

Analysis of Voltage Harmonic Trends in the Estonian Transmission System

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Motivation

- Grid changes (e.g. renewables & EVs) may impact Power Quality
- Monitoring campaigns required
- Data analytics to extract insights

Compliance with limits

- Utilization = value / limit
- Flexible aggregation of values

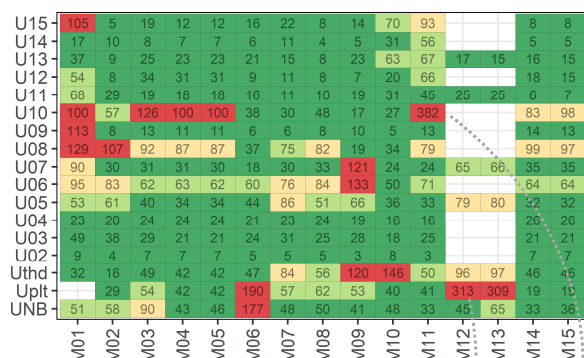


Fig. 1 – Highest limit utilization of all weeks

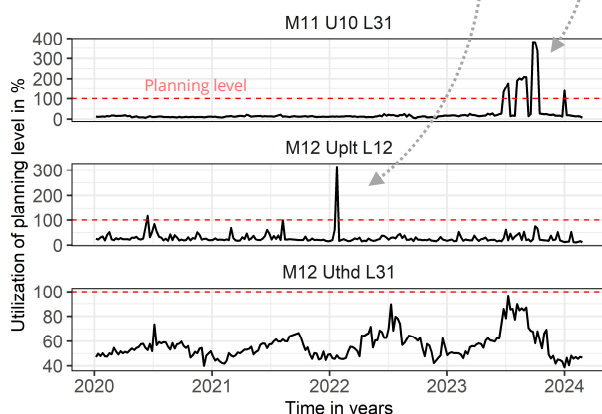


Fig. 2 – Example time series

Measurement data

- 15 sites in Estonian transmission system (110 kV & 330 kV) measured up to 7.5 years
- Planning levels for 27 PQ parameters
- Weekly 95th percentiles from 10-min values

Trend developments

- Extraction of trend component
- Quantification of recent trend gain

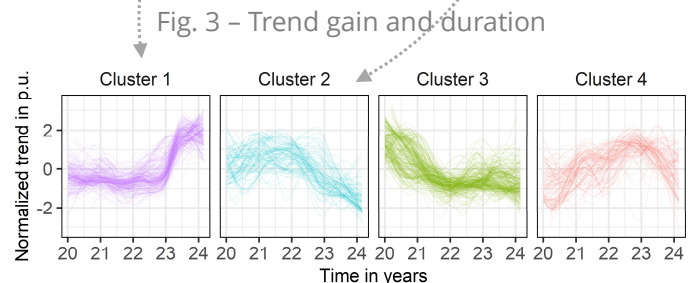
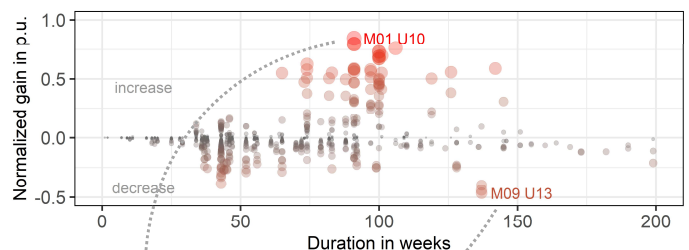


Fig. 4 – Clustering of trend components

Conclusion

- 99.6 % of weeks comply with planning levels
- Higher harmonic emissions mostly occur in summer months
- Most trends are steady or decreasing
- Some strong increases for even harmonics of order $h \leq 12$
- Findings encourage further investigation



1st ICHQP workshop

From Planning to Operation: Efficient Assessment of Harmonic Emission from Distorting Installations

King's College London, UK

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