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Electricity Authority| Te Mana Hiko
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Ref: Submission on "***Omnibus of common quality Code amendment proposals***"- Consultation paper

Thanks for the opportunity to submit toward 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 Principal 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**)
- Submissions Electricity Authority, Review of the future operation of New Zealand's Power System (**Feb 2024**)

The six Code amendment proposals in this consultation paper address issues at the heart of my current research agenda. The increasing penetration of inverter-based resources, including wind generation, solar photovoltaic generation, and battery energy storage systems, is reshaping the technical foundations upon which New Zealand's frequency and voltage management frameworks were originally designed. Several PhD, Masters and Undergraduate applied research projects over the past 2 decades, alongside NZ power system stakeholders strongly informs this submission. Many of these engineers are working across electricity stakeholders globally, majority across ANZ.

The proposal in this omnibus directly relates to transition, addressing over-frequency limits, voltage control obligations for transmission-connected generating stations, the definitional framework for instantaneous reserve products, fault ride-through obligations and exclusions, and the frequency management and frequency support obligations of generators across both islands. These are not merely housekeeping amendments. They collectively form part of the regulatory architecture that will need to accommodate a power system where inverter-based resources are dominant, system

inertia is lower, and the boundary between transmission and distribution is increasingly porous.

This submission engages with all six proposals. I support the overall direction of the amendments and offer technical and regulatory observations intended to strengthen each proposal before finalization. Particularly, I would like to draw the Authority's attention to the following items which I consider warrant specific attention in the final decision paper:

- The derivation and disclosure of the 51.25 Hz post-contingent recovery upper bound introduced under FSR-101, which does not appear in the existing principal performance obligations and whose technical basis has not been made transparent to stakeholders. The transparency implications of relocating key frequency standard definitions away from Part 1 of the Code, which serves as the primary entry point for non-specialist participants including distribution-connected generator developers particularly those at sub-transmission voltage levels
- The need for an explicit requirement under FSR-102 that station-level voltage control systems coordinate unit-level reactive dispatch, to ensure the station-level compliance pathway delivers equivalent system voltage regulation outcomes.
- The critical sequencing risk under FSR-103, where the Code amendment must not take effect before the Procurement Plan has been updated to specify the performance requirements for fast and sustained instantaneous reserve provided by generation and battery energy storage systems, and the need for an explicit transitional provision addressing the gap period.
- A drafting issue in the proposed amendment to clause 8.25B(3) under FSR-104, where the word 'wind' appears to remain in the proposed text in a manner that would perpetuate the technology-specific limitation the amendment is designed to remove, and which should be corrected before the decision is issued.
- The need under FSR-105 for the Authority to assess distributor network modelling capability across the 29 NZ utilities before the embedded generator provisions of new clause 8.25AB become operative, and to consider whether a transitional implementation period is warranted.
- A forward-looking observation under FSR-106 that the 30 MW excluded generating station threshold will affect a growing number of utility-scale solar PV projects as deployment in the 20–50 MW range increases, and that a future FSR tranche reviewing this threshold with appropriate modelling of system security implications would be a valuable complement to the housekeeping work being done in this omnibus. This might be particularly relevant to harmonic and reactive power both upstream and downstream of Point of Integration (POI)

I look forward to analysing other submissions and the final decision paper before code amendments. Please feel free to contact me for any clarifications/additions on this submission.

Nga mihi
Nirmal

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Proposal	Questions	Comments
FSR 101 Align over-frequency limits between the Code and the Policy Statement	Q1. Do you agree the proposed Code amendment will achieve the objective? If you disagree, please explain why and give alternative options to achieve the objective.	Yes. The re-insertion of the 52 Hz North Island limit into the principal performance obligations provides the necessary Code-level foundation for the Policy Statement's over-frequency management framework. The structural separation of North and South Island obligations into discrete subclauses removes an existing source of interpretive ambiguity and correctly reflects the engineering reality that North Island CCGT plants cannot tolerate the same upper-frequency excursion as South Island hydro-dominated generation. The amendment closes a meaningful gap between the Code text and the Policy Statement and will reduce the risk of compliance uncertainty for generators and the System Operator alike.
	Q.2 Do you agree with the analysis presented in this Regulatory Statement? If not, please state why you do not agree.	The regulatory statement is broadly sound. However, two additional matters should be addressed before finalization: • The Authority should provide further technical justification for the 51.25 Hz post-contingent recovery upper bound. This figure does not appear in the existing principal performance obligations, and its derivation, whether from generator plant characteristics, simulation modeling, or international benchmarking, should be disclosed in the decision so that stakeholders can assess compliance implications. • The transparency implications of relocating key frequency standard definitions away from Part 1 should be addressed. Non-specialist participants, including distribution-connected generator developers, rely on Part 1 as their primary entry point to the Code's technical obligations. Removing high-visibility frequency limit definitions without at least retaining informational cross-references risks leaving gaps in participants' understanding of the operative performance standards.
FSR 102 Clarify requirements for voltage control systems and connection transformers	Q3. Do you agree the proposed Code amendment will achieve the objective?	Yes, with the caveats noted. The amendment correctly reflects the engineering reality of inverter-based resource architecture and removes a compliance barrier that would have imposed unnecessary costs on new renewable entrants. The core objective permitting station-level (rather than unit-level) voltage control systems for transmission-connected generating stations will be achieved. However, the amendment should be strengthened in two respects before finalization: • An explicit requirement that station-level voltage control systems coordinate unit-level reactive dispatch should be included, to ensure that the station-level pathway delivers the same voltage regulation outcomes as the unit-level pathway rather than merely satisfying the formal obligation. • The Authority should clarify the application of the 'at least one connection transformer' standard in multi-PoC configurations, as the current drafting does not unambiguously address split-bus or distributed-PoC architectures that are increasingly common in utility-scale renewable projects.
	Q4. Do you agree with the analysis presented in this Regulatory Statement?	The regulatory statement is supported. The transaction cost savings for new generation developers are real and material, particularly given the volume of utility-scale renewable projects currently in the New Zealand development pipeline. Removing the unit-level transformer obligation eliminates a compliance requirement that was technically unjustified for inverter-based plants and would have imposed significant capital cost per project without any corresponding system security benefit. The proposal is consistent with the Authority's obligations to promote competition and efficiency in the generation sector, and the cost-benefit analysis presented is credible.

FSR 103 Amend the 'fast instantaneous reserve' and 'sustained instantaneous reserve' definitions	Q5. Do you agree the proposed Code amendment will achieve the objective?	Yes, subject to the critical sequencing condition regarding the Procurement Plan update. The amendment will achieve its objective of removing definitional duplication and reducing inconsistency risk, but only if the Procurement Plan update is in place at the time the Code amendment takes effect. The submission strongly recommends that the Authority: • Make the Code amendment commencement date expressly conditional on the concurrent effectiveness of the updated Procurement Plan, or alternatively adopt a staged commencement approach where the Procurement Plan is updated first. • Include an explicit transitional provision confirming that existing interruptible load providers' compliance obligations during the gap period (if any) are assessed against the pre-amendment Code text. • Confirm in the decision paper the effective date of the Procurement Plan update and the mechanism by which the two instruments will be brought into alignment simultaneously.
	Q6. Do you agree with the analysis presented in this Regulatory Statement? If not, please state why you do not agree.	The regulatory statement is supported but should be strengthened in two respects before finalization: • The settlement timing implications of aligning the trigger definition for sustained instantaneous reserve provided by load should be explicitly addressed. The shift from a 'start of contingent event' trigger to a 'frequency falls to or below 49.2 Hz' trigger has direct revenue measurement implications for BESS and interruptible load providers, and participants are entitled to a clear statement of those implications in the regulatory statement. • The regulatory statement should quantify, even in qualitative terms, the compliance certainty benefits of the amendment for the interruptible load sector, which is the primary affected party. The current regulatory statement focuses primarily on the BESS context and does not fully articulate the benefit to interruptible load providers of restoring clarity to their performance obligations.
FSR 104 Revise two fault ride through exclusions	Q7. Do you agree the proposed Code amendment will achieve the objective?	Yes, with the following conditions and caveats that should be addressed before the amendments are finalized: • For clause 8.25B(3): The drafting correction removing the word 'wind' from the phrase referencing the power source is essential and should be treated as a mandatory amendment before the proposal is finalized. The current proposed text, if enacted as drafted, would perpetuate the same technology-specific limitation that the amendment is intended to remove. (friendlier to Solar-farms, data-centre & electrified transportation) The Authority should circulate the corrected draft for confirmation before issuing the decision. • For clause 8.25D(a): The Authority should address the partial curtailment and hybrid BESS-wind edge cases in the decision paper. It is not recommended that these edge cases prevent deletion. The rationale for deletion is sound for the standard case, but participants in these configurations need regulatory certainty about whether FRT obligations apply during such operational states. A targeted clarification or savings provision in the Code amendment would address this without altering the overall policy intent.
	Q8. Do you agree with the analysis in the Regulatory Statement?	The regulatory statement is supported. The competitive neutrality argument that extending clause 8.25B(3) exclusion to all variable and intermittent generation removes a discriminatory compliance burden that has no technical justification is well-founded and is consistent with the Authority's obligations under section 32(1) of the Electricity Industry Act 2010 to promote competition in the electricity industry. The cost savings for solar PV and other non-wind variable generators from not needing to design active power recovery systems to compensate for physically unavoidable post-fault output reduction are material and the regulatory statement captures this accurately.
FSR 105 Clarify	Q9. Do you agree the	Yes. The clarification, to reflect actual practice, that the System

who provides information to assess compliance with fault ride through obligations	proposed Code amendment will achieve the objective?	Operator (rather than the grid owner) provides network models for FRT compliance assessment removes a persistent source of confusion and transaction costs, particularly for new entrant developers unfamiliar with the divergence between the Code text and operational reality. The amendment will: • Reduce connection process friction by eliminating the need for developers and their technical advisers to navigate the gap between the Code's reference to the grid owner and the actual practice of engaging the System Operator for network model provision. • Improve the quality and consistency of FRT compliance assessments by mandating software and configuration consistency and establishing a clear hierarchy (System Operator as tiebreaker) when models differ. • Provide a clear framework for embedded generator compliance assessment, albeit subject to the distributor capability concerns noted above.
	Q10. Do you agree with the analysis in the Regulatory Statement?	The regulatory statement is supported. The additional matter of distributor modelling capability for embedded generators should be addressed in the decision paper. Specifically, the Authority should: • Assess the current state of distributor network modelling capability across the major lines companies, and identify any distributors that may not currently maintain the tools or expertise required to provide FRT-compatible network models. • Consider whether a transitional provision for example, a 12 or 24-month implementation period for the embedded generator provisions is needed to allow distributors to build the necessary capability before the obligation becomes operative. • Commit to monitoring the practical application of the embedded generator provisions in the first 12 months after commencement and to reviewing any gaps in distributor compliance through the appropriate regulatory oversight mechanism.
FSR 106 Clarify obligations related to frequency management and frequency support	Q11. Do you agree the proposed Code amendment will achieve the objective?	Yes. The corrections are technically justified, and the drafting improvements are well-targeted. The amendment will achieve three distinct and valuable outcomes: • It eliminates the interpretive risk created by the inconsistent use of 'generating unit' and 'generating station' terminology across clauses 8.17, 8.19(1), and 8.19(3), providing participants near the 30 MW threshold with unambiguous guidance about the scope of the excluded generating station category. • It restores the South Island 47 Hz sustain obligation that was inadvertently removed in a previous reformatting exercise, closing a material gap in the South Island frequency management framework. • It correctly distinguishes the HVDC owner's 'electrically connected' condition from the 'synchronized' condition applicable to AC-connected generators, reflecting the fundamental technical difference between DC interconnection and synchronous AC generation interconnect.
	Q12. Do you agree with the analysis in the Regulatory Statement?	The regulatory statement is supported. The forward-looking observation regarding the 30 MW excluded generating station threshold is offered for the Authority's consideration in the broader FSR programme context. This submission notes that as the proportion of utility-scale solar PV in the 20–50 MW range increases, the cliff-edge compliance effect of the current threshold will affect a growing number of projects. A future FSR tranche that reviews the threshold with appropriate industry consultation and modeling of the system security implications would be a valuable complement to the housekeeping work being done in FSR-106.