MINUTES OF CQTG MEETING 3

Held on Wednesday 3 April 2024, 9:00am – 3.50pm
Electricity Authority office – Wellington

Members present:	Sheila Matthews (Chair), Matt Copland, Brent Duder-Findlay, Barbara Elliston, Brad Henderson (until 3.20pm), Stuart Johnston (from 9.30am), Stuart MacDonald, Rob Orange (until 3.20pm), Jon Spiller.
Apologies:	Graeme Ancell, Mike Moeahu, Gareth Williams.
In attendance:	Neville Watson (from 10.10am to 3.20pm), Phillip Beardmore, Clive Bull, Nyuk-Min Vong (Vong), Ivani Molver (online, until the end of the 'frequency options paper' section), Nuwan Herath (until the end of the 'voltage options paper' section), Katherine Moore (online), Nasser Usman Faarooqui (until 3.20pm), Rob Mitchell.

Introduction

1.1 The Chair welcomed attendees to the third meeting of the Common Quality Technical Group (CQTG). A quorum was established, with nine of the twelve members present (including the Chair). Graeme Ancell, Mike Moeahu and Gareth Williams were apologies.

1.2 The Chair welcomed new member Brent Duder-Findlay to the group, and a round of introductions followed. The Chair then provided an overview of the meeting agenda and the meeting's objectives, and provided an update on the actions recorded for the second meeting of the CQTG.

1.3 The group approved the minutes of the second meeting of the CQTG, subject to some minor amendments regarding the action items.

(a) **Action 1.7:** Re-open this action item, which the Authority had closed without completing based on the understanding that MBIE was starting its review of the voltage standards. However, MBIE's review had subsequently been put on hold.

(b) **Action 2.15:** Include the following text "and 7 (missing Code terms)", and include a deadline by which the action is to be completed.

Action Item	**3.1:** CQTG chair to amend and sign the minutes of the CQTG meeting of 10 August 2023 and publish the minutes on the Authority's website.

Frequency studies – presentation from the system operator

1.4 Ivani presented the results and key findings from the three frequency-related system studies undertaken by the system operator for the frequency-related options consultation paper. Key points raised in the CQTG's discussion on the presentation included:

Study 1:

(a) Include in the system study report a clearer justification for recommending a 5MW threshold over a 10MW threshold, for which the study's results appeared similar.

(b) In the system study report, expand on the interaction of droop and ramp rate settings for battery energy storage systems. A faster ramp rate for battery energy storage systems could reduce (in relative terms) the amount of fast instantaneous reserve the system operator must procure.

Study 2:

(a) In the system study report, clarify whether the recommendation on a deadband applies to only new generation, or whether it includes existing generation or upgrades to existing generation.

(b) Why should some generating technologies be required to have a tighter deadband than others (eg, hydro compared to geothermal)? What about generating stations procuring from elsewhere the firming of intermittency (eg, wind and solar photovoltaic generating stations procuring firming from battery energy storage systems)?

(c) In the system study report, expand on the reasons for the 0.1MW deadband proposal, and whether 0.1MW is recommended to be a permanent threshold or a temporary threshold that will be subject to review.

(d) In the system study report, clarify that the issue relates to variable and intermittent generation, not inverter-based resources per se.

Study 3:

(a) Note in the system study report that 50Hz is the starting point from which frequency fluctuations are measured. If there is less regulation of frequency in the normal band (49.8–50.2Hz), then there is less likelihood that frequency deviations are from 50Hz.

Action Item	**3.2:** System operator to consider the CQTG's feedback on the frequency-related system study reports and make any necessary amendments.

Frequency options paper

1.5 Phillip led the discussion on the draft frequency-related options paper, seeking feedback from the CQTG on the version circulated to members before the meeting.

1.6 Feedback provided at the meeting included:

(a) In the options paper, use ‘frequency controller’ or ‘frequency control system’ instead of ‘governor’, so as to capture inverter-based resources.

(b) Virtual power plants / aggregated generation with a common control system should have frequency-related asset owner performance obligations placed on them by the Code that mirror the obligations placed on same-sized single site generating stations. This is because the effect on frequency is the same / similar. The Authority could perhaps add a question in the options paper asking aggregators how they would comply with these obligations.

(c) It would be good to align the AS/NZS 4777.2 standard with the Code’s requirements for generating stations to support frequency during underfrequency events. The Authority could ask aggregators about this by including an additional question in the options paper.

(d) The options paper should be very clear about where ‘grandfathering’ requirements on existing generation are being proposed.

(e) The options paper should note the benefits as well as the costs of raising, from 45Hz to 47Hz, the minimum frequency at which South Island generation assets must remain synchronised for 30 seconds following an underfrequency event.

1.7 In relation to raising the South Island underfrequency to 47Hz, CQTG members noted the significant amount work that would be required to implement this (eg, contingency planning requirements for the system operator would change, the South Island AUFLS design would need to change) and the associated cost. However, CQTG members also noted the potential benefits (eg, greater competition in the supply side of the wholesale electricity market). Several members considered this matter would need to be reviewed at some stage and further delaying its consideration would increase the difficulty and expense of any change. The Chair noted this matter is in the ‘holding pen’ of options for addressing the frequency-related issue and an update on the status of these options was on the meeting agenda.

Action Item	**3.3:** Authority to consider including a question in the frequency-related options paper asking aggregators how they would comply with frequency-related asset owner performance obligations that applied to their aggregated generation / virtual power plants.
Action Item	**3.4:** Authority to check the underfrequency requirements in the AS/NZS 4777.2 standard and consider including a question in the frequency-related options paper on the pros and cons of aligning this standard with fault ride-through obligations in the Code.
Action Item	**3.5:** CQTG members to e-mail any additional feedback on the draft frequency-related options paper to the Authority by Monday 8 April.
Action Item	**3.6:** Authority to consider CQTG members’ feedback on the draft frequency-related options paper and incorporate as appropriate.

Ivani Molver left the meeting.

Voltage studies – presentation from the system operator

1.8 Nuwan presented the results and key findings from the three voltage-related system studies undertaken by the system operator for the voltage-related options consultation paper. Key points raised in the CQTG's discussion on the presentation included:

Studies 1 and 2:

(a) It was suggested that all distributed energy resources should be in 'voltage control' mode regardless of their distance from the GXP, rather than just those closest to the GXP.

(b) Clarification was sought as to whether the system study report was meaning 'voltage control' or 'voltage droop control'.

(c) It was noted there are instances of 1-2MW generating stations connected at 33kV, so do not implicitly assume that only large-capacity generating stations will connect at 33kV and above. Consider whether small generators would face a significant issue if all distributed energy resources connected at 33kV and above were to be captured by new voltage obligations on distribution-connected generating stations. Consider this issue under the option of placing voltage support obligations on generating stations connected at the GXP voltage rather than at 33kV and above. Maybe a 5MW threshold would be more appropriate than no threshold?

(d) Make very explicit in the system study report that the recommendation relates to distribution-connected generating stations having the capability to be dispatched to support voltage, rather than recommending responsibilities for dispatching reactive power provided generating stations connected to the distribution networks.

Study 3:

(a) It would be prohibitively expensive for small generating stations connected at voltages below the sub-transmission level to demonstrate they would comply with fault ride-through requirements. It was emphasised that the issue is with the cost of demonstrating compliance, rather than the cost of complying with the fault ride-through requirements.

(b) It was recommended that there be a suitable threshold that applies 'across the board'. Having multiple thresholds for different requirements in the Code would be confusing.

(c) It was noted that some overseas jurisdictions have different fault ride-through obligations for machine-based synchronous generation and for inverter-based resources. It was also noted that it may not be possible for some machine-based generating stations to comply with the fault ride-through obligations in the Code.

Action Item	**3.7:** System operator to consider the CQTG's feedback on the voltage-related system study reports and make any necessary amendments.
Action Item	**3.8:** Authority to consider adding a question in the voltage-related options paper regarding implications for generators and distributors of applying voltage control obligations on all generation connected at the GXP voltage.

Action Item	**3.9:** Authority to consider including a question in the voltage-related options paper on the ability of machine-based synchronous generation to comply with fault ride-through obligations.

Voltage options paper

1.9 Phillip led the discussion on the draft voltage-related options paper, seeking feedback from the CQTG on the version circulated to members before the meeting.

1.10 Feedback provided at the meeting included:

(a) There was general agreement on 'voltage control' mode being required, but clarity was needed on exactly what this meant (eg, 'voltage control' versus 'voltage droop control').

(b) There appears to be differing interpretations of the definition of 'generating unit' in the industry. The Authority should consider what needs to be done to address this.

(c) More consideration is needed on the appropriateness of including in the Code fault ride-through curves for generating stations connected on distribution networks at the GXP voltage, including any network protection considerations.

(d) A paragraph should be inserted on the appropriateness of generating stations connected to distribution networks being required to have a reactive power range of ±33% rather than the +50%/-33% currently specified in the Code for transmission-connected generating stations.

Action Item	**3.10:** Authority to consider adding a question to the voltage options consultation paper regarding the appropriateness of including in the Code fault ride-through curves for generating stations connected on distribution networks at the GXP voltage, taking into account network protection considerations.
Action Item	**3.11:** Authority to consider adding a question to the voltage options consultation paper on the appropriateness of generating stations connected to distribution networks being required to have a reactive power range of ±33%.
Action Item	**3.12:** Authority to consider how best to address differing interpretations of the Code's definition of 'generating unit'.
Action Item	**3.13:** CQTG members to e-mail any additional feedback on the draft voltage-related options paper to the Authority by Monday 8 April.
Action Item	**3.14:** Authority to consider CQTG members' feedback on the draft voltage-related options paper and incorporate as appropriate.

Nuwan Herath left the meeting.

Harmonics options paper

1.11 Nasser led the discussion on the draft harmonics options paper, seeking feedback from the CQTG on the version circulated to members before the meeting.

1.12 The Authority had invited Professor Neville Watson to attend the meeting due to his expertise in harmonics, and he provided extensive feedback on the draft paper. Feedback provided by Professor Watson and CQTG members at the meeting included:

(a) A preference for the AS/NZS 61000 series of harmonics standards rather than the IEC 61000 series of harmonics standards. This was because the AS/NZS 61000 series has been tailored for New Zealand's requirements. The consultation paper should be clear on the difference between a standard for devices and a standard for installations.

(b) The studies for the NZECP 36:1993 standard were conducted in the 1970s, and published in 1981. The New Zealand power system has changed significantly since then, and we should not be referring to NZECP 36:1993 as it is no longer fit for purpose.

(c) Planning levels and compatibility levels are indicative and should be included in the regulation.

(d) Professor Watson agreed that NZECP36:1993 standard is in conflict with AS/NZS 61000 series of standards.

(e) Reiterated that there is sufficient power quality (including harmonics) data available at every GXP/GIP.

(f) Mentioned the difference between the harmonics standard for installation of electrical assets (as discussed in NZECP36:1993) and the harmonics standards for the electrical devices/equipment (AS/NZS 61000 suite of standards)

(g) Consider different frequency ranges for the electrical assets such as EV cars (10 kHz), irrigation loads (4-6 kHz).

(h) Provided anecdotal evidence of transformers premature insulation failure due to harmonics

(i) Provided anecdotal evidence of harmonic mitigation using approaches such as phase shifting in transformers and other assets.

(j) Disagree with IEEE514 approach for harmonic allocation.

(k) Provided anecdotal evidence of discrepancies in the self-certification of power quality by the manufacturers as reported by TransGrid in Australia.

(l) Raised the issue that "net zero harmonic emissions" as discussed in the paper may not be effective as the grid is dynamic and there will be issue of measurement

(m) Also indicated that harmonic taxes is not effective for New Zealand as pointed out by the research work taken at University of Canterbury.

(n) Mentioned that the approach taken in EEA power quality guidelines 2024 is conservative and was designed specifically for distribution networks. Recommended to undertake similar approach for transmission as well.

(o) Interharmonics, super-harmonics, frequency coupling of 5th and 7th harmonics are some of the major issues with the IBR.

(p) A recommendation for a 99% compliance requirement because 95% of a week is 8.4 hours, which is a long time for harmonics to be clashing.

(q) Be detailed/specific about compliance, because the IEC 61000 series does not consider the real-world challenges of monitoring compliance with harmonics standards.

(r) Support for an open-source tool for assessing compliance with harmonics standards after equipment is installed.

(s) Allowing headroom in the allocation of total harmonic distortion is prone to arbitrariness.

(t) Treat generation and load the same for the allocation of total harmonic distortion.

(u) The harmonics allocation methodology in the Electricity Engineers' Association's 2024 power quality guidelines contains a three-stage process because feedback from electricity industry participants was for there to be a 'negotiation' stage. Under the 'negotiation' stage the network owner permits a harmonics emitter to exceed its allocation until such time as that extra amount is needed by another emitter.

Brad Henderson, Rob Orange, Neville Watson, and Nasser Usman Faarooqui left the meeting.

1.13 Due to the complexity of the topic, the Authority agreed to consider deferring the publication of an options paper, and instead releasing a discussion paper for consultation. A discussion paper would provide interested parties with a summary of the Authority's current thinking on the governance and management aspects of the harmonics issue, touching on the allocation of harmonics at a high-level. An options paper would then be released at a later date. CQTG members supported this approach.

Action Item	**3.15:** Authority to consider publishing a harmonics discussion paper before consulting on harmonics-related options.
Action Item	**3.16:** Authority to incorporate the CQTG's feedback on the draft harmonics paper.
Action Item	**3.17:** Authority to arrange an online meeting of the CQTG to discuss the next version of the draft harmonics paper.

Update on status of other options in the long list of options

1.14 This section was not covered in the meeting due to time constraints and the previous agenda items being of a higher priority. This item will be included as an agenda item for the next CQTG meeting.

Next meeting

1.15 The next meeting is proposed to be held on 10 June 2024 at the Authority's office.

1.16 The main purpose of the meeting will be to review the draft consultation material on options to address Issue 6 (information requirements) and Issue 7 (Code terminology).

1.17 The meeting closed at 3:50pm

Summary of outstanding action points

No.	Action	Who	When
1.7	• Prepare a letter from the CQTG to MBIE, urging MBIE to prioritise proposing an amendment to the Electricity (Safety) Regulations 2010, to permit the supply of electricity to installations operating at 230 volts AC to be within 10% of 230 volts AC.	Authority	Closed
2.15	• Determine a plan to progress issues 5 (harmonics), 6 (information), and 7 (Code terms).	Authority	Completed
3.1	• CQTG chair to amend and sign the minutes of the CQTG meeting of 10 August 2023 and publish the minutes on the Authority's website.	Authority	Completed
3.2	• System operator to consider the CQTG's feedback on the frequency-related system study reports and make any necessary amendments.	System operator	Completed
3.3	• Authority to consider including a question in the frequency-related options paper asking aggregators how they would comply with frequency-related asset owner performance obligations that applied to their aggregated generation / virtual power plants.	Authority	Completed
3.4	• Authority to check the underfrequency requirements in the AS/NZS 4777.2 standard and consider including a question in the frequency-related options paper on the pros and cons of aligning this standard with fault ride-through obligations in the Code.	Authority	Completed
3.5	• CQTG members to e-mail any additional feedback on the draft	CQTG members	Completed

	frequency-related options paper to the Authority by Monday 8 April.		
3.6	• Authority to consider CQTG members' feedback on the draft frequency-related options paper and incorporate as appropriate.	Authority	Completed
3.7	• System operator to consider the CQTG's feedback on the voltage-related system study reports and make any necessary amendments.	System operator	Completed
3.8	• Authority to consider adding a question in the voltage-related options paper regarding implications for generators and distributors of applying voltage control obligations on all generation connected at the GXP voltage.	Authority	Completed
3.9	• Authority to consider including a question in the voltage-related options paper on the ability of machine-based synchronous generation to comply with fault ride-through obligations	Authority	Completed
3.10	• Authority to consider adding a question to the voltage options consultation paper regarding the appropriateness of including in the Code fault ride-through curves for generating stations connected on distribution networks at the GXP voltage, taking into account network protection considerations.	Authority	Completed
3.11	• Authority to consider adding a question to the voltage options consultation paper on the appropriateness of generating stations connected to distribution networks being required to have a reactive power range of ±33%.	Authority	Completed
3.12	• Authority to consider how best to address differing interpretations of the Code's definition of 'generating unit'.	Authority	Completed
3.13	• CQTG members to e-mail any additional feedback on the draft	CQTG members	Completed

	voltage-related options paper to the Authority by Monday 8 April.		
3.14	• Authority to consider CQTG members' feedback on the draft voltage-related options paper and incorporate as appropriate.	Authority	Completed
3.15	• Authority to consider publishing a harmonics discussion paper before consulting on harmonics-related options.	Authority	Completed
3.16	• Authority to incorporate the CQTG's feedback on the draft harmonics paper.	Authority	Completed
3.17	• Authority to arrange an online meeting of the CQTG to discuss the next version of the draft harmonics paper.	Authority	Completed

Confirming the CQTG has approved these meeting minutes are a true and correct record.

Dated this 10th day of June 2024

Sheila Matthews

Chair