Submission for the Wholesale Market Arrangements for Battery Energy Storage Systems Paper

Submission by: David Haysom
LinkedIn: https://www.linkedin.com/in/davidhaysom/

Firstly, I would like to congratulate the Electricity Authority on the excellent BESS market arrangements paper.

I am making this submission as an individual with a strong interest in the efficient and resilient operation of New Zealand's electricity system that supports the critical task we have of reducing carbon emissions.

I support the Authority's objective of ensuring wholesale market arrangements promote long-term benefit to consumers, including security of supply and efficient investment signals.

My comments focus on how the proposed arrangements for battery energy storage systems can remain technology-neutral and future-proof, particularly in the context of New Zealand's hydro-dominated system and exposure to dry-year and renewable-drought risks.

In my submission I am only responding to questions one and two.

Appendix F

Submitter	

Questions	Comments
Understanding the characteristics, benefits and future operation of BESS	
Q1. Do you agree we have sufficiently identified the unique characteristics of BESS to assist in developing appropriate arrangements?	Please see Response to Q1: Identification of unique characteristics of BESSs below this table.
Q2. Do you have any views on how BESSs should be defined in the Code?	Please see Response to Q2: Definition of BESSs in the Code below this table
Q3. Do you agree that BESS can deliver the benefits described? Are there any other benefits that will assist	No Comment

us in assessing the size of benefits of different arrangements?	
Q4. Do you agree with our description of how BESSs are likely to operate and how this will change over time? If not, why?	No Comment
Q5. Do you have any other insights about potential BESS operation that will help with assessing the benefits of our options?	No Comment
Dispatch requirements for BESS when charging	
Q6. Do you agree with the way we have framed the issues?	No Comment
Q7. Do you agree with the Authority's preferred option? If not, what are alternative options that would better address the issues? Are there any particular risks with our preferred option that you would like to identify?	No Comment
Bids and offers forms for BESS	
Q8. Do you agree with how we have framed the issues?	No Comment
Q9. Do you agree with out preferred options? If not what other options would better address the issues identified?	No Comment
Q10. Do you think further restrictions to BESS participation in MFK under the current arrangements would have any effect on their participation?	No Comment
Balancing flexible trading with security needs	
Q11. Do you agree the issues identified by the Authority are worthy of attention? If so, do you agree with our framing?	No Comment
Q12. Do you agree that BESS should have the same arrangements when	No Comment

charging and discharging, and that embedded BESS should have the same arrangements as grid connected BESS?	
Q13. Do you agree with our preferred new arrangements for BESS?	No Comment
Q14. Do you see any issues with how we have defined state of charge constraints?	No Comment
Q15. Do you agree that the benefits of state of charge constraints likely outweigh the costs?	No Comment
Q16. Do you agree with how we have characterised the differences between various options?	No Comment
Q17. Are there any other options that you think would better achieve the gate closure objectives?	No Comment
Q18. Do you consider an interim solution is necessary? If so, do you agree with the potential solution we suggested?	No Comment
Q19. Do you have any information that can help us better understand the benefits and costs of different options? This includes, for example, substantiating the system risks, and how to improve our modelling of benefits.	No Comment
Constrained off payments	
Q20. Do you agree the issues identified by the Authority are worthy of attention?	No Comment
Q21. Do you agree with our framing of the issue?	No Comment
Q22. Do you consider having constrained off payments would affect bidding and offering behaviour from BESS?	No Comment

Q23 . Do you agree with our preferred solution?	No Comment

Response to Q1: Identification of unique characteristics of BESSs

Question: Do you agree we have sufficiently identified the unique characteristics of BESSs to assist in developing appropriate arrangements?

Response: I partially agree, but wonder if key characteristics relevant to long-duration and flow battery technologies should be included.

As drafted, Section 3 may risk embedding assumptions that are not technology-neutral, and which may unintentionally bias future wholesale market arrangements against long-duration BESSs.

1. Storage duration assumptions might be overly narrow and this could result in cognitive bias

Section 3.7 states:

> "Existing BESSs, as well as the BESSs expected to enter the market over the next few years, take 1–2 hours to charge from empty to full or to discharge from full to empty…"

This description is accurate for many lithium-ion installations but is not representative of all BESS technologies, nor of systems expected to be deployed in support of high-renewable electricity systems.

For example:

- Vanadium Redox Flow Batteries VRFB's are routinely designed for 6, 8, 12, or 24+ hours of storage, with no technical coupling between power (MW) and energy (MWh).
- Their operational behaviour, market participation incentives, and system value differ fundamentally from short-duration batteries.
- Framing BESSs as inherently "short-term" 1 to 2 hour technologies risks excluding technologies that are increasingly important for renewable firming, dry-year risk mitigation, and system adequacy.

New Zealand is increasing investment in renewables and appears to have increasing exposure to multi-hour and multi-day electricity deficits and vanadium redox flow batteries capex costs are reducing.

My research has unveiled projections that costs are coming down for VRFB's and opinions that they are already cost competitive for a 20 year year life cycle with appropriate funding.

2. Power–energy decoupling is not recognised

The paper does not mention that some BESS technologies allow independent sizing of MW and MWh.

For vanadium flow batteries:

- Power capacity (MW) is determined by the stack size.
- Energy capacity (MWh) is determined by electrolyte volume.
- This enables highly flexible system designs optimised for specific grid services (eg, high-energy, moderate-power applications).

This characteristic may have implications for:

- Market participation
- Bidding strategies
- Capacity adequacy
- Investment efficiency

I wonder if failing to recognise this flexibility may have risks that market arrangements that implicitly assume a fixed MW:MWh ratio could mean that opportunities are missed.

3. Additional services are not discussed

While Section 3.15 acknowledges flexibility and future ancillary services in general terms ……

> "BESSs are more capable than other generators and loads in meeting many power system needs. BESSs' control systems can be configured to respond in many ways to the needs of the power system. A BESS can respond by varying its power or voltage levels in a controlled fashion and at a speed appropriate to the need."

……. it does not recognise that some BESS technologies can provide additional or higher-value services over longer durations, including:

- Sustained firming of intermittent generation
- Extended reserve provision
- High-cycle daily operation without degradation

- Enhanced system resilience during prolonged supply shortfalls

These may be irrelevant to market arrangements and also to the system operator but maybe they should be commented on somewhere during this process as a “safety” check.

4. Does NZ have some unique characteristics that should be considered?

I wonder if the structure of NZ’s energy sources is unusual and if that has not been reflected in the paper.

- Renewable Sources 85.5%
- Hydro 53.5%
- Geothermal 19.9%
- Wind 8.9%
- Solar 1.4%
- Wood & Biogas/Waste Heat ~1.7%
- Non-Renewable Sources 14.5%
- Natural Gas 9.3%
- Coal 5.1%
- Oil/Diesel < 0.1%

The reason for that thought is that we now seem to have a lot of dry years and we don’t seem to have the financial resources to expand solar and wind at the rate we should. At the same time there is a winding back of the plan to reduce carbon emissions and agricultural emissions will be very expensive to offset. We could end up with a perfect storm and a narrow and short term construction of market arrangements could close off some storage technologies or cause delays and costs due to the need for market rearrangements not far out from now.

Conclusion for Question 1

While the paper identifies several important characteristics of BESSs, I wonder if it does not sufficiently capture the diversity of BESS technologies, particularly long-duration and flow battery systems. Without addressing these differences, there may be a risk that future arrangements will inadvertently favour short-duration lithium-ion batteries and fail to support technologies that are better suited to New Zealand’s evolving system needs and its energy source profile.

Response to Q2: Definition of BESSs in the Code

Q2. Do you have any views on how BESSs should be defined in the Code?

Response: Yes. The Code definition does not seem to be technology-neutral and explicitly recognise key functional characteristics, including charge and discharge duration flexibility and decoupled power and energy.

I believe that in order to avoid blind spots and support efficient investment and technology-neutral market outcomes, any definition of BESSs in the Code needs to avoid embedding assumptions that reflect only one battery chemistry, charge/discharge duration profile and the life cycle of BESS investments.

Principles for an appropriate definition

While remaining consistent with the Electricity Authority's desired timeframe for implementing the new market arrangements, it seems to me that a definition of a BESS it would be better if:

1. **It was technology-neutral**
    - Avoid assumptions about charge and storage duration, degradation behaviour, or charge/discharge profiles.
    - Apply equally to lithium-ion, flow batteries, and any near future battery technologies.
2. **If considered systems that have decoupled power and energy numbers**
    - Explicitly acknowledge BESSs with MW and MWh capacities that are independent of each other to ensure that they are not inadvertently penalised by market rules and therefore are excluded as investment options.
3. **If it considered a range of durations that are available now or will be in the short term**
    - From short-duration (1–2 hour) to long-duration (8–24+ hour) storage and beyond.

Conclusion for Question 2

I wonder if defining BESSs narrowly at this stage of the journey to new market arrangements risks:

- Locking in short-duration charge and discharge assumptions
- Distorting investment signals
- Undervaluing long-duration charge and discharge services
- Increasing long-term system costs

End of Submission