure, Conduct and Performance in the Wholesale Electricity Market.

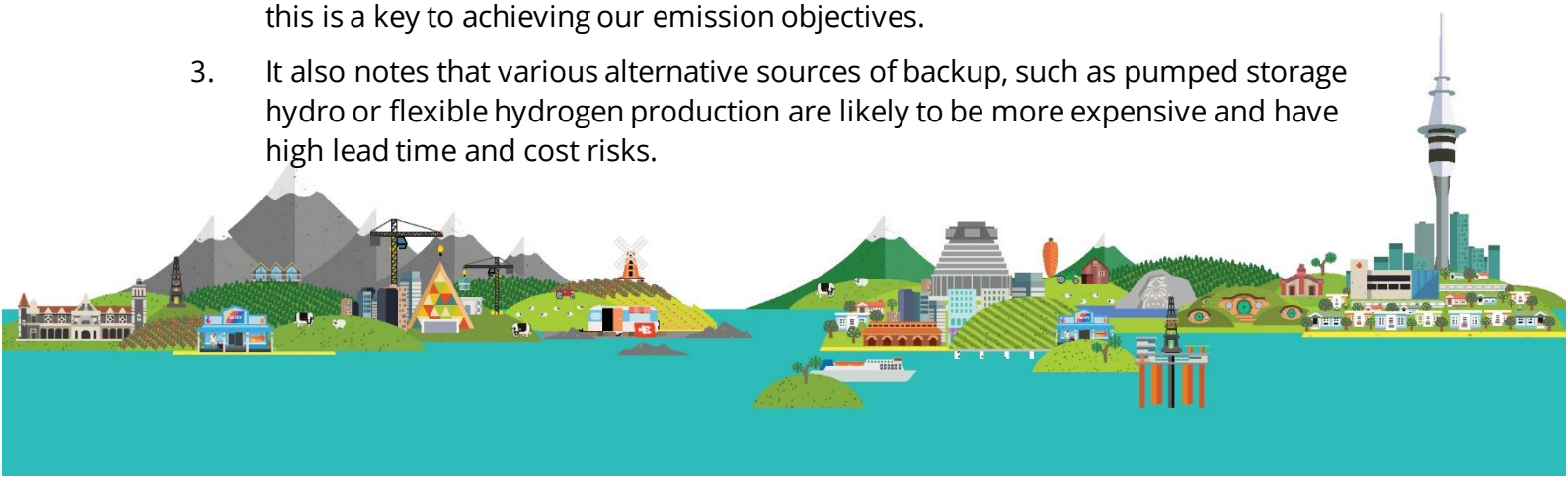
Introduction

1. Energy Resources Aotearoa ("Energy Resources") represents people and firms in the energy resources sector, from explorers and producers to distributors and users of natural resources like oil, LPG, natural gas and hydrogen.
2. This document constitutes Energy Resources' submission to the Electricity Authority on its *Market Monitoring Review of Structure, Conduct and Performance in the Wholesale Electricity Market.*

Overview

Abundant and Flexible Gas Unlocks Renewables

1. This submission explores the question of why inadequate new renewable generation is being built. The Electricity Authority was puzzled why, despite high prices and no obvious barriers to entry, insufficient renewable generation projects are being committed to.
2. Our submission explains how abundant and flexible gas is needed to provide backup for intermittent renewable generators in New Zealand. It then goes on to show how having an abundant supply of gas (with storage and flexible demand) can unlock the current blockage in renewable generator construction, and how this is a key to achieving our emission objectives.
3. It also notes that various alternative sources of backup, such as pumped storage hydro or flexible hydrogen production are likely to be more expensive and have high lead time and cost risks.



4. Finally we make note of the recent Gas Market Settings Report from the Gas Industry Company, which provides a good summary of the regulatory settings needed to support transition to increased renewables. We suggest a more joined up approach between the Electricity Authority and the GIC would have merit.

Submission

The Renewables Construction Problem - Not Enough Being Built

5. The Electricity Authority's latest price review has noted that, despite what it considers to be high electricity prices, "the pipeline of build- ready (renewable) projects has become very thin".[1]

6. It does not identify any particular barriers to entry to inhibit new investment other than the uncertainty of the investment environment going forward.

7. This lack of commitment to new renewable generation investment is not conducive to the government achieving its decarbonisation objectives. The transition is highly dependent on an abundance of low cost renewable generation to power the transition from fossil transport fuels and process heat to locally sourced (largely) renewable electricity.

8. Unlocking renewable generation investment requires certainty about the cost of providing backup for the intermittency of such renewable generation. In New Zealand, the least cost and least emitting option for such backup is natural gas (including storage for the gas and some other flexible gas loads, such as Motonui). In particular, no other current fuel (except for coal) can provide the back up for seasonal or multi-year variability of renewable generation.

Lack of Certainty of Backup Holding Back Renewables

9. It appears from the Electricity Authority's report that the lack of firm commitment to building new renewable generation may be related to the same lack of investment risk certainty that is currently afflicting the gas industry's investments decisions.

10. Section 3.3.3 of the Gas Industry Company's *Gas Market Settings Investigation* report provides a cogent explanation of the sources of this uncertainty for gas investment. We also recommend the reader look at our submission which we made to the GIC on that topic.[2] Many of these same risks apply to electricity generation investment and the uncertainty of secure (and flexible) gas supply amplifies these risks for renewable generation investment.

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[1] Para 5.188 of *Market Monitoring Review of Structure, Conduct and Performance of The Wholesale Electricity Market*.

[2] Our submission can be found at: https://www.energyresources.org.nz/dmsdocument/180

Why Backup is Needed

11. As with Final Investment Decisions for gas projects, to commit to building a long lived assets like renewable generation, investors need to have confidence they can sell the output under some kind of long term contract. The purchasers of long-term supply contracts want confidence that the supply will be delivered regardless of what the weather is doing, what the season is or whether it is a dry (or still) year or a wet (or windy) year.

12. In short, such contracts are for a constant supply of electricity - every hour, every day, every month. To be confident of meeting a constant supply some contracted form of backup is needed. If we take wind as an example, its long run average capacity factor is about 36%. Note this is the long term average so the variability for any given year could be even more, so on average 64% of the time some other form of generation is needed as back up (and for some years or months it could be a lot more). This is particularly the case for a new build where other forms of backup are already fully committed. This means we have to look at the marginal cost of backup.

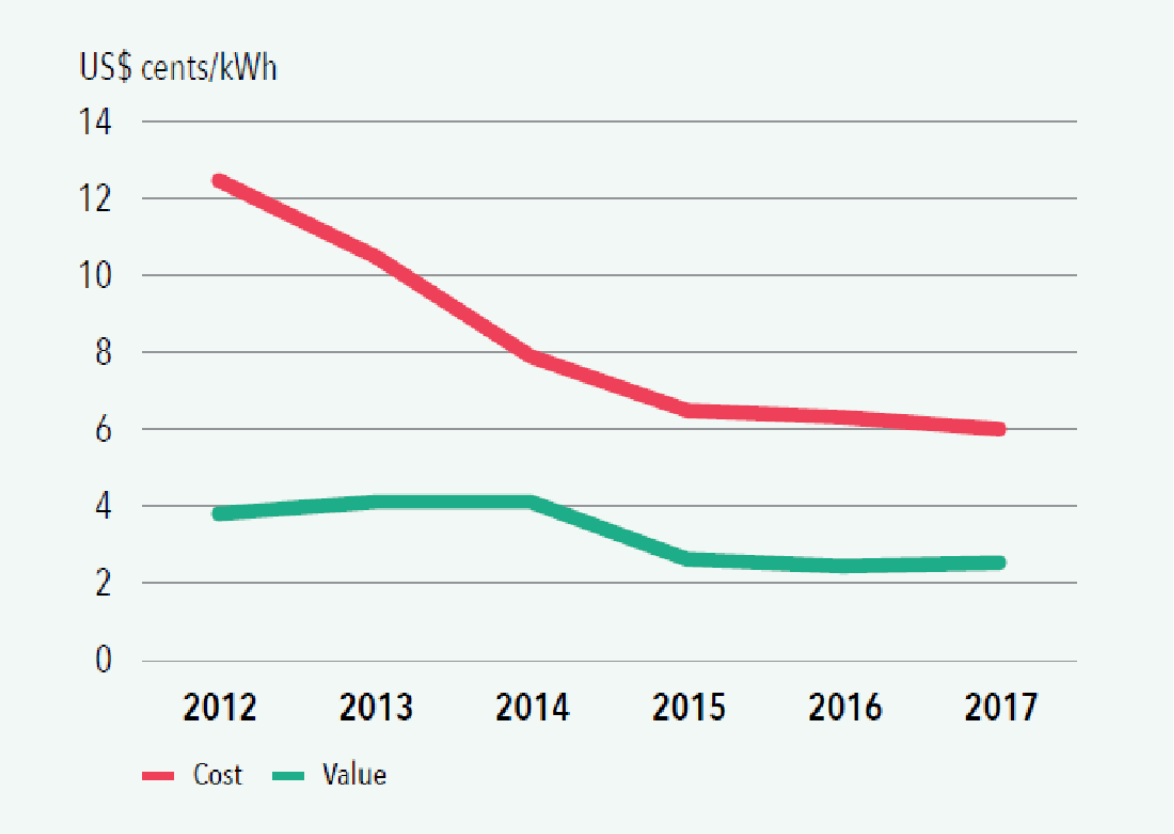
13. Industry experience and academic analysis can help calibrate how this back up cost will rise. In New Zealand, in the medium term, this back up costs is likely to reflect gas costs.

Industry Experience with Backup Costs

14. As well as the forward price curves, other useful industry perspectives can be gained from the experience of those actually investing in renewable generation. One such investor with international experience is Infratril. Their September 2018 investor newsletter provides some useful commentary,[3] in particular the figure at the top of page 7 (shown below) which illustrates how the value of intermittent renewables falls even faster than their costs, as penetration increases:

[3] The newsletter can be found at: https://infratil.com/for-investors/announcements/2018/infratil-update-newsletter-september-2018/

THE COST AND VALUE OF SOLAR ELECTRICITY (CALIFORNIA)



15. This may explain why Infratril is gradually pulling out of operating renewable generation, unless they can either receive subsidies or pass on the risk to others.

16. This falling value of renewable generation, as penetration increases can also be expressed as the increased cost of providing back up for the intermittency. Several papers have been written on how to derive this cost of back up for an existing electricity system.[4]

17. The Interim Climate Change Committee also had some good work done in this area, which may be worth revisiting this to see how it differs from the current draft advice.

Extent of Backup Needed - As Renewable Penetration Increases

18. A simplification of their approach would be to simply calculate the extent to which backup is required for each level of renewable generation penetration in NZ. That is the extent to which there is a mismatch between the timing output of the renewable generation and the timing of demand in NZ. This can be done by looking at the residual load duration curve. That is the load duration curve, after hydro variability is taken into account.

[4] A good starting point is a paper from Berlin University "System LCOE: What are the costs of variable renewables?" by Falko Ueckerdt, Lion Hirth, Gunnar Luderer and Ottmar Edenhofer. This can be found at: https://www.mcc-berlin.net/uploads/media/Ueckerdt_Hirth_Luderer_Edenhofer_System_LCOE_2013.pdf

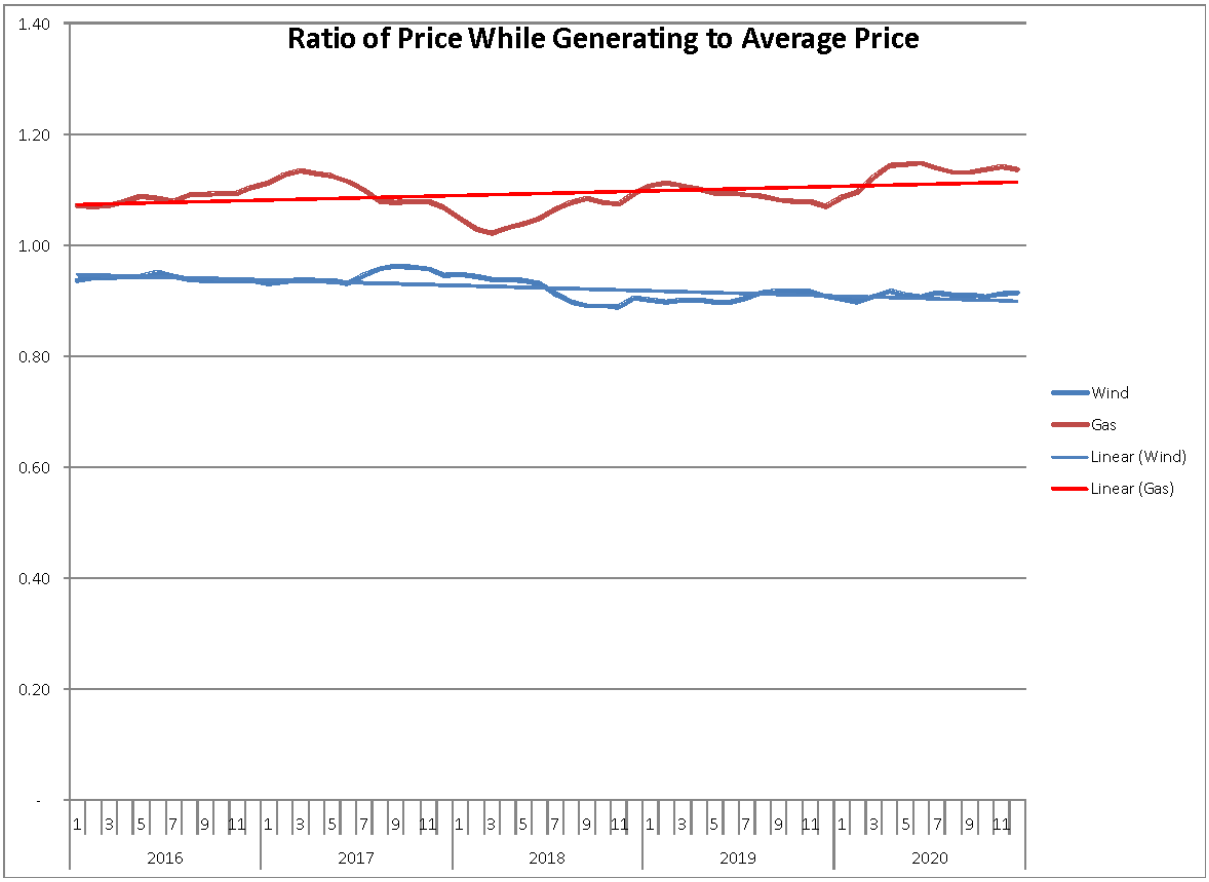
NZ Costs of Backup - Dependent on (Flexible) Gas Prices in Medium Term

19. Another way of calibrating the costs of backup for intermittent renewable generation is to look at how much below the average cost of electricity these generators have earned and how this has varied over time. In New Zealand, because of the seasonal variation of renewable energy sources (hydro and wind) and how the variability of these two inputs is moderately correlated, the back up to wind generation is usually thermal, and lately gas in particular. So when wind and hydro generation are both low, more gas generation is called, and prices increase (and vice versa). See the recent Transpower Market insights for examples.[5]

20. In practice this means that the cost of back up for renewable generation is closely correlated to the cost, and availability, of gas and thermal coal. The graph below illustrates this by showing how, over the last four years the earnings, relative to average price, of wind has decreased at the same time as the earnings, relative to average price, of gas has increased. As no new major wind plant has been commissioned in this time the driver for this increasing separation is probably mostly the gas price.

21. This gas price will, as penetration of renewables increases, also need to include the increasing need for flexibility of supply, that is increased storage. The Gas Settings Investigation suggests up to 70PJs of storage may be needed (compared to 18PJs currently available (see section 4.4.1). The costs of providing this storage is not estimated in the Gas Settings Investigation but John Culy's work for the Interim Climate Change Commission "ICCC Modelling, Dry Year Storage Options Analysis" suggests this could add at least $9/GJ to the gas price.

[5] https://www.transpower.co.nz/system-operator/market-insights



Back Up Costs About $30 - $40/MWh, at Current Gas Prices

22. One way to estimate backup costs is to look at the cost of a renewable generator (say wind at about $80/MWh) and the asking price for a level energy hedge (about $120/MWh at present for long dated hedges). This price difference (about $40/MWh) is a starting point for estimating back up costs. And tallies reasonably well with an estimated cost for running a CCGT at 64% capacity factor with gas at about $14/GJ (current spot price).

23. If the hedge price were to rise then this should attract new investment (in renewables with gas backup).

24. But it is also good to spot check the reasonableness of this cost estimate by looking at what others have said.

Interim Climate Change Committee Estimation of Backup Costs

25. A review of the document "ICC Modeling: Dry Year Storage Options Analysis",[6] suggests current back up costs for intermittent renewables are about $30/MWh (at a time when gas costs were cheaper).

26. This accounts for a large portion of the difference. It is possible that more recent increases in gas prices (due to decreasing supply, lack of offshore gas exploration opportunities) and the forecast increase in renewable penetration between now and 2024 may account for the remaining difference.

[6] April 2019, John Culy Consulting.

Timing and Cost Risks for Alternative Backup Options

27. We have referred to the ICCC work on dry year reserve options. This work concluded that pumped hydro storage was likely to be very expensive but the least worst option after flexible gas. That report did not look at timing and cost risks for construction of the proposed Lake Onslow pumped hydro storage project. The country's recent history with constructing large hydro dams in that area is not encouraging. Clyde Dam construction took 20 years from initial proposal to final commissioning and the cost blew out by a factor of three, and final capacity was significant only two thirds of the original proposal. It is likely that even if alternative backup options were to proceed they would face high risks of delays or cost increases, and thus increase our need for certainty and flexibility of gas supply in the interim.

28. Merely having the NZ Battery Project/ Lake Onslow pumped hydro concept on the as a *possibility* on the horizon will have a major chilling effect on investment into new generation (both thermal and renewable) because it threatens to impair private assets by filling the market with nomically cheap electricity (we say nominally as in reality the multitude of economic costs are real and socialised).

Coordination with the Gas Industry Company

29. We have referenced the Gas Industry Company's report to the Minister on Gas Market Settings. That report provides a useful starting point for understanding the sort of gas market settings which will be needed to support a transition to an increasingly renewable future. We suggest a greater degree of joined up thinking between the two regulatory bodies would be of benefit to New Zealand. This is because of overlapping interests and the increasing complexity of energy issues given the interwoven relationships between gas and electricity as the transition evolves.

Conclusion

Certainty of Future and Flexible Gas Supply Encourages Renewable Build

30. So back to where we started and why certainty of future gas supply, and arrangements for flexibility of this supply, and costs is the key to getting commitments to build more renewable generation. The above analysis has shown why backup is needed for anyone wanting to build new renewable generation (so they can be confident of meeting any contracted supply) and why the cost of backup is dependent on the cost (and long term certainty of supply) of gas.

31. What is needed is a regulatory environment where those wanting to build a renewable generation can have confidence that sufficient gas, and flexibility of its supply (including storage and flexible load) at a reasonable price, will be available to back up their renewable generator.

32. Three specific policy commitments from the Government would materially help with investment in the energy sector. Specifically, we would like to see the Government commit to:

    a. **a stable policy and regulatory environment with long-term and bipartisan predictability to give firms the confidence to invest:** the Government should commit to uphold a "no surprises" forward-looking decision-making process, based on meaningful dialogue with stakeholders. A core aspect of this is respect for property rights and not implementing retrospective policy changes (as seen in the recent Crown Minerals Decommissioning and Other Matters Amendment Act 2021). Without political stability behind climate policy, economic actors will likely delay making important actions to reduce emissions, or they will raise prices as risk is factored in;

    b. **withdraw support for the NZ Battery Project as currently scoped:** as covered earlier, this project will stifle investment. It should not be proceeded with, but if it is, then the terms of reference should be amended so as to not definitively preclude any fossil fuel or gas storage having a role in electricity generation; and

    c. **abandon the arbitrary target of 100% renewable electricity and accept a role for gas-fired peaking:** the Climate Change Commission, in its Final Advice, stated that "The Government should consider replacing the 100% target with a goal of aiming to achieve 95-98% renewable electricity by 2030." This is on the basis that pursuing 100% renewable electricity will result in high electricity prices making decarbonisation through electrification relatively less attractive. This view echoes that of the Interim Climate Change Committee and practically all other serious analysts who have looked at and commented on the matter.