Submission: Future Security and Resilience – Review of common quality requirements in Part 8 of the Code

Eric Pyle, Director of Public Affairs and Policy, solarZero

30th May 2023

Introduction

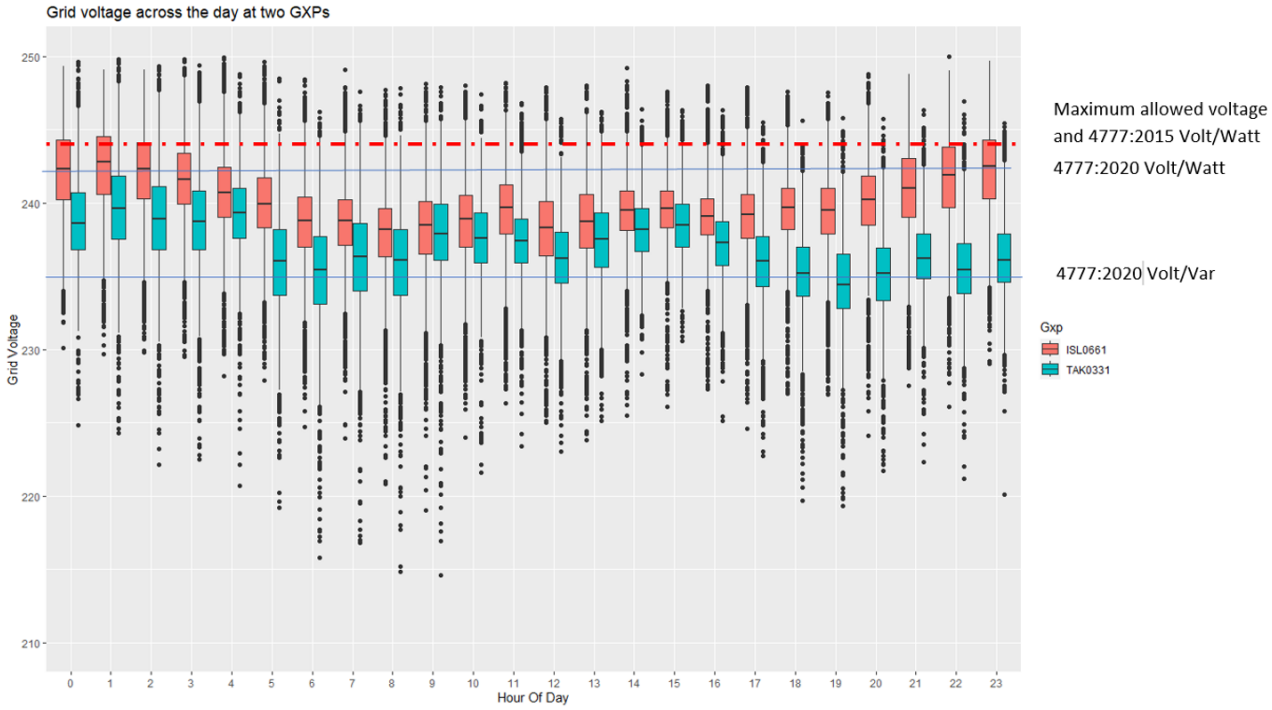
The tone of the report is that power quality is going to become an issue as more and more inverters come onto the power system. The implication, though not stated, is that power quality is currently good but without careful management quality could deteriorate creating a range of issues for consumers and power system managers.

We suggest reverse. Power quality is currently not great at the distribution level. A large number of software-controlled devices could substantially improve power quality. The report needs to focus on the positives that a myriad of software-controlled devices can bring to the power system and look to incentivize the right behaviours. It is all a question of software and incentivising the right software settings.

The data solarZero collects and observations of the power system

solarZero has over 10,000 residential solar and battery systems in New Zealand. We receive data from these every five minutes and collect around 50 million data points a day. In addition, we sample frequency every 30-40 milliseconds and collect that data when there is a frequency event.

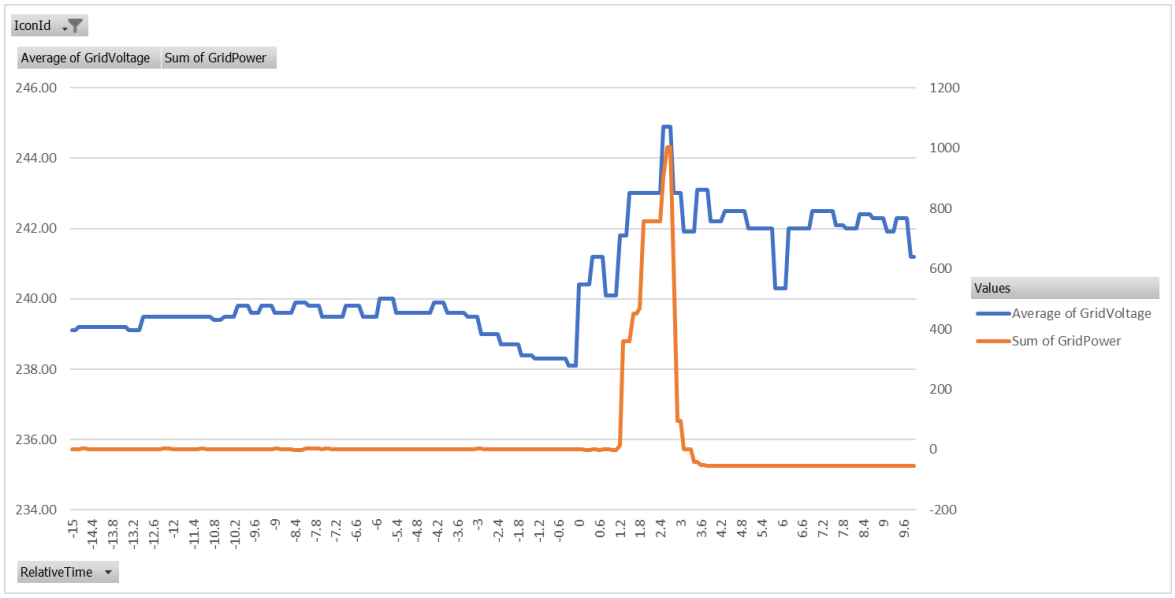
Voltages at the distribution level regularly exceed the voltage standard of +-6%. We observe most exceedances in the early hours of the morning. To be clear, we suspect the exceedances are due to high tap settings on transformers rather than injection from solar. The graph below shows voltages for solarZero systems at two GXP where we have significant proportions of our systems. The graph is a standard box and whiskers approach that shows the 25%ile, 50%ile and 75%ile via the box and outliers via the whiskers.



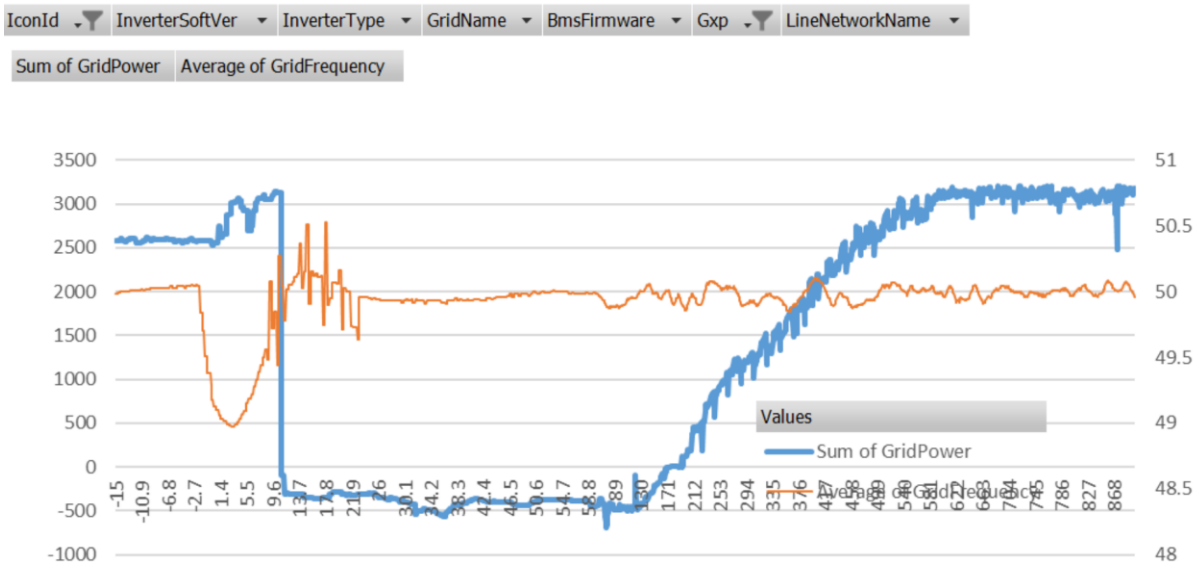
Poor power quality already impacts solarZero

solarZero is already seeing the impacts of poor power quality. On some GXP, under NZS4777.2:2020 inverters are in volt-var mode for much of the time. At times they are in volt-watt mode (see graph above). During frequency events output from the inverters can be curtailed for two reasons; (i) high ambient voltage and (ii) harmonics.

The graph below shows the impact of high ambient voltage coupled with a general voltage rise that we observe during a frequency event. The inverter output (labelled as sum of GridPower on the graph below) increases in response to a frequency event then drops back as voltage limits are hit.



In terms of harmonics, our inverters have detected harmonics during a frequency which we suspect are related to hot water ripple control. The graph below shows one of our inverters reducing power output during a frequency event due to harmonics.



We would be happy to talk EA staff through the detailed aspects of the observations we have.

Implications for standards – NZS4777.2: 2020

NSZ 4777.2:2020 is mentioned in the discussion document five times. solarZero has serious concerns about NZS4777.2:2020 and the way it was incorporated into the Code.

The voltage settings in NZS4777.2: 2020 are simply too low. SEANZ members abstained on these limits during votes for sections of the standard. The Electricity Authority believed that the standard had been through a robust standards process and adopted the standard into the Code without consultation. The standards process was not robust. The standard is controversial. It needs to be urgently removed from the Code on this basis.

The EA board paper makes two statements that are plain wrong:

(d) **note** the changes in the new standard are technical in nature for small-scale inverters and will promote efficient operation and enhance security of supply for the distribution network, and have passed a consultation process facilitated by Standards Australia. All submissions have either been resolved or incorporated in the standard

(f) **approve** making the proposed amendment without consultation or a regulatory statement on the grounds that, under section 39(3)(a) of the Electricity Industry Act 2010 (Act), it is satisfied on reasonable grounds that the amendment is technical and non-controversial

Firstly, all submission had not either been resolved or incorporated in the standard. SEANZ members abstained from key votes and were coerced into not voting against key parts (i.e. they just abstained).

Secondly, the voltage settings are controversial.

In effect, EA staff have misled the EA Board by stating that NZS477.2:2020 is non-controversial.

solarZero therefore asks through this submissions process that NZS4777.2:2020 is removed immediately from the Electricity Code.

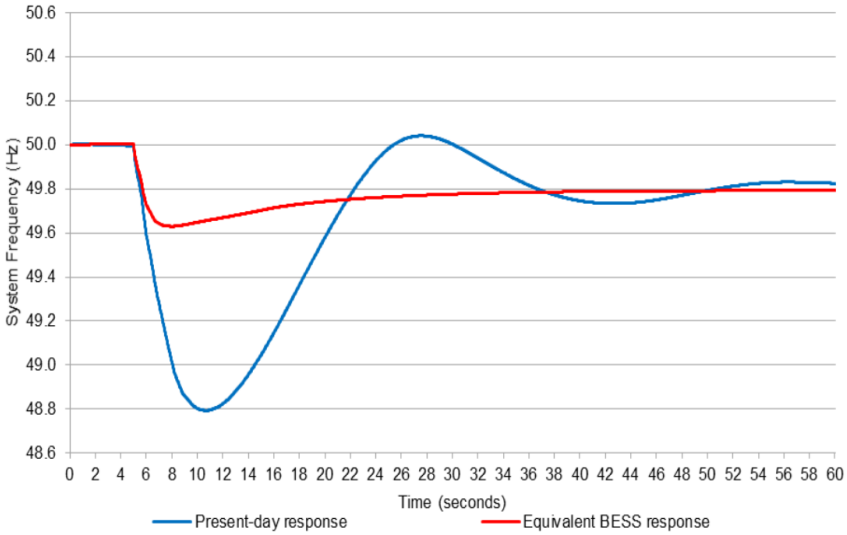
The Future Stability and Resilience (FSR) Programme

solarZero supports the FSR work. It is important to ensure that the advantages of new technologies are harnessed as the power system goes through The Transition.

Response to questions/issues

Issue 1: Inverter-based resources cause more frequency fluctuations

This statement is just plain wrong. Inverter-based resources can help manage frequency fluctuations. Transpower makes this point, that inverters can help manage frequency, in the Te Mauri Hiko series of reports. The graph below is from the Te Mauri Hiko series of reports. BESS response is provided by inverters, i.e. the graph tries to demonstrate the point that inverters (in this case connected to batteries) can help improve power quality.



We would appreciate alignment between the main electricity agencies on fundamental points like "inverter-based resources cause more frequency fluctuations". It is difficult for solarZero to navigate a path forward when the technical agency (Transpower) promotes a view that is different to the view of the policy/economic agency (Electricity Authority), on this and similar issues.

The key to inverters providing power system stability services is incentives. Inverters are all about software. Getting the right settings in the software is all about incentives. The EA needs to work with

the whole industry to develop an incentives regime that encourages the managers of inverters to provide good outcomes for the power system.

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

Again, this is plain wrong. Firstly, in the absence of high numbers of inverters we are seeing very variable voltages across the New Zealand power system (see voltage graph on page 1 of this submission) at the network level. Secondly, inverters can be programmed to provide voltage services – it is a question of software. Again it comes down to incentives. Managers of inverters can be incentivised to help manage voltage and those incentives need to be put in place.

Issue 5: Harmonics

Our inverters experience harmonics and at times trip off the system as a consequence. We would greatly appreciate action being taken to reduce harmonic distortions on the low-voltage network.

Issue 6: Asset owners sharing information

Our experience is that we have to provide information to lines companies about the solar array, inverter etc. Often this is information is entered on line in some cases via free text fields. We are unsure as to the veracity of the data entered and how useful it is given it can be free text. Providing information is important but the question we think needs working through is what will the information be used for, therefore what information should be provided and how?