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Electricity Authority  
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## Price Discovery under 100% Renewable Electricity Supply – Issues Discussion Paper

Dear Tony,

Market Development Advisory Group (“**MDAG**”) is to be commended on a thorough and useful study of how a 100% renewable electricity (“**100%RE**”) system may operate. We consider that MDAG has canvassed the issues well, and broadly agree with the paper’s conclusions.

Genesis’ own modelling across a range of credible scenarios suggests that by 2030 96% - 98% of electricity will be generated by renewables in an average year. The actual proportion of renewables will vary year-to-year depending on weather and demand conditions. We remain of the view that pursuing a 100%RE system is unlikely to be the fastest or most economic route to decarbonising the economy more broadly. Decarbonisation of New Zealand’s energy system, enabled by an affordable, low carbon, and reliable electricity supply, is a more sensible objective.

In any case, when the system approaches 100%RE many of the issues MDAG highlights can reasonably be expected to materialise.

Fundamentally, prices are likely to be much more volatile in a 100%RE system, both intra-day and in response to extended dry spells. The technology mix and climate conditions will largely dictate the degree of volatility if the current energy-only market is retained in a much more highly renewable system.

All the issues MDAG highlights are important. We would draw particular attention to several points:

1. The nature of the transition will fundamentally shape how the market and system operate in a highly renewable future. Taking the right steps now, following a long-term strategy, offers the best chance of success.

2. The systems and structures that have worked for the past 30 years may not serve us well for the next 30. Changing technologies and an increasing economy-wide reliance on electricity should cause us to reflect on whether additions to the energy-only market structure are required.
3. Solving for sudden swings in the supply/demand balance driven by unpredictable intra-day weather changes will be a key challenge. This is likely to require technological and market solutions.

As you may be aware, Genesis has done a considerable amount of work in recent years to reduce our emissions. Central to this has been our Future-gen strategy, which will see us displace some 2,650 GWh of baseload thermal generation with new renewables by 2030.

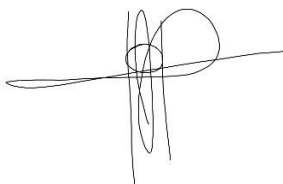
Part of this work has involved investigating a net-zero emissions operating model for the Rankine units at Huntly Power Station. We are encouraged by the results of studies to date, and are preparing to run a trial burn of advanced renewable biomass at the station to prove the concept that the asset can continue to provide dry year and seasonal cover to the system in a highly renewable future.

We consider that a net-zero fuelled thermal backup plant could make a valuable contribution to a decarbonised electricity system. Not least through preserving our current fuel diversity, whereby New Zealand enjoys a highly renewable electricity supply that is not at the complete mercy of the climate.

If the results of this work are of interest to MDAG in the context of the 100%RE workstream, we would be happy to share them with you.

Genesis' perspective on each of MDAG's specific questions is set out in the following section. We look forward to continuing to engage with you as the workstream progresses. In the meantime, please do not hesitate to contact us with any questions in respect of this submission, or if we can assist in any way.

Yours faithfully

A handwritten signature in black ink, appearing to read 'Matt Ritchie', with a horizontal line extending to the left.

Matt Ritchie

Senior Advisor, Regulatory Affairs and Government Relations

Question	Comment
<p>1. Do you agree with the broad conclusions that emerge from the simulations in relation to spot price levels and volatility, in particular:</p> <p>a. significantly more spot price volatility is likely with a 100%RE system, especially shorter-term weather-driven volatility?</p> <p>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?</p>	<p>Genesis agrees that prices are likely to be much more volatile in a 100% renewable electricity system. The technology mix and climate conditions will largely dictate the degree of volatility if the current energy only market is retained in a much more highly renewable system.</p> <p>For example, a 100%RE system that relies on overbuild and very large users curtailing during extended dry spells could be expected to be very high-cost relative to what we experience today, due to the costs of compensating large industrial users for forgoing production. It follows that where a MW of lost production needs to be compensated at the cost of very high value export commodities, managing fuel scarcity would become an extremely expensive exercise.</p> <p>Alternatively, prices in a system that can call on a right-sized dispatchable dry year reserve plant (or plants) would likely be much more stable. This is especially the case if the appropriate market mechanisms are put in place to smooth the cost of dry year reserve over time, and across those who benefit.</p> <p>Genesis therefore sees considerable value in maintaining thermal backup capacity into the future. We are progressing a major work programme to understand the capability of the current Huntly Rankine units to run on advanced biomass, a renewable net-zero carbon fuel that would enable the assets to make an important contribution to the system in a more highly renewable future. We are encouraged by the results so far.</p> <p>Although New Zealand’s relatively high proportion of hydro generation will buffer out some intra-day volatility (compared to what may be experienced in other jurisdictions internationally), the extent of protection against ‘bang bang’ (\$0 – VoLL) price swings appears to have been overstated. Even with wind accounting for a minority share of New Zealand’s generation fleet today, we are already witnessing sudden and unpredictable swings in capacity within minutes of gate closure that will become increasingly challenging to manage. The increasing volume of grid-scale solar generation slated to enter the system (mostly concentrated in the upper North Island) could be expected to exacerbate this effect.</p>

	<p>MDAG’s paper is predicated on a 100%RE system, which is a useful exercise. However, it is not obvious why New Zealand would pursue this as an objective at the expense of leveraging our highly (and increasingly) renewable electricity system to decarbonise the economy more broadly, in particular through electrifying transport and process heat. In any event, Genesis’ scenario modelling suggests New Zealand will reach 96% - 98% renewable electricity by 2030<sup>1</sup>, with the actual percentage slightly higher or lower year-to-year depending on, among other things, weather conditions.</p> <p>Ensuring the transition to this highly renewable future is orderly will require careful consideration of the operation of the wider energy system. Genesis is pleased that our calls for development of a long-term, low carbon energy strategy has been taken up by the Climate Change Commission<sup>2</sup> and Government<sup>3</sup>. We reiterate that a 30-year low-carbon energy strategy for New Zealand must be built on cross-sector ‘systems’ thinking, rather than single issue ‘siloed’ thinking to ensure a successful transition. The transition must be focused on outcomes and the plan must have regard to the interplay of factors within, and interconnectedness between, the various sectors in our economy.</p>
<p>2. If you disagree, what is your view and the reasoning for it?</p>	<p>As above.</p>
<p>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?</p>	<p>We agree a wholesale market (with real-time pricing) remains key to ensuring diverse and disaggregated resources are coordinated and optimised.</p> <p>The extent to which disaggregated resources meaningfully participate in a 100%RE system, and what technologies are in play, remains an uncertainty. Accordingly, flexibility and responsiveness will be key features of the market system that provides for these technologies.</p>
<p>4. Do you agree that these are the key issues in relation to real-time</p>	<p>Genesis agrees that these issues will be important to real time coordination.</p>

<sup>1</sup> Genesis analysis. 2022. [https://gesakentico.blob.core.windows.net/sitecontent/genesis/media/content\\_2020/investor/pdfs/fy22/hy22-results-presentation.pdf](https://gesakentico.blob.core.windows.net/sitecontent/genesis/media/content_2020/investor/pdfs/fy22/hy22-results-presentation.pdf)

<sup>2</sup> Climate Change Commission. 2021. *Ināia tonu nei: a low emissions future for Aotearoa*, <https://ccc-production-media.s3.ap-southeast-2.amazonaws.com/public/Inaia-tonu-nei-a-low-emissions-future-for-Aotearoa/Inaia-tonu-nei-a-low-emissions-future-for-Aotearoa.pdf>

<sup>3</sup> Ministry for the Environment. 2021. *Te hau mārohi ki anamata | Transitioning to a low-emissions and climate-resilient future: Have your say and shape the emissions reduction plan*, <https://environment.govt.nz/assets/publications/Emissions-reduction-plan-discussion-document.pdf>

<p>coordination? If you disagree, what is your view and the reasoning for it?</p>	<p>The uncertainty and real-time fluctuations in intermittent renewable output will create volatility in market dispatch solutions, including when expected market dispatch changes materially in real-time creating security and coordination issues.</p> <p>This is occurring now, and is likely to become more material as the system transitions to relying on a much higher proportion of intermittent renewables than it does today.</p> <p>If sufficient backup plant is not running when renewable output drops it may be difficult to respond and ramp output in the time required. This could create issues, particularly over peak demand periods. The alternative is backup plant is committed 'in case' something happens which could be an inefficient market outcome. Genesis believes that a short-term reserve or firming product may be beneficial to allow for efficient plant offering and dispatch despite the inherent uncertainty in intermittent renewable output.</p> <p>It will also be important to reduce gate closure as much as possible so offers can be optimised around the best forecasts for generation.</p>
<p>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?</p>	<p>Genesis agrees the issues highlighted in respect of ancillary services are key. In particular, whether services that are currently provided freely as by-products need to be replaced/incentivised in a much more highly renewable system.</p> <p>As above, Genesis considers a short-term or firming reserve product is likely to provide meaningful value and efficiency benefits in a more highly renewable system with greater short-term volatility.</p>
<p>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?</p>	<p>Genesis agrees that a 100%RE system would produce more extreme prices (both very high and very low/negative) than the New Zealand system is accustomed to. As MDAG notes, this volatility is likely to occur more often on an intraday basis driven by calm/dark periods having a greater impact on the operation of the system. However, prices will also continue to rise to signal scarcity in extended dry periods as they have done historically. The nature of the transition and the resulting technology mix, combined with market settings, will largely determine how these prices manifest. That is, the relative cost and appropriateness of dry year solutions, replacing the backup thermal that has traditionally supported the system, will be a key driver of price during dry spells.</p>

	<p>Genesis agrees that the preconditions set out in the paper are necessary for an energy-only market to be successful in a 100%RE system. It also appears logical fulfilling (d) and (e) is highly influenced by whether (a) to (c) are satisfied.</p> <p>The question of whether a greater incidence of very high prices would be accepted in the wider political economy of the market is much harder to answer. However, if we extrapolate recent market conditions into a future in which prices are more volatile, we are not convinced very high prices would be accepted by some participants.</p> <p>It is widely accepted that New Zealand’s electricity system has been stretched by extreme hydrological conditions and gas supply constraints dating back to early 2018. This has, at times, resulted in sustained or brief periods of ‘high’ wholesale prices both in the spot market and in forward contracts. While transitory, these conditions provide a useful study in how the market reacts to price stress.</p> <p>During periods of elevated prices some participants have repeatedly and publicly questioned the integrity of the wholesale electricity market. Per-unit residential prices and the level of investment in renewables (current and planned) bely claims that the market is fundamentally dysfunctional, but they persist nonetheless.</p> <p>This strategy has had the effect of undermining confidence in the market, creating unhelpful political pressure, and confusing consumers.</p> <p>At the same time, Genesis has contracted almost 1,200 GWh per year in long term electricity supply via power purchase agreements that have supported the development of new renewable builds<sup>4</sup>. We are confident that these contracts are economically priced over their term. Other sophisticated participants have entered into similar arrangements, and directly invested in new renewable builds.</p>
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<sup>4</sup> PPAs have been struck supporting the Waipipi and Kaiwaikawe wind farms, and the Tauhara geothermal station, under Genesis’ ‘Future-gen’ strategy to displace 2,650GWh of baseload thermal generation by 2030 - <https://www.genesisenergy.co.nz/about/media/news/renewable-generation-options-feb-2021>, <https://www.genesisenergy.co.nz/about/media/news/renewable-generation-options-feb-2021>, <https://www.genesisenergy.co.nz/genesis-energy-and-tilt-renewables-announce>

	<p>MDAG notes that a greater frequency of high price events resulting from calm/dark periods being more common than the dry year/season events we are accustomed to today may result in a greater appetite for hedging on the buy side of the market. This hypothesis is reasonable. But as long as lobbying is cheaper than purchasing cover we consider there is a risk that some participants will pursue the former strategy if it is available to them.</p> <p>As the system becomes increasingly renewable, in an energy-only market periods of very high prices – that more than balance out periods of very low/negative prices – will be necessary to incentivise the investment needed to provide for forecast increases in demand<sup>5</sup> (driven by electrification of transport and industrial processes). Even if contracting activity increases to de-risk investment in new renewable builds, underlying spot prices will need to be allowed to signal scarcity to ensure contracts strike appropriate value. If confidence is undermined to the extent that these prices will not eventuate (due to regulatory intervention or the fear of it), investment will dry up and the transition will fail.</p> <p>Artificially constraining wholesale prices would have negative consequences in terms of efficiency and investment confidence in the medium- to long-term. However, consideration should be given to what market adjustments could be made to help smooth some of the standing cost of backup thermal plant that enables New Zealand’s highly (and increasingly) renewable system.</p> <p>There is value in investigating mechanisms in addition to the energy-only wholesale market that ensure thermal backup is appropriately rewarded, and remains available when it is needed. Firm energy or capacity mechanisms could provide for a more orderly transition for thermal, and offer considerable value in supporting green peakers or renewable thermal reserve in future.</p>
<p>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?</p>	<p>As above.</p>

<sup>5</sup> <https://www.transpower.co.nz/sites/default/files/publications/resources/TP%20Whakamana%20i%20Te%20Mauri%20Hiko.pdf>

<p>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?</p>	<p>Genesis agrees accurate prices are crucial to demand-side, contracting, and investment incentives. We consider the measures suggested to increase confidence in spot prices are worthy of further examination.</p> <p>As noted earlier, confidence is hard won and easily lost but increasing awareness in respect of the drivers of price may benefit some participants and the public.</p> <p>Importantly, improving the current energy-only market and introducing backup measures should not be seen as mutually exclusive approaches. As the paper notes, the energy-only market has served its purpose well, with continual incremental improvements.</p> <p>We agree that a system approaching 100%RE will operate differently to what we are accustomed to, and the market will need to adjust accordingly. Simply, we should not accept on face value that what has worked for the past 30 years will serve us well in the next 30.</p> <p>Similarly, it is increasingly evident that a firming energy market or similar could have meaningful value through the transition and beyond. Voluntary contracting within the energy-only market has supported backup generation and future renewable builds to date. But in a future where 100% of generation is provided by renewables it is foreseeable that a capacity mechanism, in addition to the existing energy-only structure, may be necessary to manage price and supply volatility on both sides of the market. That is, prospective investors can more readily attain the confidence that new plant will achieve an appropriate return, while purchasers can insulate themselves against very high prices.</p> <p>Our analysis indicates that existing thermal plant will make a steadily declining contribution to New Zealand's generation mix over the coming decade<sup>6</sup>. However, the support these assets provide will be crucial in supporting security of supply and an orderly market when it is needed.</p> <p>Accordingly, a reserve energy or capacity mechanism could be the most efficient way of ensuring these assets remain available for when they are needed. Such a mechanism, properly designed, could provide revenue certainty for investors as they move through the transition and, to a degree, manage the volatility in wholesale prices associated with dry years.</p>
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<sup>6</sup> Genesis analysis. 2022. [https://gesakentico.blob.core.windows.net/sitecontent/genesis/media/content\\_2020/investor/pdfs/fy22/hy22-results-presentation.pdf](https://gesakentico.blob.core.windows.net/sitecontent/genesis/media/content_2020/investor/pdfs/fy22/hy22-results-presentation.pdf)



<p>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?</p>	<p>Genesis agrees these issues are key to ensuring the benefits of demand-side flexibility are realised in a highly or entirely renewable system.</p> <p>A related and key issue is ensuring that the value of DSF is able to be realised where it offers the greatest net benefit, and that systems provide for this to occur dynamically in response to events. For example, while distribution networks may consider the greatest value of DSF to be in enabling deferral of infrastructure investment, as MDAG notes the ability to manage/smooth peaks may at times offer greater value overall.</p> <p>DSF could play a low-cost and high-impact role in supporting the reliable and affordable electricity supply required to incentivise transport and process heat applications to reduce their carbon intensity. For the benefits of DSF to be fully realised, the wholesale market should offer:</p> <ul style="list-style-type: none"> <li>• Clear, simple national rules.</li> <li>• Clear pricing.</li> <li>• Standardised time-of-use network pricing.</li> </ul> <p>Overall, the consumer perspective should be central to any considerations of the role of demand-side participation in the electricity system. The value of DSF to the system is clear, however, it is less clear what rewards consumers (large or small) will require before they are prepared to allow supply to be interrupted.</p> <p>On a large scale, where the opportunity cost of a unit of electricity supply is equivalent to a unit of production of a high value export commodity, demand response is unlikely to be the most economic tool for managing intra-day or seasonal peaks.</p>
<p>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?</p>	<p>MDAG's analysis appears sound. In particular, Genesis agrees that an important factor limiting liquidity in the contract markets is a misalignment between buyers and sellers in respect of the value of risk management.</p> <p>It is reasonable to expect risk management practices will continue to adapt and evolve over time. This will in part be driven by improved understanding of the risk associated with increased volatility in a more</p>

	<p>highly renewable system. As outlined above, Genesis is already seeing this develop as wind makes up an ever-greater proportion of generation in the system.</p> <p>Increased risk premiums and lower liquidity of risk management products resulting from underlying market volatility is a key and increasing issue in relation to contract markets. Efficiently minimising market volatility, especially caused by uncertainty in the last hour prior to spot market pricing, would enable the market to better support both liquidity and pricing of risk management products.</p>
<p>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?</p>	<p>Genesis understands that the transition to a 100%RE system is not directly within scope of this project<sup>7</sup>, but may be taken into account. We consider that the nature of the transition is a central consideration, because:</p> <ul style="list-style-type: none"> <li>a) The nature of the transition will directly shape how the future market operates (path dependency).</li> <li>b) While many of the issues highlighted in the paper are currently hypothetical, the transition is occurring now, and this is therefore an excellent opportunity to ensure New Zealand is on a successful pathway.</li> </ul> <p>Genesis agrees the issues identified by MDAG are key ones. However, as is the case with measures to ensure confidence in accurate pricing, we do not consider strengthening market processes or exploring backstop mechanisms to be mutually exclusive. In fact, improving contracting incentives while ensuring a backstop prevents market failure is likely to be optimal.</p> <p>Centrally determining a retirement schedule for large thermal plant (or any plant, for that matter) risks replicating the problems that beset the sector before markets were allowed to determine investment, as the paper neatly articulates<sup>8</sup>.</p>

<sup>7</sup> <https://www.ea.govt.nz/assets/dms-assets/28/MDAG-proposed-scope-price-discovery-under-100-renewables.pdf>

<sup>8</sup> Market Development Advisory Group. 2022. *Price discovery under 100% renewable electricity supply issues discussion paper*. “For much of the last century, decisions on what, when and where to build new capacity were made by a small group of government people... This approach built the backbone of our current electricity system, but it also missed the “Goldilocks zone” by a wide mark. Billions of dollars in public funds could have been saved and put to uses of greater value to society, considerable harm to the environment could have been avoided, and security of supply should have been a lot better.”

The backup thermal generation necessary to support New Zealand's highly renewable system has been secured in recent years via bi-lateral contracts between, primarily, Genesis and other participants. This approach has worked, but some important issues have emerged.

As MDAG notes, there are fairness considerations that arise through participants benefiting from the insurance provided by thermal plant without paying its full value. In addition to the scenario MDAG describes in which participants benefit from more cover than they buy (due to the relatively large size of the underlying asset), Genesis considers issues potentially arise where participants benefit from the supply and price security arising from bi-lateral contracts to which they are not a party.

Second, the voluntary and relatively short-term nature of these agreements does not provide sufficient certainty regarding the future supply and demand balance. This may create a headwind to the certainty and confidence required to support investment in the high-capital, long-term assets necessary to enable New Zealand's transition.

The current contracts underpinning the Rankine units at Huntly Power Station end in December 2022, and it is currently unclear whether similar new agreements will be agreed and entered into to underpin backup generation from 2023 and beyond.

It appears other market participants' appetite to share the increasing cost of providing backup to the renewable electricity system is low. An effective energy strategy should consider whether appropriate incentives are in place to ensure a safe and stable transition over the next 10-15 years.

Genesis does not consider root and branch reform of the wholesale electricity market is likely to be necessary. However, complementary mechanisms that provide additional market confidence and price security seem increasingly likely to play a role during the transition and beyond.

The interaction between the New Zealand Emissions Trading Scheme ("**NZ ETS**") and the wholesale electricity market is also worth consideration, in particular how it may influence the transition.

	<p>Rising carbon prices<sup>9</sup> have driven a steady decline in thermal power generation in recent years (excluding the impact of hydro shortages) and this can be expected to continue. In some respects this is the NZ ETS working as designed. However, as carbon prices steadily rise, the impact upon the economics of thermal plant could have the unintended consequence of jeopardising security of supply.</p> <p>When running, thermal generation usually sets the wholesale electricity price as it is the most expensive form of generation. Rising input costs flow through to all wholesale market purchasers (and ultimately consumers). However, when thermal plant is not running, renewable generators often 'price up' their generation offers to marginally below the operating cost of thermal plant, knowing they can keep the thermal plant out of the market up to that point. We have seen this effect reflected in wholesale prices over the past three years, in particular, when infrastructure and/or fuel outages combined with low hydrology have led to increased security of supply risks.</p> <p>This ultimately increases the cost of electricity to all users – consumers and businesses alike – and risks creating incentives for inefficient decision making. The interplay between the wholesale electricity market and the NZ ETS has the potential to create unintended consequences for the transition.</p>
<p>12. Are there any other 'lumpy' issues that warrant specific consideration in the transition to 100%RE?</p>	<p>Demand-side choices have the potential to have large and relatively sudden impacts on the operation of the electricity market, both today and in a more highly renewable future. This is already clear in respect of the Tiwai Point aluminium smelter and the uncertainty that arose while the future of the facility was being considered in 2019/20.</p> <p>The future operations of methanol manufacturer Methanex are another important consideration, given the importance of the operation to the functioning of New Zealand's gas market and flow on effects to gas available for generation through the transition.</p> <p>These and other issues should be closely considered in New Zealand's long-term energy strategy, currently under development.</p>

<sup>9</sup> <https://www.comtrade.co.nz/>

<p>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?</p>	<p>Genesis agrees that competition, and the operation of seasonal flexibility services, is worthy of analysis. This is as important through the transition as it is at the 'end state' (whether that is 100%RE, or close to it).</p> <p>Genesis considers it is entirely likely that seasonal flexibility services will be provided in future by large thermal plant fuelled by net-zero carbon fuel. Significant work has been done on understanding the capability of the Huntly Rankine units to run on advanced renewable biomass, and Genesis will soon run a trial burn to prove this capability.</p> <p>Accordingly, in considering competition in a 100%RE market MDAG may wish to consider what market mechanisms could be developed to best balance the commercial objectives of owners of seasonal flexibility, and the security requirements of market participants and the economy at large. As set out earlier, Genesis considers adding a firm energy/capacity mechanism to the existing market could be the most efficient and predictable way to ensure thermal (whether fossil fuelled or otherwise) continues to provide crucial support to the system while maintaining price stability.</p>
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