

## Overview - Harmonic Challenges for Distribution Grid Design

As new technologies for load-based structures transition to more modern diode bridge and IGBT based rectification configurations, electrical harmonics become a key consideration in planning for distribution grid design and load structure power quality specification.

Many Utilities within the US, as well as, around the world are increasingly requiring customers to comply with the relevant harmonic standards for their specificational realm. In the United States and reciprocal with Canada, IEEE 519-2022 is the foundation of most Provider based PQ requirements for low frequency harmonic applications (3 kHz or less), and IEC 61800-3 for high frequency applications (150 kHz and above)... meaning there is an entire bandwidth of potential harmonic frequencies where no active standards make recommendations for current or voltage harmonic limits (3 kHz – 150 kHz).

Little is taught or covered about the applicational challenges of harmonic mitigation and design/specificational “best practices” for assuring proper load structure power quality. IEEE published paper references will be included for reference and referral.

Topics include:

- Develop a fundamental understanding of electrical harmonics from a load and source potential prospective.
- A review of IEEE 519-2022 and understanding current harmonic qualification (I<sub>thd</sub> and/or I<sub>td</sub>) and voltage distortion requirements (V<sub>thd</sub>), including a short discussion of the lack of harmonic qualifications for “Supraharmonics.”
- A summary review of potential existing and new installation harmonic mitigation strategies currently being deployed within many industries where non-linear loads are a significant load factor (Staged and Partial Mitigation Strategies)
- The necessity of credible harmonic modeling within the design process.
- Utility tie considerations for Power Quality in Solar Inverter applications and the need for Power Quality standard enforcement within emerging Geothermal designs.

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