30 May 2023

Future Security and Resilience
Electricity Authority
P O Box 10-041
Wellington 6140

By email: fsr@ea.govt.nz

Tēnā koutou

Future Security and Resilience - Review of common quality requirements in Part 8 of the Code - Issues Paper

WEL Networks (WEL) appreciates the opportunity to submit on the Authority's review of common quality requirements in Part 8 of the Code in response to the uptake of inverter-based variable and intermittent resources and how the Code enables different technologies.

WEL is New Zealand's sixth largest distribution network company and is 100% owned by our community through our sole shareholder WEL Energy Trust. Our purpose is to enable communities to thrive, and we work to ensure that our customers receive affordable, reliable, and environmentally sustainable energy.

In addition to providing feedback on the individual questions raised in Appendix B of the Issues Paper, WEL has made further comments about common quality issues and future work.

Given the fast-changing nature of the power system, WEL believes it is better to have a broad review of the whole electricity industry participation framework rather than tweak existing rules to attempt to meet the needs of the changing environment. The existing rules, regulations, and Code were based a very different power system to what the power system is evolving into. The Code was not written with the operation of distribution networks in mind.

We believe that regulatory targets for frequency and voltage should be reviewed in light of the characteristics of the new power system. Similarly, market arrangements should be reviewed in light of increasing amounts of zero fuel cost generation. For example, at what point does marginal cost pricing become inefficient? Could market-based arrangement for reactive power remove the need for some voltage related asset owner performance obligations (AOPOs)? How can price signals be incorporated across distribution networks to manage congestion?

Concern that new solar generation will be mostly distribution connected and therefore does not have to comply with certain frequency related, fault ride through related and voltage related AOPOs seem to be less important now. Transpower has revised its forecast of distributed versus grid scale solar and now believes that most new solar generation will be directly connected to the grid.

The issues paper notes that Part 8 of the Code was drafted some 20 years ago. We suggest that elements of Part 8 were based on even older design specifications and operational practices from last century.

The issues paper asserts there are incentives for generation to restrict size to less than 30 MW and connect to distribution networks to avoid the need to comply with certain frequency related, fault ride through related and voltage related AOPOs.

Generation sized less than 30 MW has many incentives to connect to a distribution network. However, the benefit of avoiding the need to meet certain AOPOs is far down the list. Some incentives to connect to distribution networks are:

- the high costs of system operator dispatch (ICCP connection, need for automation of receiving and acknowledging dispatch instructions on 24-hour basis).
- the cost of connection to a distribution network will typically be orders of magnitude less than the cost of connection to the transmission grid. In many cases, the distribution network will be much closer to the generation site than the transmission network.

The distributor may require voltage related AOPOs tailored to the new generation and its point of connection. It is not obvious that having a second set of AOPOs arising from the Code provides much value and may even conflict with distributor requirements.

Any AOPO must take into account the benefit provided by the AOPO and the costs of compliance for different assets. The costs of compliance for large generating units are likely to be relatively lower than the costs of compliance for small generating units. The costs of compliance for smaller generation may be such that it is uneconomic to build the generating unit. The application of a threshold limit for AOPO compliance is a pragmatic way of dealing with this situation, not to mention avoiding the considerable administration costs for many small generating units.

In addition, many existing small generation schemes were likely designed for a different operating regime than that of the current Code and the cost of remedying non-compliance will likely lead to many of these generation schemes becoming uneconomic.

WEL has assessed the priority of the common quality issue considering whether the system operator has existing means to mitigate the issue (which may increase ancillary services costs) and how soon the issue may become unmanageable.

Please find attached Appendix 1 - WEL's responses to questions raised in Appendix B of the Issues Paper.

Should you require clarification on any part of this submission please do not hesitate to contact me.

Ngā mihi nui

David Wiles
Revenue and Regulatory Manager

Appendix 1 – WEL Network's response to 'Appendix B' questions

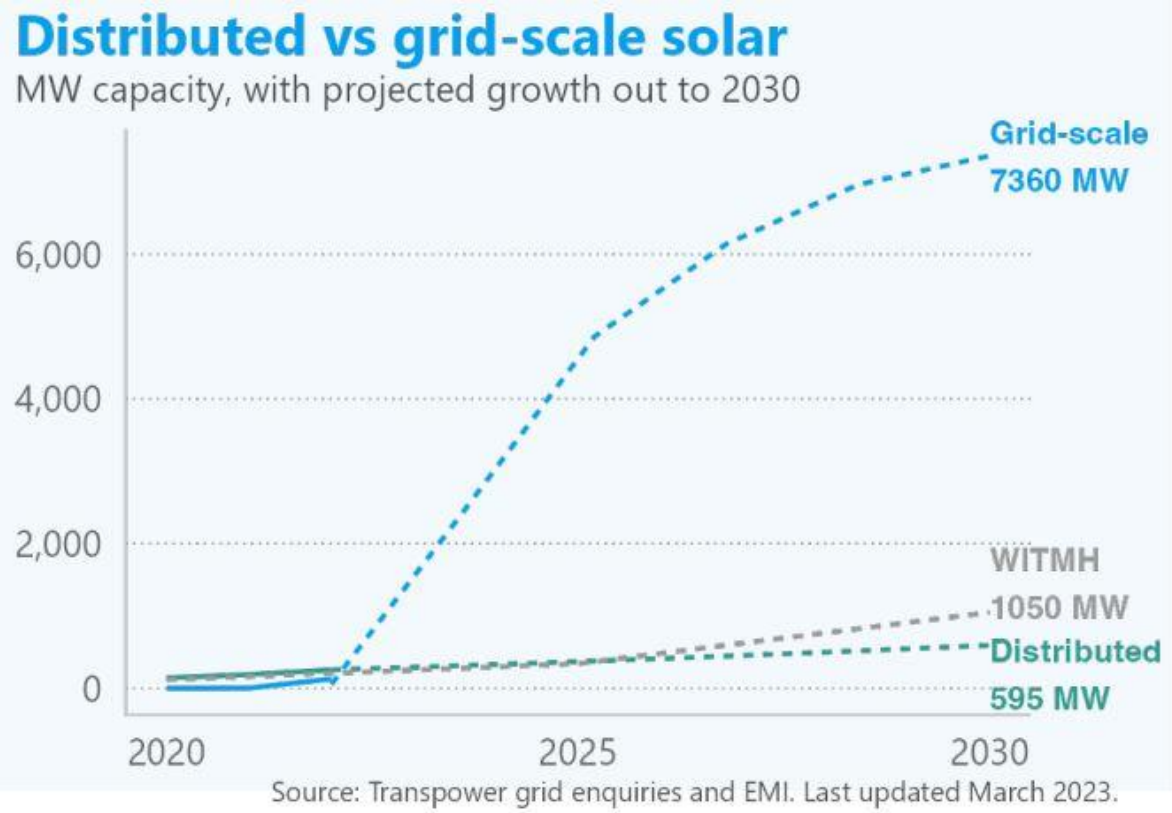
Q1 – Do you agree with the description of the first common quality issue and that addressing it should be a high priority? If you disagree, please provide your reasons.

There seem to be three intermixed issues:

1. Increased amounts of inverter based intermittent and variable generation will cause greater and faster variation of power system frequency due to the characteristics of such generation (in terms of both inverter performance and the variable nature of the fuel source;
2. The system operator believes the 30 MW export threshold in the rules means much of new generation will have not to meet the frequency related AOPOs; and
3. The system operator is obliged to continue granting dispensations due to the frequency related AOPOs poorly matching the capabilities of the inverter-based generation.

Part of the cause of the problem is the design and implementation of the rules with performance obligations being based on the characteristics of synchronous generation. Technology agnostic AOPOs are preferable as new technologies can then be incorporated more easily in the future.

We disagree that much of the new generation will be less than 30 MW and thus not have to meet the frequency related AOPOs. Transpower has revised its forecasts of distributed versus grid-scale solar:



https://www.energynews.co.nz/news/electricity/137587/transpower-completely-revises-grid-scale-solar-forecasts

The original Accelerated Electrification scenario projected 6 GW of solar by 2050, with the majority (83%) of this coming through distributed (i.e. embedded) solar and only 1 GW of grid-scale solar.

We also disagree that the system operator has to continue granting dispensations for non-compliant generation. The system operator can encourage equivalence arrangements in cases where the inverter-based generation can provide the equivalent performance of the AOPO but not exactly according to the wording of the Code. Alternatively, the system operator can put conditions in granted dispensations requiring the inverter-based generation to make the maximum contribution to frequency support within the capability of the inverter-based generation.

This should be a medium priority. The system operator has means (increased procurement of frequency keeping and reserves, encouraging use of equivalence arrangements rather than dispensations) to manage the problem in the interim.

We believe it is timely to review the overall framework for frequency in New Zealand. The frequency related obligations (e.g. in the Electricity (Safety) Regulations 2010) can be reviewed to confirm appropriateness for the future. Likewise, the system operator's Principal Performance Objectives (PPOs) can be reviewed to confirm appropriateness for the future. This of course is outside the scope of the Future Security and Resilience work programme.

It is possible that new ancillary services (e.g. inertia, regional fast intermittent generation firming) may be a good option for managing frequency deviations and reducing system inertia.

Another option is a market-based arrangement around fast frequency variations where payments are made to those who boost their output when frequency drops and costs are imposed on those who are dropping output at the time. Generators, grid connected loads, and distributors at the GXP could all be participants in such an arrangement.

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.

The problem is defined as inverter-based resources cause greater voltage deviations due to a reduction in system strength. Inadequate system strength may become an issue on New Zealand's transmission network in 3–7 years.

The first voltage-related problem should be a medium priority. The system operator has means to manage voltage deviations (e.g. voltage support ancillary service).

The AOPOs (voltage range) can be revisited. Transpower has wider voltage range agreements for some parts of the grid which allow grid voltages to go below the voltage range requirements. Widening the voltage range in Part 8 certainly seems possible in parts of the grid.

A market arrangement for grid reactive power could be implemented. This can remove the need for voltage related AOPOs. For example, a wholesale market price signal could be provided at each node for reactive power. Those parties helping the voltage issues can be rewarded and those parties adding to the voltage issue can be allocated costs.

Voltage-related requirements for distributed generation need to be set by the distributor. Dispatch of reactive power or voltage setpoints for distributed generation needs to be done by the distributor system control or Distribution System Operator (DSO).

The system operator should not have the ability to dispatch distributed generation for reactive power. The system operator has no visibility of the distribution network and no idea as to whether any reactive power dispatch instruction will overload distribution assets or cause distribution voltages to exceed regulatory limits. The reactive power dispatch instruction may cause the distributed generator to be put in breach of minimum power factor and voltage obligations in its connection contract.

The system operator would perhaps be better to focus on reactive power flows at the GXP where distributor or DSO can respond to the best of their extent possible to coordinate Distributed Energy Resources (DER) on their networks to help manage reactive power and voltage at the grid interface. A review of GXP minimum power factor requirements in transmission agreements would also be appropriate given the changes in power flows due to distributed energy resources.

Generation sized less than 30 MW is incentivised to connect to distribution networks because the high costs of connection to the transmission grid (including the connection studies required by both the grid owner and system operator and the costs of providing the IT systems required for scheduling and dispatch) would make most small generation schemes uneconomic. The incentives provided by avoiding the need to meet certain AOPOs through connecting to the distribution network would be much less.

Q3 – 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.

Issue: Inverter-based resources can cause network performance issues by disconnecting from the power system during voltage disturbances. Inadequate system strength may become an issue on New Zealand's transmission network in 3–7 years.

We agree with the description and addressing the issue is a high priority. The system operator does not have means to manage this issue and it may become a problem in the medium term.

A review of voltage related PPOs and AOPOs is appropriate. The development of a system strength ancillary service is an option.

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.

Issue: Increasingly less generation subject to fault ride through obligations.

We do not agree with the description and addressing with a high priority. Given Transpower has revised its forecast of distribution vs grid scale solar (see comment for Q1) we don't think the increasingly less generation subject being subject to fault ride through obligations is as critical as believed previously.

We note that distributors can place fault ride through obligations on distributed energy resources. It may be appropriate to review whether a different set of fault ride through obligations should apply to smaller distributed energy resources.

The system operator has a means of mitigating this issue through instantaneous reserves (i.e. the amount of inverter based generator at risk of tripping for a fault becomes the contingent event). The variability of intermittent generation during trading periods also adds to the system operator's difficultly in assessing the size of the contingent event.

While security constraints can be applied to generating units subject to dispatched by the system operator, smaller generation not subject to dispatch would not be affected. This is likely an issue to be managed by distributors in the long term.

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.

Issue: Some ambiguity around harmonics standards.

We agree, but at a medium priority. The system operator only has the obligation (Clause 7.2D of the Code) that on request, to investigate and resolve a security of supply or reliability problem arising from non-compliance with harmonic levels (and voltage flicker levels and voltage imbalance) at any point of connection to the grid.

It is not apparent that this issue should be addressed as part of the review of common quality requirements as the issue primarily affects the asset owners on each side of the point of connection to the grid.

We note that distributors can require distributed energy resources to meet certain harmonic emissions standards and if deemed necessary, to install harmonic filters as part of the distributed generation application process. Distributors will be better placed to manage harmonic issues in their network and harmonic flows from the network to the transmission grid.

Q6 – If you are a distributor, what is your experience of asset owners sharing information with you for network operation purposes?

Asset owners are quite open to sharing information to enable assessment and connection to the distribution network.

The establishment of a commercial model is required for ongoing provision of operational information.

Operational liaison between Transpower and Distributors during planned maintenance and faults is working well in our experience.

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.

Issue: Insufficient information on assets wanting to connect, or which are connected, to the power system.

We disagree with the description. The problem for the system operator may be better connected with trying to extend a centralised approach to operating the power system out into the distribution networks. A decentralised approach may be superior.

We note that the Transpower's recent forecast of the proportion of distributed vs grid scale solar (see comment for Q1) makes this issue less urgent.

Distributors are better placed to manage sharing of asset information from distributed asset owners as they are contractual counterparties.

Better forecasting of aggregate DER intended output (e.g. PV solar, wind, EV charging, demand response etc) at the GXP level would be useful to the system operator. These forecasts can be provided by the DSO. This approach would simpler than requiring massive numbers of DER owners to provide information about intended output not to mention the high operational costs of providing information to the system operator.

Similarly, alternative methods of modelling the composite dynamic frequency and voltage response at the GXP level rather than requiring massive numbers of DER owners to provide asset capability information to the system operator and distributor should be investigated.

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.

Issue: Code terms missing or not fit for purpose.

We agree with the description of the issue. We believe this should be a high priority.

We suggest that the AOPOs be phrased in a technology agnostic way as far as practicable. This will reduce the need to revisit the AOPOs with the appearance of new technologies in the future.

We suggest also reviewing terms like "synchronous" or "when synchronised" with consideration of more generic terms like "when connected to the network/grid and ready for import or export".

Q9 – Do you consider there to be other high priority common quality issues not identified in this paper that are occurring or that you expect to occur because of: a. the uptake of inverter-based resources, and/or b. how the Code enables different technologies?

There are other issues that may become evident with increasing amounts of inverter-based generation such as increase in voltage unbalance and rapid voltage changes arising from rapid changes in output at PV solar installations. It is not certain at this as to the extent or timing of any problem.

Many inverter-based energy storage systems are likely to increasingly have grid forming capabilities. Consideration of the ability of these systems to provide islanded supply during interruptions or support during emergency conditions.