29 November 2024

Discussion Document: Amendments to the Electricity Safety Regulations
Electricity Markets Policy Team, Building, Resources and Markets
Ministry of Business, Innovation & Employment
Submitted by email to electricitymarkets@mbie.govt.nz

To whom it may concern,

Electricity Networks Aotearoa (ENA) appreciates the opportunity to make a submission to the Ministry of Business, Innovation & Employment (MBIE) discussion document on *amendments to expand the permitted voltage range for electricity supply.*

ENA represents the 29 electricity distribution businesses (EDBs) in New Zealand (see Appendix B) which provide local and regional electricity networks. EDBs employ 10,000 people, deliver energy to more than two million homes and businesses and have spent or invested $8 billion in the last five years.

ENA supports a change to the statutory voltage in New Zealand to a nominal voltage of 230 Volts within a range of -6% and +10% (MBIE's option 2)[1], as described in this discussion document. ENA considers that this change will bring multiple benefits for electricity network users, at virtually no cost, including:

- The ability for low voltage networks, to which most residential consumers are connected, to accommodate higher amounts of exported electricity. This will mean that consumers who adopt rooftop solar PV will be able to export more of the electricity they generate onto the wider electricity network. That would have been constrained under the status quo.
- Alignment of New Zealand voltage limits with those typically found overseas (most notably in Australia) and with the electrotechnical standards that most products and appliances brought into New Zealand are built to.

Do not hesitate to get in touch with ENA if you'd like to discuss any of the points raised in our submission. Please contact Richard Le Gros (richard@electricity.org.nz) in the first instance.

Yours sincerely,

Richard Le Gros
Policy and Innovation Manager
Electricity Networks Aotearoa

[1] ENA is also supportive of a corresponding change to the lower voltage limit (MBIE's option 1), but this has not been an element of its advocacy to date.

Appendix A - ENA response

Submitter: Electricity Networks Aotearoa

Q1 - Would expanding the upper voltage limit from +6% to +10% help networks host more distributed generation like solar PV? Do you think this is likely to be more, less, or similar in cost to other options, like reconfiguring networks or installing additional infrastructure?

ENA considers that expanding the upper voltage limit would allow New Zealand distribution networks to accommodate more DG – especially solar PV – than under the status quo arrangements. This is because when considering how much DG can be accommodated on a particular LV feeder, EDBs must consider:

- both the amount of electricity export from those systems that can be accommodated while also ensuring that the network remains within existing voltage limits at all times; and
- allowing scope for other consumers to adopt systems on the same section of network in the future.

Changes to the upper voltage limit would therefore allow:

- EDBs to relax, to some extent, the limits on the amount of export for individual DG system
- increases to the size and number of customers connected to the system as a whole, whether or not the consumer adopts a DG system
- a larger number of future consumers to have the opportunity to adopt a DG system
- greater economies to reduce the need for new network build costs as a result of increased DG and ensure better utilisation of network capacity.

ENA has previously provided a very rough estimate to MBIE of approximately $200k-$300k per LV feeder for hosting capacity increases using traditional network reinforcement techniques, in an urban or suburban environment. Extrapolating this rough estimate across the whole distribution system, these costs would very quickly reach into the high 100s of millions, if not billions.

Q2 - Would expanding the lower voltage limit from -6% to -10% help networks host more distributed energy resources like electric vehicles? Do you think this likely to be more, less, or similar in cost to other options, like reconfiguring networks or installing additional infrastructure?

ENA sees merit in this proposal as well. Expanding the lower voltage limit will further improve hosting capacity and extend the ability to add more EV charging capacity. It would also allow more headroom to increase DG capacity (when compared to option 2).

This in effect will reduce the need for networks to upgrade capacity “early” where most devices connected to networks can be specified, or are specified, to accommodate this greater voltage range.

Allowing a full +/- 10 % would allow

- EDBs to consider dropping voltages on networks ahead of time where an increase in DG capacity is required; or
- decrease the network voltage to allow for more DG to be hosted.

Q3 - Beyond costs, do you think expanding the voltage range will have any wider benefits to the security or sustainability of the electricity system?

Changes to the regulated voltage range may give more flexibility to EDBs to operate the system in extreme situations like loss of a GXP and unexpected sustained high demands etc.

For example, the EDBs will be able to operate the system more easily, in instances like back-feeding, without exceeding the regulated voltage limits.

Q4 - Are there any other benefits to expanding the voltage range that have not been mentioned?

A higher voltage on an active load (switch mode power supply, LED lamp, or motor) would cause less current to be drawn and therefore lower losses in LV networks. This would have to be balanced with resistive load (oven, hob, heater, etc) drawing more current but, if thermostatically controlled, would consume about the same amount of energy over time.

Another possible benefit is the accommodation of flexible on-demand generation options such as batteries. Should a grid/network event occur that requires contracted support from many residential batteries, the voltage in some LV areas may climb above +6%, and this would be an exceedance for relatively short periods (a few hours at most) but still non-compliant with today's limit.

Q5 - Do you have reason to believe that any appliances you manufacture, sell, or use would be at significant risk of failing if the maximum permitted voltage increased from 244 V to 253 V? If so, what appliance(s), why do you think it could be affected, and what would the impact be?

While ENA and its members are not appliance manufacturers or retailers, we note that some old 'constant impedance' appliances (e.g. irons, rice cookers, clothes dryers, etc) which are designed to operate within 230 +/- 6% may have an extra risk of failure under these proposals that should be considered.

Q6 - Do you have reason to believe that any appliances you manufacture, sell, or use would be significantly affected if the minimum voltage was allowed to fall from 216 V to 207 V? If so, what appliance(s), why do you think it could be affected, and what would the impact be?

While ENA and its members are not appliance manufacturers or retailers, we note that induction motors (the most prevalent type) may perform poorly at lower voltages (e.g. reduced torque, increased slip, increased current, overheating, insulation stress due to overheating, reduced efficiency or stalling). These risks should be carefully considered in the context of these proposals.

Q7 - Are there any specialised appliances that are at higher risk of failing from wider standard voltage ranges, or where the impacts of failures would be particularly serious?

The performance of induction motors under these proposals should be assessed, especially in the context of production lines/industrial applications.

Q8 - Do you think an alternative approach should be taken to manage the demands of distributed energy resources on low voltage networks? If so, what approach and why would it be preferential to expanding voltage limits?

ENA anticipates that as the opportunities for 'smart' control of the electricity distribution system matures we will see EDBs increasingly using dynamic operating envelopes to ensure that solar PV (and other forms of DER) are operated within the physical limits of the network. This approach is already business as usual in some jurisdictions, most notable South Australia. However, given that these technologies and techniques are still some way away from being ubiquitous in New Zealand, and that the change to the statutory voltage limits is effectively cost neutral, we think the voltage limits change should be pursued.

Q9 - If voltage limits were expanded, do you believe those changes should be phased in? If so, how? If not, why do you think a phased approach is undesirable?

ENA considers that an instantaneous introduction of new voltage limits (as opposed to phase in over time) is preferable. Government, regulators and industry will need to make it clear to consumers that while the regulated limits may have changed, that does not necessarily mean that all parts of the electricity distribution system will be operating to these greater limits immediately.

ENA believes that this approach is preferable to a phased approach as it allows for a single national position to be conveyed to consumers, manufacturers, importers and retailers of relevant electrical appliances, rather than a more complicated and piecemeal approach spread over time and geography.

Q10 - If voltage limits were expanded, are there any specific safeguards you believe should be introduced for 'higher-risk' appliances, if any?

No comment.

Q11 - What costs would be involved in expanding the regulated voltage range? Who would face those costs?

EDBs will incur some costs in changing internal engineering standards and guidance, and in changes to some network equipment – transformer taps, protection settings, etc. Given that these changes could potentially be made as and when standards are reviewed and equipment is maintained or adjusted, these costs can hopefully be kept quite minimal.

DG owners whose inverters are configured to conform to existing regulated voltage ranges may incur some costs in updating these devices to take full advantage of a higher upper limit. ENA assumes that this imposition would be considered favourably in light of an ability to export more electricity onto the network and make better use of their existing generation capacity. There may be challenges associated with older inverters that are not easily updated to account for the proposed new voltage limits.

Q12 - Are there other regulations or standards that would need updating if regulated voltage ranges were changed? Please be specific where possible.

Some types of regulations, standards, etc that may need to be updated could include:

- relevant sections of the Electricity Industry Participation Code
- applicable New Zealand standards for solar PV inverters (e.g. AS/NZS 4777 suite)
- agreements between industry participants (e.g. traders and EDBs)
- internal documents/guidelines of industry participants (e.g. EDB engineering policies/standards)
- technical standards for DG connection, published by EDBs.

Changes to the regulated voltage limits may also drive greater adoption of DER (which encompasses DG) amongst consumers. This would be a positive outcome but would increase the urgency for regulators and the electricity sector to develop enabling regulation, technical codes and operating practices to ensure the system as a whole continues to function optimally. This work is already underway but would take on an even increased priority under an accelerated DER uptake scenario.

Q13 - Is there anything which has not been covered by the previous questions that you believe we should consider?

Public safety should be the overriding concern of government and the industry when considering the changes proposed in this discussion document. ENA and its members will be supportive of any further studies or assessments required in this regard.

ENA also suggests that meter equipment providers should be consulted with (if not already) to ensure that there are no potential issues with revenue metering.

Appendix B: ENA Members

Electricity Networks Aotearoa makes this submission along with the support of its members, listed below.

- Alpine Energy
- Aurora Energy
- Buller Electricity
- Centralines
- Counties Energy
- Electra
- EA Networks
- Firstlight Network
- Horizon Energy Distribution
- MainPower NZ
- Marlborough Lines
- Nelson Electricity
- Network Tasman
- Network Waitaki
- Northpower
- Orion New Zealand
- Powerco
- PowerNet ((which manages The Power Company, Electricity Invercargill, OtagoNet and Lakeland Network)
- Scanpower
- The Lines Company
- Top Energy
- Unison Networks
- Vector
- Waipa Networks
- WEL Networks
- Wellington Electricity Lines
- Westpower