

## ENGINEERING DEPARTMENT OF ELECTRICAL, COMPUTER, AND SOFTWARE ENGINEERING

School of Engineering 20 Symonds St Auckland, New Zealand Telephone 64 9 923 9523 Facsimile 64 9 373 7461

The University of Auckland Private Bag 92019 Auckland, New Zealand

30 May 2023

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

Ref: Submission on Future Security and Resilience - Review of common quality requirements in Part 8 of the Code

Thank you for the opportunity to submit on Future Security and Resilience - Review of common quality requirements in Part 8 of the Code

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

We feel that part 8 of the code is long over-due and hopefully it will better clarify roles and responsibilities for all the electricity stakeholders to ensure not only continued high reliability but ensure resilience in the context of new security threats, challenges and increased expectations from this important lifeline.

Nirmal Nair (he/him)

Poukairangi | Associate Dean Postgraduate Research

Te Herenga Mātai Pūkaha | Faculty of Engineering

Ahonuku | Associate Professor

Te Kura Pūhanga Hiko, Rorohiko me te Pūmanawa | Department of Electrical, Computer, and Software Engineering Waipapa Taumata Rau | The University of Auckland 405.643 (Bldg 405, Room 643), 5-7 Grafton Road

Tāmaki Makaurau | Auckland 1010

Aotearoa | New Zealand Tele: +64 9 923 9523 Fax: +64 9 373 7461





## Appendix B Format for submissions

	Question	Comment
Q1.	Do you agree with the description of the first common quality issue and that addressing it should be a high priority? If you disagree, please provide your reasons.	Agree with the first common quality issue. The fact that NZ does not have AGC and instead uses MFK does not blend naturally to having granular frequency keeping market arrangements as in other ISOs. The obligations amongst the current 3 modes of frequency response (Governor-AOPO, MFK and 5-minute energy dispatch) will get more challenged and will potentially under-utilize opportunities for integrating other traceable albeit expensive options to help participate in the frequency keeping. A revisit to see if we have 2 buckets (Synchronous- i.e. Governor and Flexible i.e. MFK+ 5 minute dispatch) needs to be revisited. Keeping this focused around technical rather than market impacts, in the first pass will be advisable. The participatory limit i.e. 30 MW etc. if reduced due to possibility of inverter-based generation will also need to factor some notion of number of inverters participating, availability, traceability, source (e.g., preference to battery storage) and times (day time availability of solar backed resource etc.) will need to be clarified.  Another item that will need some clarity is around correlating frequency keeping with the amount of wind-farm being dispatched in real-time.
Q2.	Do you agree with the description of the second common quality issue (ie, first voltage-related issue) and that addressing it should be a high priority? If you disagree, please provide your reasons.	We partially disagree with the premise of certainty with regards to inverter causing larger voltage deviations. New Zealand North Island, particularly Auckland based reactive compensation by STATCOM etc. has been constituted based on existing grid configuration and generation mix. So the notion that grid-strength will decrease with reduced synchronous generation and attributing the replacement generation i.e. inverter-based generation as the root-cause of the description of the second common quality merits a more detailed and nuanced analysis. Without that, the question would arise of the existing transmission reactive investments. The basis of this submission is

3. Do you agree with the description of the third common quality issue (ie, second voltage-related issue) and that addressing it should be a high priority? If you disagree, please provide your reasons.

Q4. Do you agree with the description of the fourth common quality issue (ie, third voltage-related issue) and that addressing it should be a high priority? If you disagree, please provide your reasons.

derived from our prior involvement researching NZ Wind-farm FRT development.

(https://link.springer.com/chapter/10. 1007/978-981-4585-27-9 3)

And associated wind-farm protection https://link.springer.com/chapter/10.1 007/978-981-4585-30-9 12

Again, we partially disagree with regards to system inertia being the sole cause of dis-harmonization and AUFLS issues. It depends. We quote this based on prior work done on this internationally as well as NZ Grid specific. Some examples here <a href="https://e-cigre.org/publication/810-protection-and-automation-issues-of-islanded-systems-during-system-restorationblack-start">https://e-cigre.org/publication/810-protection-and-automation-issues-of-islanded-systems-during-system-restorationblack-start</a>

We have experimented and reported on increasing the block-size of NZ AUFLS

https://ieeexplore.ieee.org/document/6102531

In addition how to price AUFLS as a extended reserve product https://e-

cigre.org/publication/SESSION2018 B5-124

We do not see any discussion that currently exists in NZ to ascertain if this fourth common quality issue would really happen here due to large-scale integration of Solar farms, batteries etc. This group has been active in IEEE standards around interfacing of inverter based energy resources to transmission and distribution and guides or codes similar to this have not been seen or prevalent in NZ yet. We need to have assessments regarding if these practices and codes being recommended in electricity networks that have market operations like USA need to be factored for NZ. Before we embark upon code changes to address this third voltage-related issue is mandated extreme care needs to be exercised. If not, this will become unmanageable and add to confusion of who is responsible and how to assign responsibility when things go wrong.

https://sagroups.ieee.org/2800/

https://standards.ieee.org/ieee/1547/5

Q5. Do you agree with the description of the fifth common quality issue and that addressing it should be a high priority? If you disagree, please provide your reasons.

I disagree with the premise of "harmonics" being a big issue from viewpoint of bulk security. The very fact that there is no clarity around managing and responsibility of "power" aka. Voltage quality and how to allocate it even in the current configuration is a testament to this. With inverter-based generation this challenge is likely to increase. So making it more simpler will help the order of the day. This submitter is part of developing new micro-grid standards.

https://standards.ieee.org/ieee/2030.1 2/7398/

For distributors this needs to be made more simpler else compliance will become a challenge simply because the onus will be on the increasing inverter-based plants (generation and storage) that will proliferate within the networks.

Not applicable

Q7. Do you agree with the description of the sixth common quality issue and that addressing it should be a high priority? If you disagree, please provide your reasons.

If you are a distributor, what is your

experience of asset owners sharing information with you

for network operation purposes?

Q6.

Agree. Network operators should have more information not less. Very similar to market operators and participants.

Q8. Do you agree with the description of the seventh common quality issue and that addressing it should be a high priority? If you disagree, please provide your reasons.

Agree completely. By the time this group gets together and works on it will have to grapple with newer terms like grid-forming, following and supporting modes, AC-DC MV/LV Grids etc.

- Q9. Do you consider there to be other high priority common quality issues not identified in this paper that are occurring orthat you expect to occur because of:
- Agree. Some of these new modes of emerging operating architectures identified in response to Q8.
- a. the uptake of inverter-based resources, and/or
- b. how the Code enables different technologies?