



Power quality studies: helping to ensure adequate voltage quality

Adequate voltage quality is very important when it comes to ensuring sound operation of the Elia grid. While there is no such thing as an ideal voltage quality, it is important for disruption to be kept to a minimum. Some of this disruption may come from the grid users' facilities, which is why grid users have to respect certain emission limits for disruptive facilities.

When connecting or modifying its disruptive facilities, the grid user should follow Synergrid procedure C10/17 describing the methodology to be adopted when assessing the emission levels of its facilities' disruption and comparing them with the admissible limits.

Once the connection is in service, Elia may perform trials to assess the level of disruption, which reduces the risk of voltage problems in the Elia grid, for the benefit of all users.

I. Power quality studies: principles

Power quality is closely linked to the characteristics of the electrical feed. The electrical feed comprises a three-phase voltage wave system. The voltage is characterised by its frequency, amplitude, sinusoidal wave form and the symmetry of the three-phase system. In practice, there are almost always imperfections in voltage. Generally they do not present a problem but it is still important that they are kept to a minimum and that there is no interference with sensitive facilities.

I.1. Two priorities: availability and quality of power

The assessment of power quality covers:

- voltage continuity, whereby an interruption in voltage supply that lasts over three minutes is considered an unavailability;
- power quality. This involves checking whether the voltage has the properties required (in terms of amplitude, frequency, sinusoidal wave form, symmetry between the various phases, and so on). A number of issues may be noted, such as short-term interruptions, voltage dips, harmonics, amplitude fluctuations and imbalances.

I.2. Disruption caused by the grid user's facilities

Apart from interruptions and voltage dips, disruption in the Elia grid is often caused by the facilities of grid users (consumers and generators). This kind of disruption may cause electrical facilities to heat up more than normal, thus shortening their service life. Above a certain level of disruption, there is a risk that electrical facilities will malfunction or be damaged. That is why emission limits for disruptive facilities have been set and are included in the Grid Codes.

I.3. Emission limits in the Grid Codes

The disruption in the Elia grid caused by a grid user's facilities is tolerated as long as it does not exceed certain limits. The limits are specified in the Grid Codes, the technical reports CEI 61000 3 6, IEC 61000 3 7 and IEC 61000-3-13, and Synergrid procedure C10/17 "Power Quality specifications for users connected to high- and medium voltage networks". These documents also set out the procedure to be followed by Elia when connecting facilities that may cause disruption.

The grid user's facilities must be designed and operated to comply with the authorised disruption emission limits as set out in Synergrid C10/17, which describes the methodology to be used to assess the facilities' emission levels vis-à-vis the admissible emission limits.

II. Assessing, studying, verifying and monitoring

The grid user's facilities must be designed and operated to comply with the authorised disruption emission limits as set out in Synergrid C10/17. As part of connection studies, when designing or modifying the characteristics, operation or functioning of its facilities, the grid user must demonstrate by means of appropriate studies that its facilities are designed to comply with the prevailing emission limits.



Synergrid C10/17 describes the methodology to be used to assess the facilities' emission levels vis-à-vis the admissible emission limits.

The grid user must take all the appropriate steps to comply with the Stage 1 emission limits given in the Synergrid procedure. These studies are carried out before its facilities are connected to the Elia grid and should be submitted to Elia for approval.

If, even after applying additional measures, meeting the Stage 1 emission limits poses problems for the grid user, the relevant user must ask Elia to calculate the Stage 2 emission limits (or any one-off, temporary Stage 3 emission limits if necessary). The grid user will cover the cost of this study in accordance with the regulated tariffs. Based on these adjusted emission limits provided by Elia, the user should verify whether its facilities comply with the authorised emission limits. The user will have to submit written evidence of this verification to Elia for approval.

II.1. Verification measurements

At any time after the disruptive facilities have been commissioned, Elia may carry out power quality verification measurements to gauge the level of disruption being caused by these facilities.

II.2. Continuous monitoring

Elia keeps an eye on the disruptive facilities by using continuous monitoring.

If the data from the verification measurements or monitoring show that voltages have exceeded the limits, Elia may demand additional and essential technical measures aimed at limiting the disruption caused.

II.3. Regulated tariffs

The tariffs for power quality studies and verification measurements are endorsed by the regulator and published on the Elia website. For grid users, the cost of these services is relatively low, considering the fact that these studies and measurements enable the user to be connected to the high-voltage grid while also pinpointing those measures that the user must take in order to comply with the emission limits.

III. Benefits of power quality studies

Power quality studies contribute to the quality of the Elia grid, for the benefit of all users. In addition, these studies enable users whose facilities cause an excessively high level of disruption to be connected to the grid and to operate without necessarily having to spend large amounts of money on sometimes expensive filtering and compensation solutions.

IV. Legal and contractual basis

The power quality requirements (specifically, the conditions linked to Stage 3 of Synergrid C10/17) are set by Elia and are specified in the connection contract.

The admissible level of disruption in the Elia grid is determined on the basis of the Grid Codes and, in more detail, the technical reports IEC 61000 3 6, IEC 61000 3 7 and IEC 61000-3-13, and Synergrid procedure C10/17 "Power Quality specifications for users connected to high- and medium voltage networks".

In accordance with the Grid Codes, Elia ensures that the voltage at the access point conforms to EN 50160. Grid users must comply with these voltage characteristics to determine the degree of immunity of their electrical facilities. Grid users must also take necessary and sufficient measures to appropriately protect their critical facilities from the effects of interruptions and voltage dips. They must also be mindful of their facilities' feed requirements and how their facilities are connected to the Elia grid (e.g. the redundancy that is built in).

Power quality studies in 3 key points

- The grid user must conduct power quality studies if there is a risk of excessive disruption being caused by the facilities that are to be connected to the Elia grid. Additional measures may be required depending on the probability of the admissible limits being exceeded.
- The studies and measurements implemented by the grid user and Elia limit the voltage disruption stemming from the grid users' facilities. This conformity to the emission thresholds set down in the Grid Codes leads to more efficient operation of the grid, which is beneficial for all users.
- The tariffs for power quality studies and measurements implemented by Elia to limit grid disruption must be approved by CREG.