

10 April 2024

Electricity Authority| Te Mana Hiko
PO Box 10041,
Wellington 6143

Ref: Submission on “*The future operation of New Zealand’s Power System*”- Consultation paper

Thanks for the opportunity to submit towards EA’s consultation addressing the key drivers for change and the challenges and opportunities with power system operation in NZ over the coming decades and beyond.

I have worked across industry, research and academia in India, USA and New Zealand. My contributions to industry include protective relaying, power system operations, optimization and resilience in the context of smart grids, electricity markets and integration of renewable resources. I am actively engaged towards University of Auckland’s outreach with power system stakeholders, internationally and across New Zealand. Additionally, I engage through technical and leadership roles with [IEEE Power & Energy Society](#) and [CIGRE](#) whose working groups directly feeds to [IEEE](#) and [IEC](#) standards respectively.

Particularly relevant to this submission I would also like to acknowledge my ongoing work as a key researcher and Principle Investigator toward MBIE Advanced Energy Technology platform funded [Future Architecture of the Network | Te Whatunga Hiko](#) that is looking at future NZ AC/DC Hybrid Transmission and Distribution Grid by 2050 as well as TEC funded Centre of Research Excellence [QuakeCoRE | Te Hiranga Rū : NZ Centre for Earthquake Resilience](#) looking at transformational advancements in NZ’s infrastructure resilience that could be can be achieved through strategic adoption of disruptive technologies, via government and market-led initiatives.

I direct the Power Systems Group (PSG) at University of Auckland and Principal Investigator in the recently formed [Green Energy Engineering Centre \(GEEC\)](#) housed with Faculty of Engineering with an intention to form University of Auckland Energy Research Centre in the next couple of years.

.Power System Group (PSG) have in the past have made submissions on critical issues associated with New Zealand transmission investment and security of supply for energy as below

- Ministerial review of electricity market cites (PSG) submission in Page 26 for recommendation 17 to restructure SOE
- Submissions Electricity Commission, MED; Transmission Upgrades (2006), North Island Reactive Proposal (2010), Electricity Markets (2010).
- Submissions Electricity Authority, Review of common quality requirements in Part 8 of the Code (May 2023)

Since the separation of Transpower from former Electricity Corporation of New Zealand (ECNZ) in May 1993, as a stand-alone entity in April 1994 and subsequent formation of New Zealand Electricity Market (NZEM) in October 1996 leading to the revised mandate for Transpower being both the transmission grid owner and system operator, year 2024 is perhaps coincidentally the best time since the last almost 30 years to revisit the existing operational structure and regulatory governance. Incidentally the previous arrangement happened following **June 1993: Government policy on energy** framework whose stated objective was “**To facilitate the development of cost-effective renewable energy consistent with the Government’s Energy Policy Framework**” and the main driver then was encouraging renewables.

The commerce commission has been an integral part of the NZEM governance ensuring lower-cost to consumers since starting with industry self-governance, followed by establishment of Electricity Commission arising due to some risky operational situation during post-winter Sept 2001 and March-June 2003. The maturation of the market instrument to facilitate more financial transparency and addressing conflict of interest (due to historical ownership structure of generation assets) around December 2009 led to the formation of another regulator Electricity Authority (EA). The non-clarity/perception that vertical integration of generation-retailers causing market power and academic commentary around perceived \$4.3 billion overcharging called to question the rationale of an energy-only LMP market here in NZ. There were no comparable markets to justifying this economic treatise of NZEM, which relied on 60+% annually of run-of-water hydro resources that had well-known hydrological scarcity patterns. Eclectic metrics (Herfindahl–Hirschman Index) for oligopolistic

constructs related to other fields were compared with but no clear consensus emerged. However, creation of the EA and its operation since the last 14+ years it has helped us mature into other financial instruments like Financial Transmission Right (FTR) in 2013, opening-up of the retail market participants following manageable and not too extreme prudential arrangements etc. following larger divestments of our main generation stakeholders. (Including AUS-NZ Energy Derivatives).

The temporary management of some ancillary service products like Extended reserves using Automatic Under Frequency Load Shedding (AUFLS) in 2021 and 'world's-first' marketed NZ electricity reserves market for distributed resources fleet collection (['Virtual Power Plant'](#)) in November 2022, both managed by New Zealand Stock Exchange (NZX) have been made possible to be trialed and accommodated with existing operational and financial regulatory structures. These were incumbent upon us a country to separate out traditional ancillary service arrangement we have around NZEM frequency keeping for our LMP energy-only market structures but also help develop what is being coined as "essential or stability services" emergent in other carbon dominated power systems like Australia and UK (examples used in this consultation paper).

The missing element in this consultation paper was the associated market arrangements which we practice currently and regulated by EA (structural separation of operation with Transpower being SO). This is important for understanding how coordinated operation amongst Transmission-Distribution can provide transparency and clarity to financials for the future emerging highly distributed connected resources and new entrants (with less prudential back-stop and high-risk) where existing bigger gen-tailers of NZ appear not participating yet but likely to participate in the coming years as we move from 88% renewables to the target of higher percentage of new renewables powered by intention to support zero-carbon economy aspirations. This is no criticism but as the current consultation paper proceeds towards discussion around Conflict of Interest (actual or perceived) the role of other players of NZEM like Gentailler, Retailer and New technology providers will also need to be worked out apart from the highly regulated Transpower and the 29 Distribution network owners.

Another aspect that was missing from the consultation document was the current cost to carry out system operation (light coordination) by Transpower. [Browsing 2023 Transpower's audited annual report](#), roughly about 177+45=222 million\$ out of total of 362m operational costs appears could be attributed to system operation with rest for grid maintenance which presumably could be proxy to Transpower role as Grid owner. (grid maintenance could also explain the rise of 16% of operating rise expense from 2022 attributed to Cyclone Gabrielle).

The consultation paper identifies needs for increasing coordination downstream with distribution network utilities. There will be cost increases presumably for Transpower. This might be in addition to what the 29 distribution utilities currently expend on their existing grid coordination both upstream with Transpower individually and downstream with their customer base. For distributors group formation it could be additional.

The role of the 2 regulators and their levy-expense aspect around this can also be addressed. EA has currently [\\$4.6mil appropriated through the levy](#). There could be some comparable number that Commerce Commission would have in their line-item for regulating Transpower as a grid owner (and associated investments) and the [29 distributors](#).

A corollary consultation paper around the above two aspects will help future decision maker of how best NZ needs to proceed with regards to tighter coordination by the various grid operators and assess the cost-benefit analysis of which arrangement will be most economic to regulate, if we decide to change operational structure.



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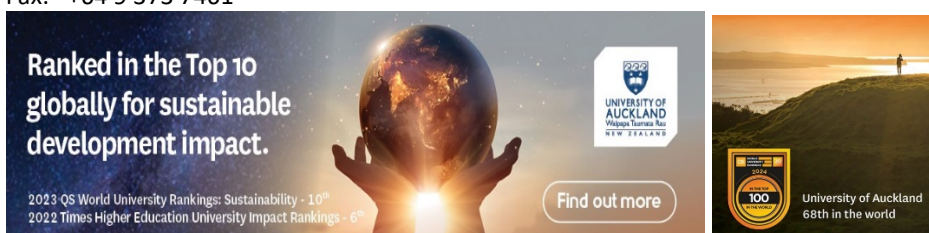
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Appendix

Questions	Comments
<p>Q1. Do you consider section 3 to be an accurate summary of the existing arrangements for power system operation in New Zealand? Please give reasons if you do not agree.</p>	<p>Section 3 covers the existing arrangement of Transpower and 29 distributors along with EA, ComCom and Worksafe. NZX was missing and could be worth considering (EMS- Transpower subsidiary is the touch-point currently). Commentary around Extended reserves products provided earlier.</p>
<p>Q2. Do you agree that we have captured the key drivers of change in New Zealand's power system operation? Please give reasons if you do not agree.</p>	<p>The one driver that was perhaps missing was the role of non-traditional players (including asset owners) like solar-farm developers, off-shore wind-farm operators, other retail players like EV charging and potentially Waka Kotahi (NZ transport agency) that has the capability to have visibility resources for mobility, access & usage. These future entities will be necessary to be brought to the fold for ensuring that the combined (Transmission + Distribution) grid co-ordination helps support equity access to these new entities that may need grid coordination for safe and secure real-time electric power systems and scheduling/recovery for healthy grid operation.</p>
<p>Q3. Do you have any feedback on our description of each key driver?</p>	<p>The drivers identified in the consultation paper has provided good references to exiting trends globally.</p>
<p>Q4. What do you consider will be most helpful to increase coordination in system operation? Please provide reasons for your answer.</p>	<p>Transparency, Trust and Compliance-Investigation regime in case of unexplained outage during an increasing (perhaps exponential) transition of faster and deeper electrification, if the key drivers of Q.2 eventuates.</p>
<p>Q5. Looking at overseas jurisdictions, what developments in future system operation are relevant and useful for New Zealand? Please provide reasons for your answer.</p>	<p>The choice of Australia, Ireland and UK illustrated in the discussion paper is appropriate. UK for its legal and policy jurisprudence NZ policy and governance aligns towards. Ireland is an outlier as it still has connection to other stronger power networks but considering the fact that it has operational experience of operating with large-scale onshore wind farms, as NZ embarks upon our off-shore wind farm install, maybe it does provide some new ideas to operate safely these large generation fleets to our future grid. In case of Australia, I would recommend just focusing on Western Australia Network (comprising of the South Western Interconnected Network alongside North West Interconnected system and the large-scale microgrid structure). The rest of the National Electricity Market (NEM) of Australia cannot add any value to NZ because of its largely carbon-based generation profile and having a Nodal Electricity market settlement. (ancillary services and the financial products are not comparable to what NZ follows) and following them might make our coordination requirements more conservative leading to become expensive in terms of compliance and regulation.</p>
<p>Q6. Do you consider existing power system obligations are compatible with the uptake of DER and IBR-based generation? Please provide reasons for your answer.</p>	<p>For distribution generation fleet that uses IBR our current obligations are consistent and aligned with existing international standards and practices. Since we did not have same uptake as Australia on roof-top solar (due to subsidies like Feed-in-Tariff and other government back purchase support), we have not had challenges around incompliance to standards and</p>

	<p>uncoordinated penetration. Also, the market uptake of solar+battery together and that being the dominant uptake of DER globally, our current standards driven obligation is compatible for safe integration. The only item that will need faster and increased obligation development is for solar farms that are coming online at a very fast rate within NZ sub-transmission and distribution grid. We will need to fast-track some obligation within 12 to 18 months. The size, scale and interconnection network points are very network specific and NZ will need to come up with ride-through clauses that better reflect the short-circuit strength of our interconnection points across the length and breadth of our nation. Further, responsibility matrix and investigation team preparation will need to be quickly setup, in case we end up with an unexplained localized, regional or even island-wide uncoordinated outage as the these primarily IBR based DER farms get integrated.</p>
<p>Q7. Do you consider we need an increased level of coordination of network planning, investment and operations across the New Zealand power system? Please provide reasons for your answer.</p>	<p>We could need increased level of coordination for network operations. (Described in the next question). For network planning and investment, I feel that the current regulatory structure around ComCom is fine. How to extend the existing reliability centric investment (SAIDI/SAIFI) towards resilience-based back-up planning might be one area that coordination needs to be carried out from an operational planning viewpoint. This will need to be aligned with how the new structures in NZ evolves around Emergency management (CDEM, NEMA etc..) that needs a coordinated focus around extreme events like flooding and high wind.(affecting both generation and grid availability)</p>
<p>Q8. Do you think there are significant conflicts of interests for industry participants with concurrent roles in network ownership, network operation and network planning? Please provide reasons for your answer.</p>	<p>I do not think there are any conflict of interests for Transpower as a system operator and a grid owner. However, the ownership structure of distribution network operator is quite varied and hence the network ownership aspects might have varying degree of perceived or actual conflict of interest with co-owners of the assets (e.g Councils, Trust, overseas-investors, other allied business that the Trust/councils own). Only one of the distribution network utility is exposed to NZX, as an energy and technology provider, and there is the challenge for them to address issues around long-term asset planning along with interest to have less CAPEX from viewpoint of value to investors during business cycle which are much shorter. The network operation function of distribution utilities is well integrated technically but however, the new ancillary services emerging and potentially in future will require some well-structured separation with the ownership and planning side particularly for distributor entities. More investment will need to be capitalized and separated out and tightly integrated with Transpower's SO to ensure real-time security at all-costs. The new arrangements (or clarified existing arrangements) will also need to take into confidence the other existing players like retailers, metering entities, Independent Power Producers (like solar-farm, onshore and off-shore wind farm operators). Particularly for IT and OT services there might be other providers that could be in future</p>

	<p>contracted out just like we do dark-fibre dedicated communication channels, service and quality-of-service contracts that are deployed. This will then provide confidence across NZ for emerging and new entities like long duration and short-duration storage providers, mobility charging aggregators, peer-to-peer trading platform operators to have very-low entry barriers to this new enhanced coordinated operational electrical power system grid structure, since these new players would be attracted only to countries which showcases and ensures level-playing field as NZ embarks on moving towards 98%+ renewable grid operation in the coming years...</p>
<p>Q9. Do you have any further views on whether this is a good time for the Authority to assess future system operation in New Zealand, and whether there are other challenges or opportunities that we have not covered adequately in this paper? Please provide reasons for your answer.</p>	<p>This is a good time to assess the regulatory structure of NZ power systems and help better align with other allied inter-dependent infrastructures and their management/regulation like transport and emergency management. Whakamana i Te Mauri Hiko is in fact indirectly our NZ Energy Strategy and since NZ does not have a coordinated energy strategy that usually comes out of MBIE (which itself is being reshaped to better reflect future planning operation), we have no time to lose now for another energy a.k.a electricity policy to be consulted for recommendations. . If we do not proceed faster here, we will be seriously challenged for workforce, supply-chains and lead-time to move faster and deeper on our electrification build-up as every other country is accelerating as part of their decarbonization through deeper electrification.</p> <p>NZ has used up all our spare capacity of available grid resources and all the “Glide-Path” of distributed resources strategy for planning and management which was in vogue in early 2000’s.</p> <p>The only other item we need to be mindful is about factoring our existing NZEM and its almost 49% public market exposure (market cap @NZ\$38.95b) toward more distributed and highly-variable future power system resources (including DER). This is likely to get more private capital entering into NZ electrical power systems in the coming years and decades and future power system operation needs to be equally reliable, secure and address increasing demands on becoming more resilient (e.g. Any medium e.g < 50000 ICPS outage will required to be powered-back within 8 hours)</p>