

# Improving network capacity to host distributed energy resources

---

Decision

27 July 2021



## Executive summary

The capacity of a network to import electricity from consumer distributed energy resources (DER), including distributed generation such as rooftop solar PV and batteries, is referred to as the network's 'hosting capacity'.

Part 6 of the Electricity Industry Participation Code 2010 (the Code) provides for connection of distributed generation to a local network. From 15 October to 3 December 2019, we consulted on a proposal to amend Part 6 to better align it with the Authority's statutory objective by enhancing a distributor's network hosting capacity while maintaining reliable supply to all consumers.

Having considered the feedback received from 10 submitters, we decided to undertake further consultation on additional provisions that would have the effect of placing a 5-year end date on some aspects of the proposed amendment.

The purpose of including an end date was to incentivise local distributors and other industry parties (e.g. those that design and install small-scale distributed generation systems for investors) to develop innovative new approaches to managing network congestion and enhancing hosting capacity. Such approaches should, along with appropriate future Code amendments, further improve upon the current provisions in Part 6 that support efficient and reliable supply for the long term benefit of consumers. We published a short supplementary consultation paper on these proposed additional measures on 18 August 2020.

We have decided to proceed with the Code amendment, with only minor drafting changes from those we consulted on. The approved Code amendment is set out in Appendix A of this paper.

The amendments are designed to better address a range of network congestion issues associated with more distributed generation connecting to distribution networks, particularly to low voltage distribution networks, as evidenced in many international jurisdictions. In most cases, New Zealand does not yet suffer these issues. However, the Authority and industry here have been monitoring international experiences with new consumer technologies. The Authority considers it is prudent take a small number of "no regrets" steps to cost-effectively enhance the hosting capacity of existing networks. These steps require amending Part 6 of the Code to change the eligibility criteria for one of the distributed generation connection application processes contained in that Part.

This Code amendment should be seen within the broader context of the Authority's more widely-encompassing work on "Updating the Regulatory Settings for Distribution Networks". In fact, a number of suggestions put forward in submissions, that are beyond the narrow scope of this review, have been referred to that project workstream.

This paper sets out the issues considered, the proposed solutions, submitted views and the Authority's decision.

# Contents

Executive summary	ii
1 We have decided to amend the Code Consumers will benefit from technology advances	4 4
2 The initial amendment relates to the eligibility criteria for the Part 1A connection process in Part 6	5
3 The supplementary amendment includes an end date	6
4 The amendment promotes our statutory objective	7
The amendment promotes the three limbs of the Authority's statutory objective	7
The benefits of the proposal are greater than the costs	7
The benefits of enhanced hosting capacity are significant	7
The costs of requiring compliance with the inverter standard are minimal	8
The amendment is consistent with regulatory requirements	9
5 The Authority considered the following matters in making this decision	9
The initial October 2019 consultation	9
Issue 1: clause 1D(a) of Schedule 6.1 references a superseded standard, raising uncertainty about which version should apply	10
Issue 2: distributors and consumers are missing a low cost, high return opportunity to maximise and future proof low voltage network hosting capacity	10
Issue 3: the Part 1A process could better address connection applications to parts of the network subject to export congestion	11
Other matters considered	13
The supplementary August 2020 consultation	14
Question 1: Do you agree with the proposal to add an end date to the Code amendment previously consulted upon by the Authority, as described in this section? If not, why not?	14
Question 2: Do you agree the additional proposed amendment is preferable to the other option? If you disagree, please explain your preferred option in terms consistent with the Authority's statutory objective in section 15 of the Electricity Industry Act 2010.	16
Question 3: Are there any other options that you consider are preferable to the options discussed? If so, please provide details.	17
Question 4: Do you agree the Authority's proposed amendment complies with section 32(1) of the Act? If you don't agree, please explain your reasons.	18
Question 5: Do you agree with the drafting of the proposed amendment? If not, why not?	18
Appendix A Approved Code amendment	19

## Tables

Table 1: List of submitters on the initial October 2019 consultation paper	9
Table 2: List of submitters on the supplementary August 2020 consultation paper	14

# 1 We have decided to amend the Code

## **Consumers will benefit from technology advances**

- 1.1 The Electricity Authority (Authority) has decided to amend Part 6 of the Electricity Industry Participation Code 2010 (Code). The amendment will:
- (a) replace the reference to a superseded standard in clause 1D(a) with the current standard
  - (b) add new eligibility criteria to the existing criteria for the Part 1A distributed generation connection application process. The new criteria:
    - (i) make mandatory two advanced power quality modes that are included in the inverter standard AS/NZS 4777.2:2015 as optional modes only. The two modes are the volt-watt response mode and the volt-var response mode.
    - (ii) introduce a maximum export power limit for consumer installations to which new or upgraded distributed generation is to be connected - applications must comply with the limit specified by the distributor
  - (c) include a 5-year end date for the amendments outlined in (b) that will provide incentives for distributors to further innovate in developing solutions to congestion on lower voltage networks.
- 1.2 We have completed two rounds of consultation on this topic, consulting on:
- (a) the amendments outlined in paragraph 1.1(a) and (b) above in our 15 October 2019 consultation paper (the initial consultation)
  - (b) the amendments outlined in paragraph 1.1(c) above in our 18 August 2020 consultation paper (the supplementary consultation).<sup>1</sup>
- 1.3 We decided to undertake the supplementary consultation following our consideration of submissions on the initial consultation.
- 1.4 Consumers will benefit from the amendments outlined in paragraph 1.1 above because the local networks from which most consumers receive their electricity supply will experience improved power quality and, for consumers that invest in technologies such as solar PV and batteries, an increased ability of the local network to accept (host) electricity that:
- (a) exceeds a consumer's immediate consumption needs
  - (b) a consumer is unable to, or chooses not to, store onsite, for example in a battery energy storage system (battery ESS).
- 1.5 A network's 'hosting capacity' is the amount of new generation or consumption that can be connected to a network without diminishing the reliability or voltage quality experienced by other consumers. The capacity of networks to host more of the electricity exported from consumer distributed generation ultimately increases competition in the energy market while maintaining supply reliability for all consumers – including the supply quality and reliability enjoyed by a distributed generator's neighbours.

---

<sup>1</sup> Both consultation papers are available at: <https://www.ea.govt.nz/development/work-programme/evolving-tech-business/open-networks/consultations/#c18633>

- 1.6 This paper sets out the matters relevant to our decision. For clarity, the paper refers to:
- (a) an *initial amendment*, which we consulted on in the 15 October 2019 consultation paper
  - (b) a *supplementary amendment*, which we consulted on in our 18 August 2020 consultation paper.

## 2 The initial amendment relates to the eligibility criteria for the Part 1A connection process in Part 6

- 2.1 On 15 October 2019, we published a consultation paper titled *Integrating hosting capacity into small-scale distributed generation connections*.<sup>2</sup>
- 2.2 We consulted on a proposal to amend the Code to better align Part 6 with the Authority's statutory objective by enhancing the hosting capacity of distributors' networks while maintaining reliable supply to all consumers.
- 2.3 The consultation paper considered three issues related to the eligibility criteria for the Part 1A distributed generation connection application process,<sup>3</sup> set out in clause 1D of Schedule 6.1:
- (a) Issue 1: clause 1D(a) of Schedule 6.1 currently references a superseded standard, leading to uncertainty about which version of the standard should apply. This is a relatively minor issue brought about by the release of a revised and updated standard covering inverter-connected energy system installation requirements.
  - (b) Issue 2: distributors and consumers are missing a low cost, high return opportunity to maximise and future proof network hosting capacity.
  - (c) Issue 3: the Part 1A process could better address connection applications to parts of the network subject to export congestion.
- 2.4 The proposed Code amendment would address these issues as follows.
- 2.5 First, the proposed amendment replaces the reference to AS 4777.1 in clause 1D(a) with the current standard AS/NZS 4777.1:2016.<sup>4</sup>
- 2.6 Second, the proposed amendment adds new eligibility criteria to the existing criteria for the Part 1A process. The new criteria:
- (a) make mandatory two advanced power quality modes that are included in the inverter standard AS/NZS 4777.2:2015 as *optional* modes only. The two modes

---

<sup>2</sup> See: <https://www.ea.govt.nz/dmsdocument/25855-consultation-paper-integration-of-hosting-capacity-into-part-6-october-2019>

<sup>3</sup> Part 6 provides two alternative connection application processes for connecting distributed generation of up to 10 kW capacity, referred to as (a) Part 1 and (b) Part 1A. The Part 1 process provides for a more comprehensive application review by the distributor, which can consume significant time and technical resources. The Part 1A process was introduced to provide a more streamlined connection application process if the distributed generation included a suitably capable, standards-compliant inverter. Part 1A generally provides a faster turnaround of a connection application and requires less technical resources.

<sup>4</sup> The AS/NZS 4777 standards suite provides requirements for inverter-connected energy systems. AS/NZS 4777.1 covers system installation requirements and AS/NZS 4777.2 covers inverter requirements. At the time we consulted on the Code amendments covered in this decision paper, the current versions of the two standards were AS/NZS 4777.1:2016 (*Part 1: Installation requirements*) and AS/NZS 4777.2:2015 (*Part 2: Inverter requirements*) respectively. In 2020, AS/NZS 4777.2:2015 was under active review and we pick this factor up later in this paper.

are the *volt-watt* response mode and the *volt-var* response mode, collectively referred to as *volt response modes*.

With appropriate settings applied to the inverter, use of the volt response modes can provide enhanced network voltage regulation in the vicinity of the distributed generation connection. Providing local automatic voltage regulation serves to increase the power export capacity of local distributed generation connections and, within limits, can avoid excessively high local voltages that exceed statutory limits.

- (b) introduce a maximum *export power threshold* for consumer installations to which new or upgraded distributed generation is to be connected; applications must comply with the limit specified by the distributor in its connection and operations standards, if any.
- 2.7 Distributed generation connection applications that do not meet the expanded eligibility criteria for the Part 1A process remain able to use the alternative Part 1 process.
- 2.8 The proposed amendment thereby incentivises the use of standards-compliant inverters, including the optional modes described, because the Part 1A process provides connection applicants with a simpler process that has shorter timeframes, and has a lower application cost and greater certainty.

### 3 The supplementary amendment includes an end date

- 3.1 On 18 August 2020, we published a consultation paper titled *Integrating hosting capacity into Part 6 of the Code, sunset clause*.<sup>5</sup> This supplementary consultation paper was relatively brief and proposed a single additional provision to the Code amendment proposed in the initial October 2019 consultation paper.
- 3.2 Having considered submissions on the initial consultation paper, the Authority concluded that while the proposed Code amendment would deliver long-term benefits to consumers, it could be further improved.
- 3.3 Specifically, the supplementary consultation paper proposed adding a 5-year end date (i.e. a 'sunset clause' or 'expiry date') to the proposed new eligibility criteria for the Part 1A process as outlined in paragraph 2.6 above:
- (a) a requirement for mandatory inclusion of two advanced power quality modes that are included in the inverter standard AS/NZS 4777.2:2015 as optional modes only – the two modes are the volt-watt response mode and the volt-var response mode
  - (b) a maximum export power limit for electrical installations to which new or upgraded distributed generation is to be connected – applications must comply with the limit specified by the distributor, if the distributor chooses to include such a limit.
- 3.4 The purpose of including an end date on these two eligibility criteria is to incentivise distributors and other industry parties to develop innovative new approaches to managing network congestion and enhancing hosting capacity. The other industry parties here would include businesses that design and install distributed generation systems for investors.
- 3.5 We considered that new approaches should, with appropriate future Code amendments, further improve upon the current provisions in Part 6 that support efficient and reliable supply for the long term benefit of consumers. The addition of an end date would

---

<sup>5</sup> See: <https://www.ea.govt.nz/assets/dms-assets/27/27217Consultation-paper-Integration-of-hosting-capacity-into-Part-6-of-the-Code-sunset-clause.pdf>

balance the risk that prescriptive, static regulation would fall behind in times of rapid technological development. This is the environment we are currently experiencing under climate change induced decarbonisation of economies.

## **4 The amendment promotes our statutory objective**

4.1 The Authority's statutory objective is to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers.

### **The amendment promotes the three limbs of the Authority's statutory objective**

4.2 Having considered the submissions received on the Code amendment proposal, including consideration of both the initial and the supplementary consultation papers, the Authority considers the final Code amendment will deliver long-term benefits to consumers, as set out below.

4.3 Firstly, the amendment will promote competition by providing more consumers with access to electricity supply alternatives, such as distributed generation – and possibly incorporating battery energy storage systems – placing downward pressure on delivered energy prices.

4.4 Secondly, the amendment will promote reliable supply to consumers by:

- (a) unlocking latent hosting capacity in the networks to which consumers connect
- (b) incentivising distributors and other stakeholders to develop innovative new solutions that enhance diminishing hosting capacity.

4.5 Thirdly, the amendment will promote the efficient operation of the electricity industry by:

- (a) increasing the utilisation of existing network assets
- (b) incentivising more standardisation of the network interface equipment used in distributed generation installations
- (c) incentivising innovative development of new technologies that can enhance network hosting capacity.

### **The benefits of the proposal are greater than the costs**

4.6 The Authority has assessed the economic benefits and costs of the amendment, and expects it to deliver a net economic benefit.

4.7 The initial consultation paper provided a simplified evaluation of benefits and costs on the basis that the potentially large benefit stream is significantly greater than the very low level of costs that might result from adopting the proposal. The supplementary consultation paper considered that the net benefits would be further enhanced by including an end date provision.

### **The benefits of enhanced hosting capacity are significant**

4.8 In summary, consumer benefits will accrue from strengthened incentives to use the streamlined Part 1A connection application process, which in turn provides clarity around the use of inverters in new distributed generation systems that:

- (a) comply with the relevant inverter standard

- (b) are capable of implementing two volt response modes, deployment of which will be specified in each distributor's connection and operation standards to address local network needs.
- 4.9 The use of such inverters can increase network hosting capacity, which allows more renewable distributed generation to connect to a local network before potentially costly network upgrades are required.
- 4.10 Given the level of investment in network equipment by distributors, network upgrade deferral, even if for just one year, could be expected to deliver benefits in the order of millions of dollars annually across the low voltage networks that connect to approximately 2.21 million active installation control points (ICPs) nationwide.
- 4.11 The amendment also provides clarity that distributors may set maximum power export limits for congested (or soon to be congested) parts of their networks. This has the effect of more equitably allocating increasingly scarce hosting capacity amongst competing users in the absence of market mechanisms that might otherwise address congestion on local networks.
- 4.12 Reflecting that the electricity industry is in a period of significant technological change, the Authority considers the supplementary amendment to include an end date would balance the risk that prescriptive, static regulation will fall behind consumer needs. The 5-year end date is set far enough out to provide connection process certainty in the near term but close enough to incentivise businesses to develop new approaches that will benefit consumers in the longer-term. This will include development of new technologies, new standards, new best practices and new regulatory approaches requiring future amendments to the Code.
- The costs of requiring compliance with the inverter standard are minimal**
- 4.13 Relative to the expected order of magnitude of the benefits, the Authority considers the costs of the proposal will be minimal. Inverters deployed in New Zealand broadly conform with the relevant standard adopted for New Zealand and Australia, which is AS/NZS 4777.2.
- 4.14 Some applications that would have been eligible for the Part 1A process would no longer be eligible for consideration under that process. However, such applications are not automatically precluded from connection because they can still be assessed and approved under the alternative Part 1 process. The Part 1 process provides longer timeframes to consider a connection proposal, which in turn enables the distributor to carry out a more detailed assessment of the proposed distributed generation connection in the context of the available hosting capacity of the relevant part of the network. Reflecting this, applications made under the Part 1 process can, at the distributor's discretion, require a higher application fee (up to \$200 versus up to \$100 for an application made under Part 1A).
- 4.15 The Authority is confident that significant net benefits will accrue to consumers from the proposed Code amendment. At the very least, the proposal represents a no-regrets approach.
- 4.16 Section 3 of the initial consultation paper describes the costs and benefits of the proposal in more detail.



## **The amendment is consistent with regulatory requirements**

- 4.17 The Code amendment is consistent with the requirements of section 32(1) of the Electricity Industry Act 2010.
- 4.18 The amendment is also consistent with the Authority's Code amendment principles: it is lawful and it will improve the efficiency of the electricity industry for the long-term benefit of consumers.
- 4.19 The Authority has clearly identified an efficiency gain from cost-effectively enhancing network hosting capacity and improving regulatory certainty and has used a qualitative cost benefit analysis to assess long-term net benefits for consumers.

## **5 The Authority considered the following matters in making this decision**

### **The initial October 2019 consultation**

- 5.1 We received submissions on our initial October 2019 consultation paper from the 10 parties listed in Table 1. The submissions are available on our website at: <https://www.ea.govt.nz/development/work-programme/evolving-tech-business/open-networks/consultations/#c18236>

**Table 1: List of submitters on the initial October 2019 consultation paper**

<b>Submitter</b>	<b>Category</b>
The Electricity Engineers' Association (EEA)	Industry association
Powerco Vector Orion Wellington Electricity Unison	Distributors
Nova Energy	Retailer
Pioneer Generation	Generator
Ecotricity Solarcity	Distributed generation designers/installers

- 5.2 At a high level, support for the Authority's assessment of the issues, and proposed solutions, fell broadly along participant category lines:
- the EEA, distributors and Nova Energy expressed general support for the proposal and made some relatively minor improvement suggestions
  - Pioneer Energy agreed with the proposals to remedy issues 1 (updated standard reference) and 2 (require the volt response modes) but, along with Ecotricity and Solarcity, disagreed with the proposal to remedy issue 3 (clarify that the distributor may impose a maximum export power limit in congested parts of the network).

- 5.3 The following summary of the key concerns<sup>6</sup> raised in submissions, and the Authority's decisions having considered each submission, follows the order of presentation of the three issues discussed in the consultation paper.

**Issue 1: clause 1D(a) of Schedule 6.1 references a superseded standard, raising uncertainty about which version should apply**

**What we proposed**

- 5.4 The proposed Code amendment would replace the reference to AS 4777.1 in clause 1D(a) of Schedule 6.1 with the current standard AS/NZS 4777.1:2016.

**Submitters' views**

- 5.5 Submitters expressed unanimous support for the description of the issue and the proposed solution.
- 5.6 However, as a related matter, EEA considered that updating the inverter installation standard referenced in the Code would raise a conflict with the Electricity (Safety) Regulations 2010 (the ESRs), administered by MBIE. This is because the ESRs have not yet been updated to require the use of the latest standard for use in the safety regulations.

**Our decision**

- 5.7 The technical issue raised by EEA will be resolved when MBIE updates the ESRs to reference the latest relevant standard. We understand that MBIE is working on such an update.
- 5.8 We have decided to amend the Code as described in the consultation paper and liaise further with MBIE regarding the timing of the amendments.
- 5.9 The approved Code amendment is set out in Appendix A.

**Issue 2: distributors and consumers are missing a low cost, high return opportunity to maximise and future proof low voltage network hosting capacity**

**What we proposed**

- 5.10 The proposed amendment would add new eligibility criteria to the existing criteria for access to the Part 1A process by prospective distributed generators.
- 5.11 The new criteria would make mandatory two advanced power quality modes that are included in the inverter standard AS/NZS 4777.2:2015 as *optional* modes only. The two modes are the *volt-watt* response mode and the *volt-var* response mode, collectively referred to as *volt response modes*.
- 5.12 With appropriate settings applied to the inverter, use of the volt response modes can provide enhanced network voltage regulation in the vicinity of the distributed generation connection. Providing local automatic voltage regulation serves to increase the power export capacity of local distributed generation connections, avoiding excessively high local voltages, while deferring substantive investment in the network.

---

<sup>6</sup> We use the phrase "submission concerns" in this section (in place of the more usual "submission issues") to avoid confusion with the three "issues" the Code amendment seeks to remedy.

- 5.13 Distributed generation connection applications that do not meet the expanded eligibility criteria for the Part 1A process remain able to use the Part 1 process.

#### **Submitters' views**

- 5.14 Submitters expressed unanimous support for the description of the issue and the proposed solution.
- 5.15 EEA argued for the inclusion of additional rights for distributors to include further eligibility criteria for the Part 1A process. These additional criteria would include "... *any of the other inverter operational modes described in AS/NZS 4777.2 that they may wish to use.*"

#### **Our decision**

- 5.16 We note the support for the proposal expressed in the consultation paper. However, we do not support EEA's call for additional rights for distributors to specify other operational modes as eligibility criteria for the Part 1A process.
- 5.17 We think EEA may have misinterpreted our intention regarding the eligibility criteria for the Part 1A process. To be eligible under Part 1A, an inverter must have all of the *mandatory* modes and capabilities specified in AS/NZS 4777.2:2015 *plus* volt-watt mode *and* volt-var mode. These are the *hardware* capabilities that EEA originally sought in its 2016 Code amendment request.
- 5.18 Beyond the hardware capabilities, a distributor already has the right to specify – in its connection and operation standards – the *settings* that authorised inverter installers must apply in the inverter *firmware*. An inverter included in a connection application must be set up, before commissioning, to meet the distributor's operational settings, including settings that variously enable or disable the mandatory modes and capabilities included in the inverter (including settings for the two volt response modes). That said, we expect that distributor connection and operation standards will specify the default country settings, unless there is good reason to do otherwise.
- 5.19 Reflecting that standardised settings can efficiently avoid unnecessary cost and complexity in setting up new inverters for customers, we also support the development by industry of a practice note or a guideline covering inverter settings, hosting capacity methodologies and congestion management approaches.
- 5.20 Building on this theme, we further consider that fixed regulation runs the risk of inefficiently locking in outdated engineering standards and practices. This is particularly relevant to the rapidly changing technological environment surrounding electricity networks.
- 5.21 Taking the above matters relevant to our decision into account, we have decided to amend the Code as described in the initial consultation paper but to further consider and consult on the inclusion of an end date before finalising the Code amendment. We picked this theme up in section 3 above.

### **Issue 3: the Part 1A process could better address connection applications to parts of the network subject to export congestion**

#### **What we proposed**

- 5.22 The proposed amendment would add new eligibility criteria to the existing criteria for the Part 1A process. The new criteria would introduce a maximum *export power limit* for

consumer installations to which new or upgraded distributed generation is to be connected; applications must comply with the limit specified by the distributor, if any.

### **Submitters' views**

5.23 EEA and distributors supported this part of the proposal but Pioneer Energy, Ecotricity and Solarcity disagreed.

5.24 Solarcity provided details underpinning its view, which were essentially the same as the views expressed by Pioneer Energy and Ecotricity:

*We have concerns about lines companies arbitrarily setting limits on the amount of distributed energy that can be connected to the power system. In particular, we are concerned about the following proposed part of the code: "(c) has an export power limit at the ICP of the distributed generator that meets the maximum export power, if any, specified by the distributor in its connection and operation standards."*

*We would like to see:*

- *Robust and transparent methodologies for calculating the amount of distributed generation that can be connected.*
- *A mechanism for challenging decisions made by lines companies on distributed generation limits.*

*Our views are based on the variable approach to distributed generation connections across lines companies that we have experienced over recent years. We are aware of two lines companies that have recently set solar export limits that from our perspective have no transparency or justification.*

### **Our decision**

5.25 We note the support by EEA and distributors for the proposal expressed in the consultation paper.

5.26 With respect to the views expressed by Solarcity, Pioneer Energy and Ecotricity, we make the following comments.

5.27 Amongst their other responsibilities and regulations related to provision of line function services, distributors are responsible under the ESRs to maintain voltage and frequency of supply on low voltage networks and for the safety of network equipment.<sup>7</sup>

5.28 Accordingly, distributors have always been able to specify import and export limits for connected parties, including distributed generators. The purpose of the Code amendment (drafted in the consultation paper as clause 1D(c) of Schedule 6.1) was to clarify that adherence to a maximum export limit in a part of the network that could, as a future point in time, become congested, is a pre-requisite for approval of a connection application under the Part 1A process.

5.29 Distributed generation connection applications that do not meet the expanded eligibility criteria for the Part 1A process remain able to use the Part 1 process. Part 1 provides longer timeframes to fully assess the impact of proposed distributed generation, which may or may not require adherence to a maximum export power limit. It is important that applicants and installers understand that the maximum export power threshold is a

---

<sup>7</sup> Electricity (Safety) Regulations 2010, Part 3 – Systems of supply (particularly sections 28 (voltage supply to installations) and 29 (frequency of electricity supplied)) and Part 4 – Safety of works.

threshold above which manual assessment is required, and is not a limit on how much power can be exported.

- 5.30 We expect that the development of rapidly advancing new technologies, practices, network pricing incentives, and competitive services should overtake the need for this Code amendment. We encourage distributors to look at innovative new approaches as an alternative to Code requirements so that the adoption of renewable DER is not unnecessarily hindered.
- 5.31 Taking the above matters relevant to our decision into account, we have decided to amend the Code as described in the initial consultation paper but, in line with our decision on issue 2 above, to further consider and consult on the inclusion of an end date before finalising the Code amendment. We picked this theme up in section 3 above.
- 5.32 Note that the approved Code amendment contains minor drafting improvements suggested by some submitters.

### **Other matters considered**

- 5.33 A number of submissions on the initial consultation paper raised matters that, while not directly related to the three issues the initial Code amendment sought to address, would reasonably require further consideration by the Authority.
- 5.34 Further details are available in the published submissions but the following provides a flavour of the additional matters raised:
- (a) The Authority should also consider how to support the integration of all distributed energy resource devices (instead of distributed generation only), by enabling distributors to improve network visibility and data collection (both static and real-time) for network congestion modelling, and establishing standards for demand response requirements.
  - (b) Small-scale distributed generation is likely to increase short-term power fluctuations as intermittent generation replaces dispatched generation.
  - (c) Hosting capacity estimates will be inaccurate for networks with low quality and quantity of low voltage load data. This will become a material problem as penetration levels increase.
  - (d) Underground sections of networks may experience congestion issues because the volt-var mode has a limited ability to constrain voltage in an underground network.
  - (e) Consumers using batteries to draw down power may introduce significant additional net load (similar to an electric vehicle charger). This will have flow-on effects to transmission and distribution pricing, and the value of controlling that load.
  - (f) Common approaches to listing pre-approved inverter models on distributor websites. There may be efficiencies if distributors collaborate on this, possibly by compiling a New Zealand master list, as we understand is done in Australia.
  - (g) Issues on the distribution network impact the transmission grid. However, Transpower's analysis identified distribution networks could host 9-10GW of solar PV (balanced with battery technology) by 2050. Transpower's analysis supports the Authority's focus on having well-designed inverters installed. Further, when you consider rapidly increasing uptake of electric vehicles with batteries of 50 kWh or more, the ability to store solar energy is exponentially increasing.

- (h) A submitter encouraged the Authority to collaborate with the Electricity Networks Association on the ENA's work to progress its Network Transformation Roadmap (NTR). The ENA's NTR Working Group 3 is developing options/recommendations for appropriate arrangements for new distributed energy resource connections to low voltage networks, including distributed energy resource connection standards.
- 5.35 We acknowledge that there is a range of corollary matters associated with the expected uptake of new technologies by consumers. Most of these matters will require continuous monitoring, consideration and development of solutions.
- 5.36 The Authority's Open Networks project actively considers these and other relevant matters within that workstream.

**The supplementary August 2020 consultation**

- 5.37 We received submissions on our supplementary August 2020 consultation paper from the 5 parties listed in Table 1. The submissions are available on our website at: <https://www.ea.govt.nz/development/work-programme/evolving-tech-business/open-networks/consultations/#c18236>

**Table 2: List of submitters on the supplementary August 2020 consultation paper**

Submitter	Category
The Electricity Engineers' Association (EEA)	Industry association
Orion Unison Vector Wellington Electricity (WELL)	Distributors

- 5.38 At a high level, support for the Authority's proposal to add an end date to the proposed Code amendment included in the initial consultation paper was divided:
- (a) EEA, Unison and Vector did not support the proposal to include an end date
- (b) Orion and WELL supported the proposal.
- 5.39 The following summary of the key themes raised in submissions, and the Authority's decisions having considered each submission, follow the order of the 5 questions asked in the consultation paper.

**Question 1: Do you agree with the proposal to add an end date to the Code amendment previously consulted upon by the Authority, as described in this section? If not, why not?**

**What we proposed**

- 5.40 The proposed Code amendment would add a 5-year end date (sunset clause) into the Part 1A application process specified in Part 6 of the Code, affecting inverter volt-watt and volt-var response modes and the provision of maximum export power limits.

### **Submitters' views**

- 5.41 *EEA* did not support addition of an end date and would prefer inclusion of a date by which a review of Part 6 must be completed. *EEA* considered the proposal would create a standards void, leave customers, suppliers and organisations in limbo, and create risks to network stability and market competition by remaining silent on the minimum standards required after the end date.
- 5.42 *Vector* did not agree with the proposal. *Vector* considered the proposal would create significant uncertainty around the use of advanced voltage response features that support a distributor's efficient operations and infrastructure planning processes. If a viable alternative was to become available, *Vector* considered such an option would likely require other technological or regulatory developments before it could deliver the same hosting capacity improvements and compete as a low-cost alternative to the built-in volt response modes provided in inverters today.
- 5.43 *Unison* responded to the consultation paper in a covering letter. *Unison* stated that it supported the *EEA* submission. While it agreed it is important for regulations to not lock in engineering solutions that may be superseded, *Unison* considered that a sunset clause would not incentivise distributors to adopt further changes, new technologies or develop competitive solutions. *Unison* expressed support for standards to ensure consistency, stability and lower transaction costs and considered that New Zealand is a technology-taker, and is likely to follow technology shifts and solutions rather than developing small-scale local solutions. *Unison* expressed support for mandating a future review of the required standards.
- 5.44 *Orion* and *WELL* expressed support for the proposal. *WELL* agreed with the Authority's view that technology is changing quickly and that standards relating to new technology needs to be reviewed to ensure they remain fit for purpose. *WELL* encouraged the Authority to continue to strike the balance between legislation (Codes) that set terms that are difficult to change, and expected outcome standards that allow flexibility with the pace of technological development through evolving standards, which target compliance with the output standard of the legislation. *WELL* considers this would alleviate redrafting of "hard-coded" legislation settings and defer this detail to standards that evolve with technology but still meet minimum Code targets.

### **Our views**

- 5.45 The submitted views express preferences that favour either:
- (a) the certainty of known standards for connection and operation of distributed generation, including:
    - (i) the joint AS/NZS inverter performance standard relevant to New Zealand
    - (ii) specifications of maximum export power; or
  - (b) the need to provide incentives to continuously innovate to provide new approaches and solutions.
- 5.46 Submissions raise good points both in support of the proposal and against it.
- 5.47 Having considered the views expressed both for and against inclusion of an end date, we remain of the view that an end date will balance the risk that prescriptive, static regulation will fall behind in the current environment. That environment foreshadows rapid technological developments that will impact all parts of the interconnected electricity network, particularly at the distribution and low voltage network levels.

**Question 2: Do you agree the additional proposed amendment is preferable to the other option? If you disagree, please explain your preferred option in terms consistent with the Authority’s statutory objective in section 15 of the Electricity Industry Act 2010.**

**What we proposed**

- 5.48 The alternative option considered in the consultation paper was an obligation for the Authority to undertake an operational review of Part 6 within a set period of time, say 5 years. The supplementary consultation paper noted the rapid development of new technology and standards and considered it likely that the requirements would need to be reviewed within that time in any case.

**Submitters’ views**

- 5.49 EEA noted that AS/NZS 4777.2:2015 was (at the time it made its submission) already under review. EEA submitted that including an end date for control settings would go against the Authority’s reliable supply objective because control settings are required to maintain reliable supply to all consumers and for consumer equipment to remain connected.
- 5.50 Vector favoured the alternative option, which it considered provides a more responsible approach. Vector provided a range of views in support of not sunseting AS/NZS 4777.2.
- 5.51 In contrast to the above views, Orion and WELL agreed with the proposal. WELL considered that an end date is preferable to a review date as an end date provides a stronger mechanism to ensuring the standards are re-examined to ensure they are fit for purpose.

**Our views**

- 5.52 We note EEA’s point regarding review of the then current AS/NZS 4777.2:2015 and that the standard has since been updated to AS/NZS 4777.2:2020, providing for (amongst other things) mandatory inclusion of the volt response modes and providing settings for many inverter functions directly relevant to New Zealand network conditions.
- 5.53 Regarding both EEA’s and Vector’s reasons for not supporting setting an end date, we consider the views may have missed the point. All applications for connection of distributed generation must be consistent with the local distributor’s connection and operation standards. Part 6 regulates distributor connection and operation standards only to the extent set out in the defined term “connection and operation standards” included in Part 1.
- 5.54 The main points are that, in simple terms, connection and operation standards must:
- (a) be set out in written policies and standards
  - (b) relate to distributed generation that is or is to be connected to the distributor’s network
  - (c) be published on the distributor’s website
  - (d) reflect, or be consistent with, reasonable and prudent operating practice.
- 5.55 Connection and operation standards are not fixed and the distributor may amend them from time to time; in fact, distributor’s *should* amend their connection and operation standards to reflect, or be consistent with, reasonable and prudent operating practice as such practice evolves over time.



- 5.56 The Code amendment proposed in the initial consultation paper was intended to clarify that a distributor *may* include its policies for specifying available maximum export power. The supplementary consultation paper proposed limiting that ability to a finite period of time, nominally a future date that is 5 years from the date on which the Code amendment comes into force. Limiting the time period for this aspect of the Code amendment will incentivise distributors to develop new approaches to managing network hosting capacity.
- 5.57 On balance, we agree with WELL that an end date provides a stronger mechanism to ensure that standards and approaches are re-examined to ensure they are fit for purpose. It also sharpens the incentive on distributors to lead technical innovation.<sup>8</sup>
- 5.58 A shortcoming of the alternative option is that if the review doesn't occur, the Code could lock in inefficient approaches. For example, enabling a distributor's connection and operation standards to retain a maximum export power threshold when superior options are available is unlikely to be in the long-term interests of consumers that invest in DER.

**Question 3: Are there any other options that you consider are preferable to the options discussed? If so, please provide details.**

**Submitters' views**

- 5.59 EEA stated that its preferred option would leave the amended clauses without an expiry date and provide reference to meeting the requirements of an industry Practice Note developed by the Electricity Authority or EEA or to the then proposed (now published) amended AS/NZS 4777.2.
- 5.60 Vector proposed that rather than setting a timeline for its removal, the Authority could put monitoring processes in place to assess market conditions around small scale distributed generation and the new mandatory volt-response modes. Vector further considered that the Part 1 process already provides a connection application process that can consider alternative approaches.
- 5.61 Orion suggested no other options.
- 5.62 WELL submitted that the Code provisions are aimed at individual installations, however some consideration may need to be applied to cumulative effects, where individually the problem is not seen, but collectively (networked), customers may experience a detrimental effect. This will be managed by distributors having the ability to dynamically alter their operational settings so all customers continue to receive a reliable high quality supply rather than through a static, "set and forget" approach.

**Our views**

- 5.63 We agree that EEA's suggestion of a Practice Note or other industry guideline is a valuable idea as a means of communicating industry best practice but consider the role of guidelines is that they are non-mandatory in terms of the Code.
- 5.64 Regarding Vector's suggested alternative, a shortcoming of monitoring only is that if the review doesn't occur, the Code could lock in inefficient approaches.

---

<sup>8</sup> Of course, some distributors will actively innovate – and have already innovated – without the impetus that additional incentives may provide. We note recent news regarding Orion installing low voltage network sensors and Westpower's development of low voltage network monitoring technology as examples of proactive innovation.

5.65 Regarding WELL's point, applying future-proofed settings to inverters is clearly a risk. As is presently the case, distributor's will need to be mindful of their responsibilities under the ESRs to ensure electricity is delivered within the statutory power quality limits. We consider active control of inverter settings directly would pose many challenges.

**Question 4: Do you agree the Authority's proposed amendment complies with section 32(1) of the Act? If you don't agree, please explain your reasons.**

**Submitters' views**

5.66 *EEA, Orion and WELL* agreed that the Authority's proposed amendment complies with section 32(1) of the Act.

5.67 *Vector* referred to its response to Question 2.

**Our view**

5.68 Having considered submitted views, we remain of the view that the proposed Code amendment proposed amendment complies with section 32(1) of the Act.

**Question 5: Do you agree with the drafting of the proposed amendment? If not, why not?**

**What we proposed**

5.69 The proposed a Code amendment that would add a 5-year end date (sunset clause) into Part 6 affecting inverter volt-watt and volt-var response modes and the provision of maximum export power limits.

**Submitters' views**

5.70 *EEA* reiterated that it did not support the Authority's proposal to include an end date and did not comment on the Code amendment drafting.

5.71 *Vector* reiterated that it did not support the Authority's proposal to include an end date but did suggest some drafting changes that would remove ambiguity.

5.72 *Orion and WELL* agreed with the drafting of the proposed Code amendment.

**Our views**

5.73 Regarding *Vector's* suggested drafting improvements, we consider they remove ambiguity and have incorporated them in the Code amendment.

**Our decision**

5.74 We have decided to amend the Code as described in the initial and supplementary consultation papers, including incorporating the drafting improvements as above.

5.75 The approved Code amendment is set out in Appendix A.

## Appendix A Approved Code amendment

A.1 The following explains the drafting conventions used in the approved Code amendment.

- (a) Black text is text proposed in the supplementary consultation paper and where the text is
  - (i) underlined is additional text to be added to the existing Code requirement, and was proposed in the consultation paper
  - (ii) strikethrough is existing text to be deleted from the existing Code requirement and was proposed in the consultation paper
  - (iii) neither underlined or strikethrough is text in the existing Code requirement that remains in force
- (b) Red text is text that has been amended since the initial consultation and has been amended after consideration of submissions
  - (i) underlined is additional text that has been added
  - (ii) strikethrough is text that has been deleted.
- (c) Blue text is text that has been amended since the supplementary consultation on the inclusion of an end date and has been amended after consideration of submissions
  - (i) underlined is additional text that has been added
  - (ii) strikethrough is text that has been deleted.

### 1.1 Interpretation

...

**connection and operation standards**, in relation to a **distributor** or **distributed generation**,—

- (a) means requirements, as amended from time to time by the **distributor**, that—
  - (i) are set out in written policies and standards of the **distributor**; and
  - (ii) relate to connecting **distributed generation** to a **distribution network** or to a **consumer installation** that is connected to a **distribution network**, and the operation of the **distribution network**, including requirements relating to the planning, design, construction, testing, inspection, and operation of **distributed generation** that is, or is proposed to be, connected; and
  - (iii) are made publicly available in accordance with clause 6.3; and
  - (iv) reflect, or are consistent with, **reasonable and prudent operating practice**; and
- (b) includes the following, as amended from time to time by the **distributor**:
  - (i) the **distributor's congestion management policy**, as referred to in clause 6.3(2)(d); and
  - (ii) the **distributor's** emergency response policies; and
  - (iii) the **distributor's** safety standards; and
- (c) until 1 September 2026, may include the **distributor's** policies for specifying available maximum export power amongst categories of network users, a

maximum export power threshold for applications under Part 1A of Schedule 6.1, and the methodology used to determine that threshold.

...

maximum export power means the maximum active power exported into the local network or embedded network at an ICP of a distributed generator, and is equal to—

- (a) the nameplate capacity of the distributed generation minus the minimum load at the point of connection; or
  - (b) the power export limit imposed by an active export control device.
- [This definition expires on 1 September 2026](#)

## Part 6 Connection of distributed generation

...

### 6.3 Distributors must make information publicly available

- (1) The purpose of this clause is to require each distributor to make certain information publicly available to enable the approval of distributed generation under Schedule 6.1.
- (2) Each distributor must make publicly available, free of charge, from its office and Internet site,—
  - (a) forms for applications under Schedule 6.1; and
  - (b) the distributor's connection and operation standards; and
  - (c) a copy of the regulated terms, together with an explanation of how the regulated terms will apply if—
    - (i) approval is granted under Schedule 6.1; and
    - (ii) the distributor and the distributed generator do not enter into a connection contract; and
  - (d) a statement of the circumstances in which distributed generation will be, or may be, curtailed or interrupted from time to time in order to ensure that the distributor's other connection and operation standards are met; and
  - (da) a list of all locations on its distribution network that the distributor—
    - (i) knows to be subject to export congestion; or
    - (ii) expects to become subject to export congestion within the next 12 months; and
  - (db) [until 1 September 2026](#), the maximum export power threshold and the methodology used to determine that threshold, for locations at which the distributor has set a maximum export power threshold for applications under Part 1A of Schedule 6.1; and
  - (e) a list of any fees that the distributor charges under Schedule 6.1, which must not exceed the relevant maximum fees prescribed in Schedule 6.5; and
  - (f) a list of the makes and models of inverters that the distributor has approved for connection to its distribution network; and
  - (g) the distributor's contact information for any enquiries relating to the connection of distributed generation to its distribution network.

...

## Schedule 6.1 Process for obtaining approval

...

### 1D When application may be made under Part 1A

- (1) A distributed generator may elect to apply to a distributor under Part 1A instead of Part 1 if the distributed generation to which the application relates—
  - (a) is designed and installed in accordance with AS/NZS 4777.1:2016; and
  - (b) incorporates an inverter that—

- (i) has been tested and issued a Declaration of Conformity with AS/NZS 4777.2:2015 by a laboratory with accreditation issued or recognised by International Accreditation New Zealand; and
  - (ii) has ~~protection settings, control settings, and volt response mode settings~~ that meet the **distributor's connection and operation standards; and**
- (2) Until 1 September 2026, in order to make an application under subclause (1), the distributed generation must also have:
- (a) a volt-watt response mode;
  - (b) a volt-var response mode; ~~and~~
  - (c) control settings and volt response mode settings that meet the distributor's connection and operation standards; and
  - (de) a maximum export power limit at the ICP of the distributed generator that does not exceed the maximum export power threshold, if any, specified by the distributor in its connection and operation standards.

...

### Part 1A

Applications for distributed generation of 10 kW or less in total in specified circumstances

...

#### 9B Application for distributed generation of 10 kW or less in total in specified circumstances

...

- (2) An application must include the following:
- (a) the name, contact, and address details of the **distributed generator** and, if applicable, the **distributed generator's agent**;
  - (b) a brief description of the physical location at the address at which the **distributed generation** is or will be connected;
  - (c) any application fee specified by the **distributor** in accordance with clause 6.3(2)(e);
  - (d) details of the make and model of the inverter;
  - (e) confirmation as to whether the inverter—
    - (i) is included on the **distributor's** list of approved inverters made publicly available under clause 6.3(2)(f); or
    - (ii) conforms with the ~~protection settings, control settings, and volt response mode settings~~ specified in the **distributor's connection and operation standards**;
  - ~~(ea) confirmation that the distributed generation has a maximum export power that the maximum export power threshold, if any, specified by the distributor in its connection and operation standards;~~
  - (f) if the inverter is not included on the **distributor's** list of approved inverters, a copy of the AS/NZS 4777.2:2015 Declaration of Conformity certificate for the inverter;
  - (g) details of—
    - (i) the **nameplate capacity** of the **distributed generation**; and
    - (ii) the fuel type of the **distributed generation** (for example, solar, wind, or liquid fuel); ~~and~~
    - ~~(iii) the maximum export power of the distributed generation.~~
- (2A) Until 1 September 2026, in order to make an application under subclause (2), an application must also include the following:

- (a) confirmation as to whether the inverter conforms with the control settings and volt response mode settings specified in the **distributor's connection and operation standards**;
- (b) ~~(a)~~ confirmation that the **distributed generation** has a **maximum export power limit** that ~~meets~~ does not exceed the **maximum export power** threshold, if any, specified by the **distributor** in its **connection and operation standards**; and
- (c) ~~(b)~~ the **maximum export power** of the **distributed generation**.

