Appendix A Format for submissions: Integrating hosting capacity into Part 6 on low voltage networks

Submitter	Electricity Engineers' Association (EEA)

A.1 Please use the following table to provide your feedback on the questions included in this paper.

Question	**Response**
Q1. Have we adequately outlined the issues with increasing levels of SSDG, particularly inverter-connected solar PV systems?	<u>Harmonics</u> In section 3.9 of the issues paper it states 'harmonic issues can arise from the electronic components incorporated into inverters that do not comply with Standards'. This is not entirely accurate. ALL power electronics will produce some harmonics, even those that comply with Standards. Standards often limit the acceptable level of harmonics, and generally it is impossible to remove them completely. As the penetration of power electronics in the network increases (not just inverters, but also other household appliances such as heat pumps, some modern washing machines etc) these harmonics can have a cumulative effect. Diversity may lessen the impact (i.e. different brands of inverters or heat pumps will have a different harmonic profile). While harmonics are not currently a significant concern around DG, it is conceivable that high penetrations of inverter connected DG could have implications on harmonics/ power quality even if the inverters used comply with standards. This may be an area for future industry research so the implications can be understood and managed.

	NZECP 36:1993 This electrical code of practice is out of date and not fit for purpose for managing harmonics in modern LV networks. EEA has asked Energysafe to remove NZECP 36 and has published an EEA Power Quality Guide (2013) to assist networks in managing power quality (including harmonics). It remains unclear if or when Worksafe / Energy Safety will remove/review ECP 36. Regulation 31 of the Electricity (Safety) Regulation relating to quality of supply allows compliance with standards instead of ECP 36, however the standards referenced are global IEC standards, rather than their AS/NZS equivalents which are written specifically for the NZ context. Voltage flicker Section 3.7 of the issues paper states 'Other voltage-related problems can occur, such as voltage flicker and short duration voltage spikes, but these are not specifically associated with high levels of SSDG'. These problems may occur with high levels of SSDG so should not be discounted as a possible issue.
Q2. What other factors are relevant to these technical network considerations?	None in relation to this code change.
Q3. Do you agree these options broadly represent the range of actions we could consider at this time? Are there other broad conceptual options we should consider that are not covered by these three approaches?	We do not have further approaches to suggest currently.
Q4. Do you think the Authority should pursue the types of measures that Option B would require? If not, please outline your alternative preferred approach, including if possible the costs and benefits. If you consider there is a valid Option C-style alternative,	EEA supports the EA looking at option B. Although current SSGD levels are low, option B appears to be a reasonable 'least regrets' approach. Ideally Volt-VAr and Volt-Watt capability should be enabled **before** we see an accelerated uptake of SSDG to enable better outcomes and future proof the system.

please provide details, including your view on how your alternative would meet the Authority's statutory objective.	
Q5. Do you have any comments on the draft EEA guide's stated objectives?	EEA wish to clarify some statements made in section 5 of the issues paper regarding the EEA guide: • The Heading "The EEA guide would require distributors to use more advanced inverter power quality modes" (5.10). This is misleading and needs to be qualified. The EEA guide does not require advanced inverter power quality modes in all cases (see comments below) • 5.15(a) Part 1A already requires the inverter to conform to AS/NZS 4777.2 as noted in the Issue Papers' clause B15(b). • 5.15(b) The EEA guide does not require volt-var and the volt-watt modes to be mandatory features in all cases - only when the DG applicant's requested power export exceeds the LV network's lower export power threshold 'H1'. Thus, where this threshold is not exceeded, inverters without these features can still be used according to the EEA guide. • Making power quality response mode capability mandatory under Part 1A could simplify the Part 1A eligibility criteria. However, this may disadvantage some applicants (with regards to inverter cost or availability) wishing to only import small amounts of power to the grid. These cases would otherwise qualify for the 'green' category of the EEA guide's 'traffic light system', which is below the lower export power threshold H1, where inverter power response mode capability such as volt-var is not required.

Q6. What advanced power quality capabilities do inverters sold into the New Zealand market possess?	The Electricity (Safety) Regulations still cites AS 4777.1:2005 and is yet to recognise the superseding standards AS/NZS 4777.1: 2016 and AS/NZS 4777.2 2015. There is still confusion whether inverters certified to the more recent standards can be used in New Zealand (see reference below). Those selling inverters into the NZ market may be struggling with this ambiguity. We do not have a clear idea if inverters sold into NZ certified to the 2005 standard or to the more recent standards, allowing more power quality capabilities. The EEA advocates for the adoption of the 2015/2016 standards - however it is unclear when the Standards cited in the Schedules of the Electricity (Safety) Regulations will be updated by MBIE to accept AS/NZS 4777.2:2015 certified inverters. Reference: WorkSafe regulatory guidance note on AS/NZS 4777 https://worksafe.govt.nz/laws-and-regulations/regulations/electrical-regulations/regulatory-guidance-notes/regulatory-application-of-asnzs-4777/
Q7. Is it reasonable to assume that the advanced power quality modes outlined are currently available in the marketplace at no additional cost? If not, what are the likely incremental costs involved to obtain these modes?	Additional costs should be minimal, as it will be increasingly common for these to be standard built in features. The types of AS/NZS compliant inverters produced will likely be dictated by the larger Australian market, which already requires compliance with the latest Standards.
Q8. Would a default requirement to provide volt-var and volt-watt modes for all future inverter installations that use the Part 1A connection process have any unintended adverse consequences (for example, leaving a stock of unsold inverters that are otherwise compliant with the superseded AS4777:2005 standard suite)? Are these adverse consequences surmountable?	The Part 1 (not Part 1A) application process is currently agnostic to the inverter Standard. Thus, as is currently the case, all AS4777:2005 inverter connection applications are and must be processed through Part 1 and the inverter approved at the discretion of the distributor. So, the problem of unsold stock does not arise. If there was significant concern that suppliers would be unable to sell existing stock a ‘sunset clause’ could be added to provide a limited window of time for them to sell remaining stock. However, if we are too slow moving in adopting new Standards, we risk becoming a ‘dumping

	ground' for 'old' products which can no longer be sold in other jurisdictions.
Q9. What comments do you have about the hosting capacity assessment process described in detail in the draft EEA guide?	EEA wish to clarify some statements made in section 5.17-5.21 of the issues paper regarding hosting capacity in the EEA guide: • See heading: "The EEA guide would require distributors to assess the hosting capacity of each low voltage network". The EEA guide recommends this as a preferred option. The guide also provides the option of using arbitrary export power thresholds which may be appropriate for many or all the distributor's LV networks (see page 46). As such, the guide's traffic light system for assessing connection applications can be practised in both cases. • 5.20(a) Again, it is possible that an inverter without these power quality response modes could still be used if the export is below the lower export threshold. • 5.20(b) The EEA guide does not limit the amount of power imported into the network. However, the power import requested by the applicant may be subject to the mitigation measures outlined in the EEA guide's traffic light system. If the power import requested exceeds the upper export power threshold H2, then a manual assessment is required, and this must then be undertaken via the Part 1 application process. Under Part 1 and manual assessment, it is up to the discretion of the distributor to determine mitigation requirements and import limit if any. • 5.25(a) Under Part 1A as proposed by the EEA guide, again as explained under Q5, the proposed inverter is not necessarily required to have power quality modes to enable it to regulate voltage.

	• 5.25(b) and footnote 22: To avoid confusion, we emphasize here that the EEA guide's maximum export power, which is set equal to the upper export power threshold H2, is only a qualifying limit above which the Applicant may not use the Part 1A process. Above this threshold, manual assessment of the application is required, and this must be processed via a Part 1 application.
Q10. Do you support the Code amendment request discussed in the draft EEA guide? If not, please explain why and, if possible, suggest an alternative approach.	We support the amendment.
Q11. Do you think there is a problem or conflict with the '10 kW total' versus '5 kW per phase' thresholds respectively adopted in the Code and AS/NZS 4777.2:2015? If so, would you support aligning the Code threshold with the inverter standard?	The 5kVA per phase limit applies to **unbalance** between phases, not the overall output per phase. There may be advantage in adjusting the threshold in the code to 15kW, as above 15 kVA the Standard requires additional protection, this making it a logical cut off point. The limit should be based on the power level injected into the distribution network, not the total output of the generation. As an example, a 20 kW PV DG system on a commercial installation were the load is never below 20 kW, is no different to a load reduction.
Q12. Do you think there are emerging problems with capacity or power quality from in-home electric vehicle chargers, or is it too early to tell? We are keen to hear industry views and experiences and from parties that supply electric vehicle charging equipment.	While the Vector paper provides a start point, it should be noted that there are other industry studies that have expanded understanding of the assumptions and issues and come to different conclusions. EVs are being built with bigger batteries and more powerful chargers; however that doesn't necessarily mean they will be drawing more power from the network every night, as the distance they travel each day may not change (i.e. the energy it takes to commute to work, which determines the level of average daily recharge, won't change unless you move much further away from your place of work).

	Also, with larger batteries, EVs don't need to be charged as often. This allows for greater diversity, which means that although more powerful chargers may be used, there may be fewer of them in use at any one time, thus putting less pressure on the network (especially if there are time of use incentives). There is a lot of support for a system whereby EV charging can be varied to better manage network congestion. A system that could create diversity of when charging occurs could reduce the amount of investment in network reinforcement, potentially saving consumers significant cost. Such a system could be achieved in a multitude of ways including time of use pricing to incentivise consumers and/or package deals from retailers or 3rd party players that are 'set and forget' and easy for consumers to use. The benefits of 'smart' vs 'passive' charging have been investigated in the "Driving Change" white paper referenced below. Note: Vehicle to grid, or V2G, technology will be another issue that needs to be addressed in NZ. For the purposes of the EIPC a V2G setup could be treated as an SSDG, or more accurately IES as the battery releases rather than generates energy. <u>References</u> '"Driving change" –Issues and options to maximise the opportunities from large-scale electric vehicle uptake in New Zealand' – A white paper commissioned by Orion, Unison and Powerco http://www.concept.co.nz/uploads/2/5/5/4/25542442/ev_study_v1.0.pdf