# VECTOR SUBMISSION ON THE ELECTRICITY AUTHORITY ISSUES PAPER: REVIEW OF COMMON QUALITY REQUIREMENTS IN PART 8 OF THE CODE

vector

## Introduction

Vector is an innovative New Zealand energy company which runs a portfolio of businesses delivering energy and communication services to more than one million homes and commercial customers across Australasia and the Pacific.

Vector is leading the country in creating a new energy future through its Symphony strategy which puts customers at the heart of the energy system. Vector's electricity distribution business believes the way to achieve more long-term affordability for customers is through increasing deployment of non-wires alternatives and effective orchestration of manageable load and injection, over the long term. Since increasing electricity demand is a function of New Zealand's decarbonisation effort, a more affordable decarbonisation can be achieved if the *Electricity Industry Participation Code 2010* (the Code) provides appropriate standards and mechanisms that enable distributors to orchestrate manageable load and injection.

We support the Electricity Authority's (the Authority) focus in its issues paper, *Review of Common Quality Requirements in Part 8 of the Code*. We agree with the descriptions of each of the issues, and that many of the issues are of a high priority except for issue 5, "ambiguity around harmonics standards". In relation to this issue, we agree that harmonics may increase with an increase in inverter-based resources, however, there are many interacting factors that lead to harmonics appearing on the electrical system and parties today are working well together to resolve harmonics issues as they arise. We therefore consider the need to further define arrangements in the Code to manage these circumstances as a low priority.

## Issue 1: Inverter-based resources cause more frequency fluctuations

***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.*

We agree with the description of the issue that inverter-based resources are more likely to cause frequency fluctuations as we transition to a supply side dominated by variable, intermittent renewable resources and lower system inertia.

We also agree that this issue should be a high priority.

## Issues 2, 3, 4: Inverter-based resources cause more voltage issues

***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 agree with the description of the issue that inverter-based variable and intermittent resources will cause greater voltage deviations and that addressing it should be a high priority.

We expect that Auckland's GXPs are unlikely to back-feed because of distributed generation connections in Auckland. This is due to the urban nature of our network as well as the scarcity and relatively high cost of land, limiting the number of large, distributed generation facilities able to be developed here. The generally high density of our housing means that there is a high ratio of load to potential DG.

Vector utilises the AS/NZ 4777 inverter standards with Volt-Watt and Volt-Var response modes that smooth voltage deviations and ensure that distributed generation resources do not exceed voltage limits at their point of connection.

We expect that the proposed expansion of the allowable voltage range to ±10% from ±6%

of nominal voltage will lead to increased hosting capacity of distributed generation on our network and could create a larger envelope for potential voltage deviations.

We believe the use of dynamic operating envelopes[1] provides an additional (and essential) backstop for distribution operation that mitigates negative impacts from distributed energy resources (DER), like solar PV and EV charging, on distribution network assets and consumers during constrained periods. Managing DER during constrained periods would have an indirect, positive impact on power quality in that immediate area and would reduce the magnitude of potential voltage deviations from intermittent, variable DER.

We would welcome regulatory support for further implementation of dynamic operating envelopes.

***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.*

We agree with the description of the third common quality issue that grid-following inverter-based resources could disconnect from the power system and cause significant network performance issues. We agree that addressing it should be a high priority.

In general, we believe this issue will be more prevalent in transmission-connected generation.

***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.*

We agree with the description of the issue that less generation capacity is expected to be subject to fault ride-through obligations in the Code and agree that addressing it should be a high priority.

The AS/NZS 4777.2:2020 standard for smart inverters now includes fault ride-through settings by default, and we would expect this to be included as part of the standard going forward, which should mitigate some of this risk.

## Issue 5: There is some ambiguity around harmonics standards

***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.*

We agree with the description of the methods available for resolving harmonics, and we agree that there is potentially an issue from inverter-driven devices to introduce harmonics into the electricity system. However, we do not consider this to be a high priority at this stage. It is not clear that harmonics introduced by inverter-based devices, particularly those located on the distribution network, will cause significant problems for consumers. Many devices are becoming increasingly tolerant of harmonic distortions.

We recommend that the Authority take a proportional response with respect to harmonics. We recommend monitoring local and international trends, particularly in areas like South Australia where distributed generation penetration rates are the highest in the world, so that we can gather data and better understand how actions undertaken to decarbonise the economy are specifically related to harmonics issues. We agree that we should continue to

[1] For more information on DOEs: On the calculation and use of dynamic operating envelopes, Battery Storage and Grid Integration Program, Australian National University

stay current with the guidelines in international standards such as IEC 61000 and IEEE 519 and include those when relevant in safety regulations, appliance regulations, and connection policies.

We will continue to work with Transpower to identify the cause(s) and resolve any issues related to harmonics detected at GXPs and do not see a need for the Code to further define arrangements for managing these circumstances.

## Issue 6: Network operators have insufficient information on assets wanting to connect, or which are connected, to the power system

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

Outside of distributed generation asset owners informing distributors of connections (as required per the Code), we have had little success in getting asset owners to share information with us about other DERs for network operation purposes.

We modified our network connection standards in April this year, requesting that consumers or their agents notify us of any EV chargers connected to the network (see section 5.14 of Vector's *Electricity Network Connection Standard*[2]). We have a plan to educate relevant parties in the sector about this new requirement, primarily focussing on EV equipment providers and electricians, and hope that this results in better information about new EV charger installations occurring on our network.

Another way that asset owners might provide information in the future to Vector about DERs is through a new tariff offering for retailers in 2023. Customer DERs (e.g. EV chargers, batteries) can be directly connected to Vector's Distributed Energy Resource Management System (DERMS) platform, or indirectly via a third party's platform (e.g. electricity retailer or DER manager). Customers connected to Vector's DERMS (directly or indirectly via a third party) may receive the benefit of a lower electricity tariff from their electricity retailer or third-party DER manager[3]. We are optimistic that this could provide additional information on DERs but have had limited response to date.

While the Default Distributor Agreement (DDA) provides for a mechanism by which retailers are obligated to inform distributors if they are managing load on our networks and establish and agree a load management protocol with us, we have no process to similarly engage with aggregators operating DER on our networks who are not retailers. The DDA does not apply to them, and they have no obligation to come to the table and agree to an operating protocol.

We are also concerned that the existing mechanisms to establish load management protocols with retailers under the DDA are untested and may not be fit for purpose. As noted in our response to Q2, we believe the concept of a dynamic operating envelope, being rolled out in Australia, will be an essential long-term solution that supports system resilience.

***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.*

Yes, we agree with the description of the issue that network operators face and that addressing it should be a high priority.

We would welcome the proposed recommendation that the Code be clearer about DER

[2] https://www.vector.co.nz/kentico_content/assets/5890bcd5-2689-46ad-8feb-3645cbad92c1/ESA002_Electricity_Network_Connection_Standard.pdf

[3] Further information can be found on http://vector.co.nz/personal/electricity/about-our-network/pricing

asset owners having a requirement to provide information to the relevant connecting network. This would improve information available to the System Operator and distribution networks to inform network planning and operation practices.

There will be a need to exchange information between the System Operator and distributors related to the inverter-based equipment that operates beneath GXPs, however we believe it will be challenging to specify exactly what information should be exchanged.

DER asset owners operating at the distribution level may be receiving and responding to signals from multiple parties (energy markets, transmission system operator, distribution networks, retailers, flexibility service providers, consumers), and the arrangements for how those multiple signals are resolved is unsettled: how is information exchanged between parties; what signals will be used or prioritised by DERs; and how to coordinate a response to emergency events that occur on the local and/or national electricity systems.

We are primarily concerned about the issue of "tier bypass", where the operator of one tier of the system is dispatching resources connected to another, without any visibility of the real-time constraints on those networks. The system operator does not have visibility beyond the GXP and will not have knowledge of all the local physical and power quality constraints impacting dispatchable DER. These constraints change every hour of every day, and the distribution networks are tasked with planning and operating the networks below the GXP to manage these constraints.

We would reduce the number of signals received by DER asset owners and manage the risk of tier bypass by ensuring distributors are enabled to orchestrate manageable load and injection on their networks. Alongside a robust data exchange between distributors and the System Operator, distributors can then send DER asset owners signals that satisfy both the System Operator's and distribution network's needs.

The ENA and the FlexForum have both identified this exchange of data between the System Operator and distributors as an area for further investigation and may be interested to work with the Authority to explore this topic.

## Issue 7: Some Code terms missing or not fit for purpose

***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.*

We agree with the description of the issue and agree with the proposal to review and revise definitions in the Code as a high priority.

***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*
*b. How the code enables different technologies*

Our forecasts show that peak demand growth by 2052 will be predominantly driven by the electrification of transport and the substitution of gas water heating to electricity. The energy storage properties of batteries and hot-water cylinders in these loads make them suitable for demand-side response and allows for the load to be shifted away from peak times through orchestration. There is therefore a significant opportunity to reduce actual peak demand growth through effective orchestration of DERs.

Up until now, distributors have been able to rely on a degree of diversity in consumer behaviour in their network planning, sizing, and operation. The concept of large quantities of DERs on our low-voltage networks responding, en masse, to external signals like spot prices

or system frequency, is a significant sea change with a direct impact on the level of diversity of consumer behaviour.

As DER scale grows, actions by aggregators may start to breach thermal limits as well as power quality, potentially putting reliability, network assets and public safety at risk. As is the case today, our primary responsibility to our consumers will be to keep the network safe, stable, and reliable and we support the following changes to support this:

- the expansion of the allowable operating voltage from ±6% of nominal to ±10% of nominal, which allows distribution networks to support higher uptakes of inverter-based resources with existing infrastructure
- the Minimum Energy Performance Standards (administered by EECA) ensuring that all EV chargers sold or installed in NZ have smart capability and are set to off-peak charging by default[4]
- enabling mechanisms that distributors can use to manage the impacts of synchronized behaviour from DERs, such as mandatory compliance with dynamic operating envelopes[5] for DERs

## Concluding comments

We are happy to discuss with the Authority any aspects of this submission. Please contact Matt Smith (Policy Advisor, Strategic Planning) at Matt.Smith@vector.co.nz in the first instance.

No part of this submission is confidential, and we are happy for this submission to be published in its entirety.

Yours sincerely

**Dr James Tipping**
GM Market Strategy / Regulation

[4] Our full set of recommendations on smart electric vehicle chargers are included in our response to EECA's Green Paper: Improving the performance of electric vehicle chargers: https://blob-static.vector.co.nz/blob/vector/media/vector-2022/vector_eeca_ev_smart_charging_submission_1.pdf

[5] See footnote 1 and our responses to Q2 and Q6