



20 August 2024

Electricity Authority  
Te Mana Hiko

Future Security and Resilience

Via email: [fsr@ea.govt.nz](mailto:fsr@ea.govt.nz)

**Submission on Common Quality Requirements Paper 3: The governance and management of harmonics in New Zealand's power system**

Kia ora,

I am writing on behalf of Helios Energy Limited to submit our feedback on the consultation that was released by the Electricity Authority regarding Part 8 of the common quality requirements on the 25<sup>th</sup> June 2024

Helios is a Kiwi company that was established in early 2020 when its founders recognised the potential for grid-scale solar to make a positive contribution to Aotearoa's economy, energy market and zero carbon targets.

Our portfolio spans various stages of the grid connection application process with Transpower and our Edgecumbe project was the first grid-scale solar development in the country to receive contracted permission to connect to the national grid. We are experiencing first-hand some of the issues that have been identified with the common quality requirements in Part 8 of the Electricity Industry Participation Code 2010, and we welcome the opportunity to provide our feedback on these.

Helios believes that higher levels of inverter-based variable generation are key for Aotearoa to succeed in achieving a zero carbon electricity future. The majority of new connection requests to the system operator are inverter-based, and the paper also recognises this reality. The electricity system must be capable of supporting increased inverter-based variable generation, such as solar, and this support must be achieved in the most efficient, cost-effective way to ensure an equitable zero carbon future.

Ngā mihi,

/s/ Jeff Schlichting

Managing Director, Co-founder

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**Helios Energy Response, in table Format for Submissions:**

<b>Question</b>	<b>Comment</b>
<p>Q1. Do you consider the Authority has accurately summarised New Zealand's existing key regulatory requirements for harmonics? If you disagree, please explain why.</p>	<p>Yes</p>
<p>Q2. Do you agree the Authority has identified the main challenges with the existing arrangements for the governance of harmonics? If there are any additional challenges, please set these out in your response</p>	<p>Yes, we agree that authority has identified the main challenges associated with the existing arrangements for governance of harmonics.</p> <p>Under the existing arrangements, the grid owner establishes baseline harmonic levels at the point of connection using the nearest harmonic meters. Using this information, grid owner will identify the current harmonic headroom between the baseline readings and the NZECP36 limits. Conceptually a maximum of 30% of the current headroom is allocated to new harmonic contributions from a developer's large new generation or load. There are a number of challenges with this methodology:</p> <ul style="list-style-type: none"> <li>• NZECP36 may not be the appropriate standard to set the planning limits.</li> <li>• The harmonics emissions may include diversity between identical harmonic sources. If diversity is not taken into account, the harmonic modelling and pre-connection compliance assessment may include significant error. The implications of this error include requirements for harmonic mitigation to be installed that is not required once commissioning of the plant is complete and/or inappropriately designed mitigation.</li> <li>• It may result in pre-emptive (and potentially redundant/unnecessary) installation of filters where the accuracy of the harmonic assessment is questionable. This adds significant capital cost to the project without assurance of its effectiveness. For projects of the scale that Helios works in, this is likely to require filter banks costing approximately NZD\$4M on average. This leads to adding an increase of NZD\$1-4/MWh to our Levelised Cost of Energy.</li> </ul>

<p>Q3. Do you consider the existing regulatory framework for the governance of harmonics in New Zealand is compatible with the uptake of inverter-based resources? Please give reasons for your answer.</p>	<p>In our opinion the current framework is likely to lead to developers taking a pre-emptive, conservative approach that could lead to significant economic inefficiency as well as the possibility of harmonic filters “fighting” one another. We also believe that the framework doesn’t correctly account for total harmonic distortion (THD) as it is not a given that different inverter based solutions constructively interfere. In many cases, they can destructively interfere, leading to lower THD at different points in the network.</p>
<p>Q4. Do you have any feedback on the Authority’s suggested way forward to help address the challenges with the existing arrangements for the governance of harmonics?</p>	<p>We agree with the Authority’s suggested way forward covered under points 4.23 to 4.26 of the consultation paper. The AS/NZS 61000 series should be carefully tailored to suit NZ electricity industry arrangements by forming a working group of the key stakeholders.</p>
<p>Q5. Do you have feedback on any of the elements of good industry practice relating to a framework for managing harmonics? This may include feedback relating to elements you consider are missing from the summary provided in section 5 of this paper.</p>	<p>We would expect that the working group posited above would draw on examples from other jurisdictions where harmonic allocation best practices have been successfully implemented. (Please see further comments below.)</p>
<p>Q6. Do you agree with a ‘whole of system’ approach to allocating harmonics, so that any differences in harmonic allocation methodologies between electricity networks do not cause excessive harmonics? If you disagree, please explain why.</p>	<p>Yes, the ‘whole of system’ approach is necessary to reflect and accommodate an evolving and more dynamic grid in Aotearoa NZ.</p>
<p>Q7. Do you have any feedback on the suitability for New Zealand’s power system of the harmonics standard NZECP 36:1993, or the AS/NZS 61000 series of harmonics standards?</p>	<p>We note that there have been a number of studies carried out in overseas jurisdictions with regards to implementation of AS/NZS 61000 series of harmonic standards. In our view, it is imperative to take into account the learnings from overseas jurisdictions where this standard has been implemented. We note one such study has been carried out by Australian Renewable Energy Agency (ARENA) in collaboration with the University of Wollongong and various industry participants (<a href="#">link to the study</a>).</p>

Q8. Do you have any feedback on the alternative approaches to limiting harmonic emissions, including alternative approaches you consider to be appropriate for New Zealand's electricity industry?

We believe preemptive installation of harmonic filters may prove to be inefficient and ineffective for the reasons detailed in Table 1 of the consultation paper.

A prudent solution could be derived by combining key elements of Options 1 and 3 based on the following principles:

- Maximising the available headroom
- Open access approach. However, ensure the first mover advantage is removed. Where planning limits are going to be exceeded, the mitigation can be managed by network companies and grid owner. The cost of mitigation should be spread across the connected parties based on their respective harmonic emissions ('causer pays' approach).

A thorough cost allocation methodology should be devised with inputs from all stakeholders. The methodology should ensure that all generation technologies are treated with equity and that an abundance of small scale projects in a particular area (at EDB level) does not impose potential cost on larger grid-scale projects in that area.