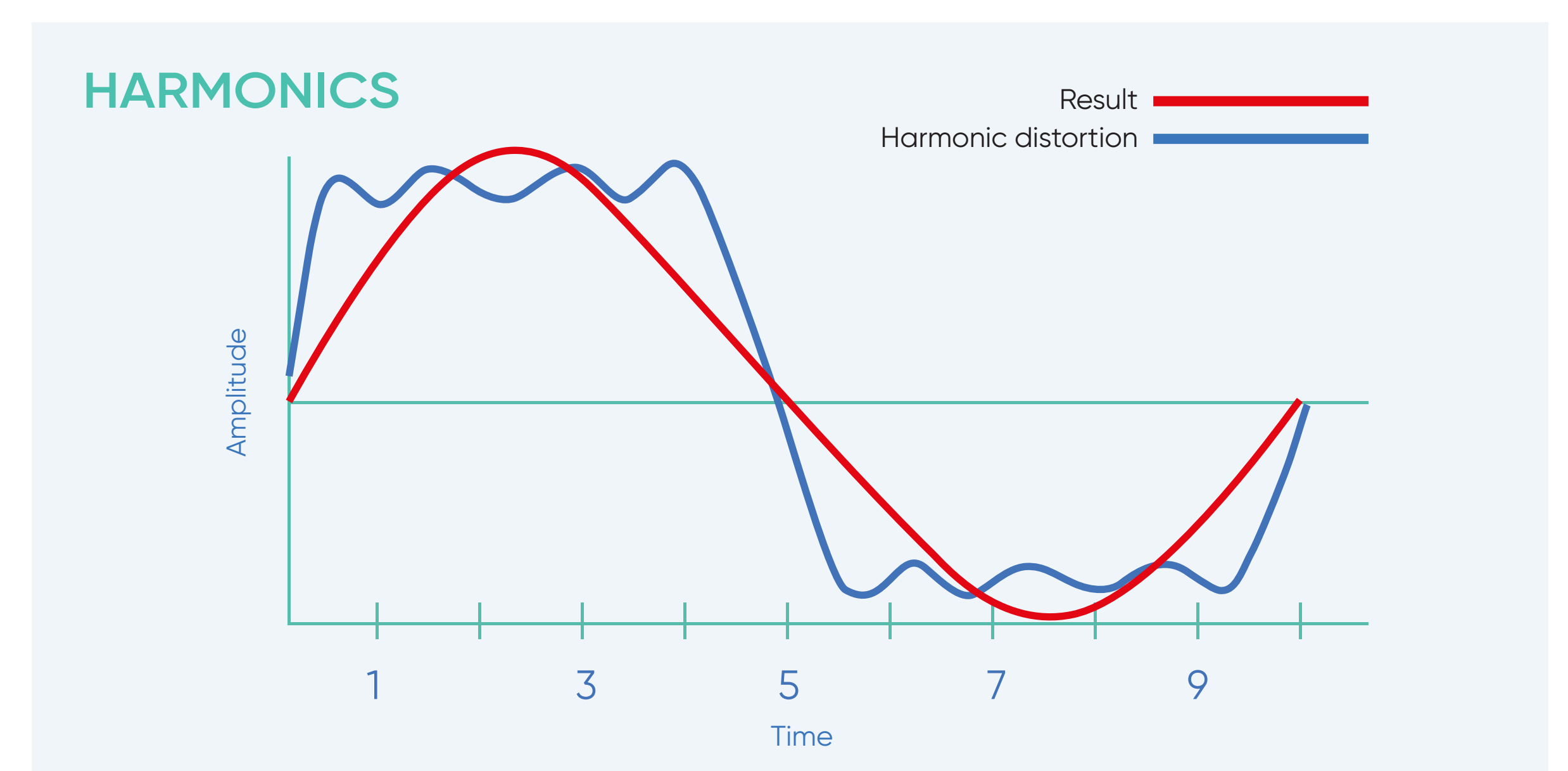
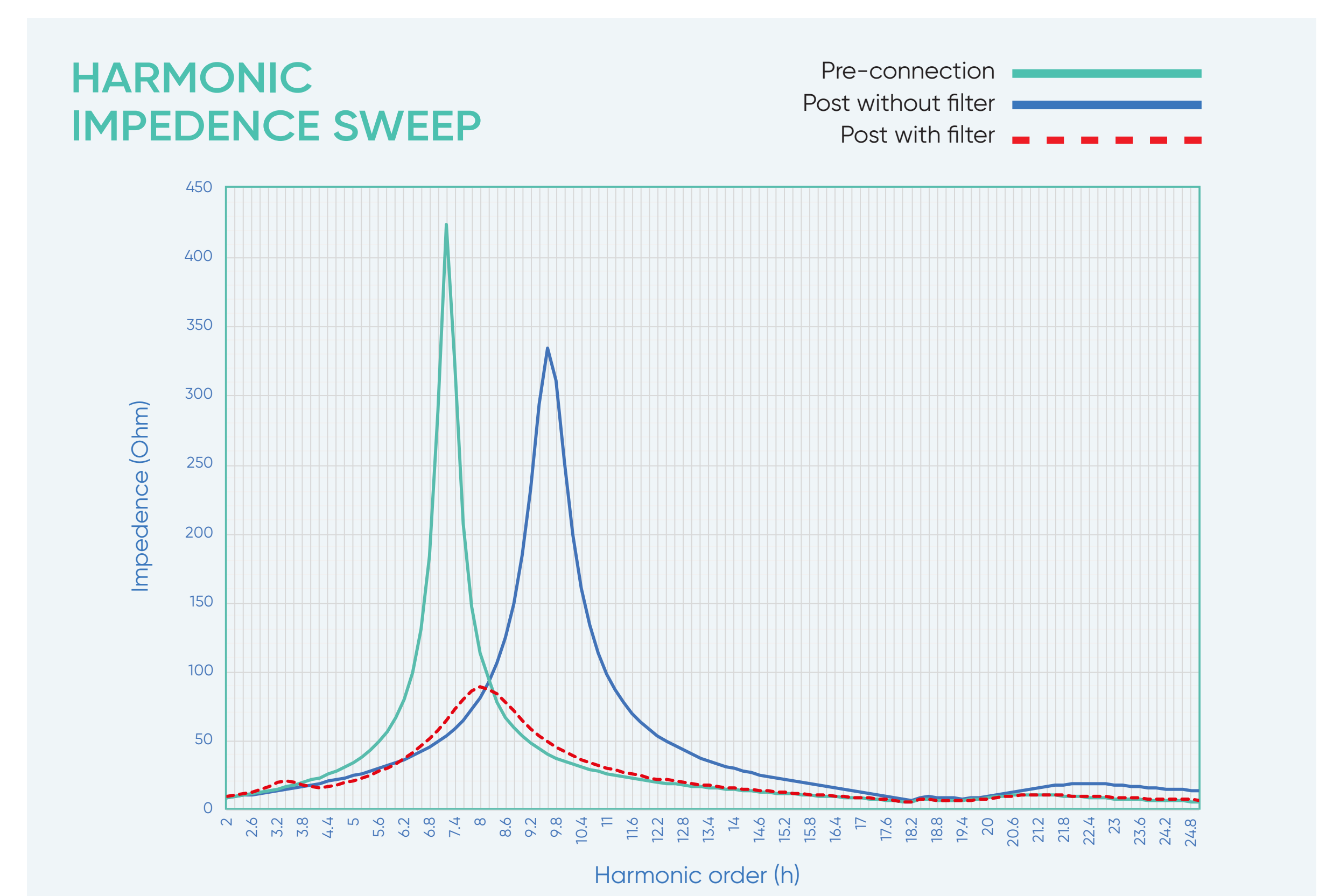
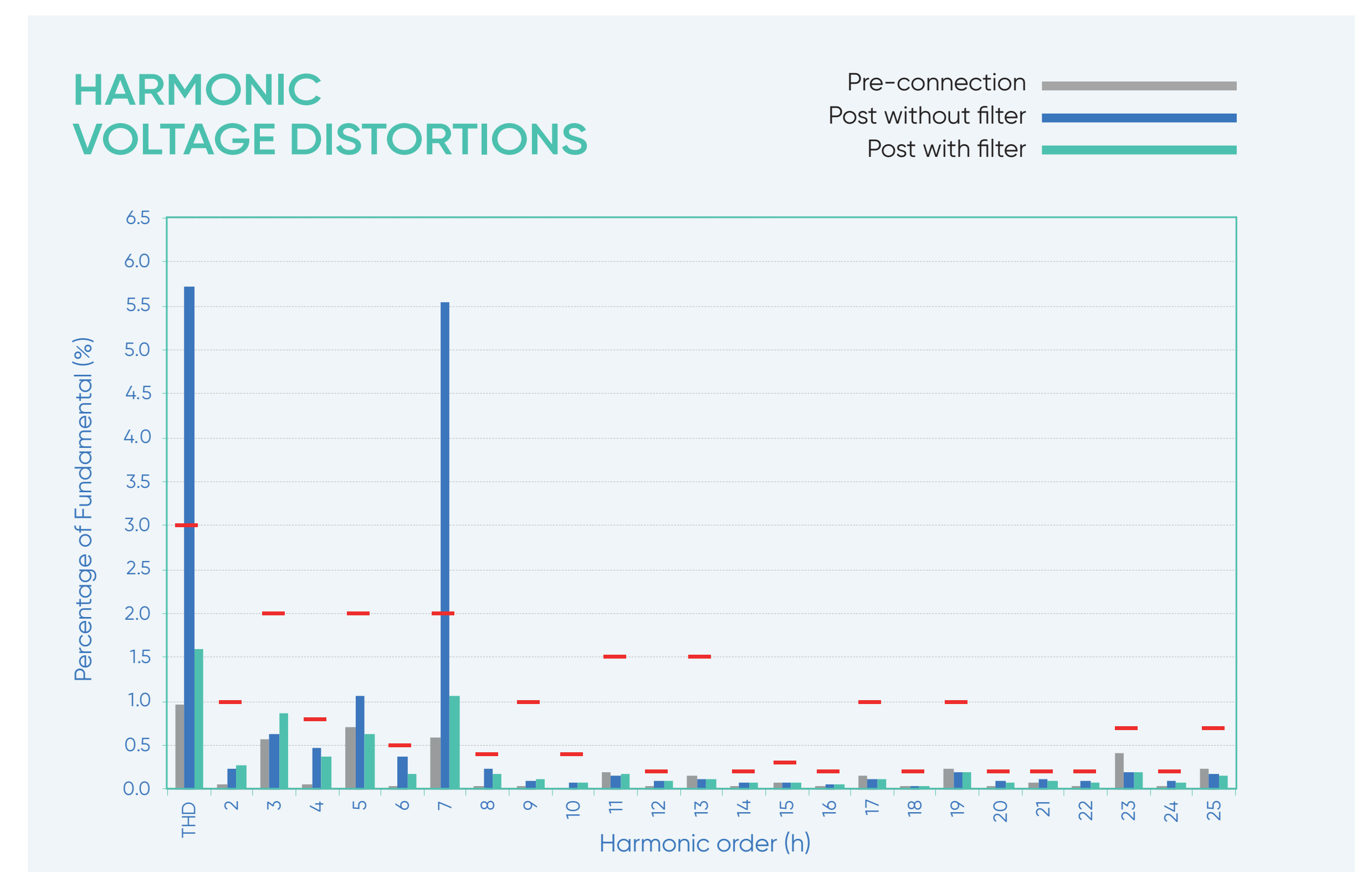




IS YOUR RENEWABLE SITE CAUSING HARMONIC ISSUES WHEN CONNECTING TO THE GRID?



THE SITE

- The example site includes an integrated renewable network connection including a 30MW PV, a 50MW wind farm, and BESS at a 33kV grid connection.
- Before the site's development, there were no non-compliant harmonic distortions, and we can see these distortions clearly come from the site's development and network connection.

FILTER OVERVIEW

- Passive harmonic filters include capacitors, reactors, and resistors.
- These typically provide an alternative impedance path for harmonic currents and dampen the harmonic impedance profile.
- Based on specific impedance profiles, these filters will need to be built per site requirements to avoid over/underrated filter designs and poor performance.

CASE DISCUSSION

- In this example, we can see harmonic limit exceedances in the 7th order, meaning additional measures were needed for the site to be connected and operated.
- To accurately identify this issue and correctly design the filter, completing a

Filter Design (Power System) study simulates the filter and its performance.

- There is a commercial benefit to engineering a site-specific filter, as engineering costs, through a comprehensive harmonic filter design, are minimal compared to the cost of a filter, and inadequate filter installation can cause poor performance.
- Design optimization allows individual components to be precisely calculated, ensuring the most cost-effective design.

CONCLUSION

- Harmonic impedances above ISO/TSO regulation can make renewable integration difficult and cause sites to be turned off.
- Harmonic studies allow for accurate identification of which harmonic orders have non-compliant distortion and therefore allow equipment design to meet site requirements.
- This passive harmonic filter equipment, via specially designed capacitors, reactors, and resistors, mitigates the issue, ensures operational efficiency, and meets grid requirements while also being the most cost-effective solution to the overall project.



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