

# TECHNICAL REPORT



Demand side power quality management

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## DEMAND SIDE POWER QUALITY MANAGEMENT

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The text of this Technical Report is based on the following documents:

|               |                  |
|---------------|------------------|
| Enquiry draft | Report on voting |
| 85/640/DTR    | 85/647/RVDTR     |

Full information on the voting for the approval of this Technical Report can be found in the report on voting indicated in the above table.

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## INTRODUCTION

The effective management of power quality on the demand side (power consumer) is an essential activity to ensure the proper operation of the electrical equipment operating on the consumer site.

While the level of power quality present at the point of supply is generally monitored, and managed by the power provider (utility), the actual level of power disturbances present on the consumer site could be significantly worse and may negatively impact the operation of the electrical equipment. The interaction between these loads and the voltage supply is often the cause of degraded power quality on the demand side.

One effective step in the prevention of the hindrances caused by power quality is the assessment of the level of power quality disturbance present on the demand side. However, proper measurements require adequate planning and understanding of the measurement systems and their results.

This document provides guidance on how to establish, implement, exploit, maintain and improve a demand side power quality monitoring system. This document will also facilitate the tailoring of power quality monitoring concepts to the specific site where it will be deployed.

Disturbances in the electrical energy can have an important impact on the equipment, processes, organization's activities and environment. Some electrical installations (industrial sites, data centres, hospitals, etc.) are particularly impacted by the poor quality of electrical energy.

The quality of the electrical energy has different origins, impacts and measurement indicators on the supply side and on the demand side – see Figure 1 presenting an overview of the electrical network from generation (supply side) to consumer (demand side).

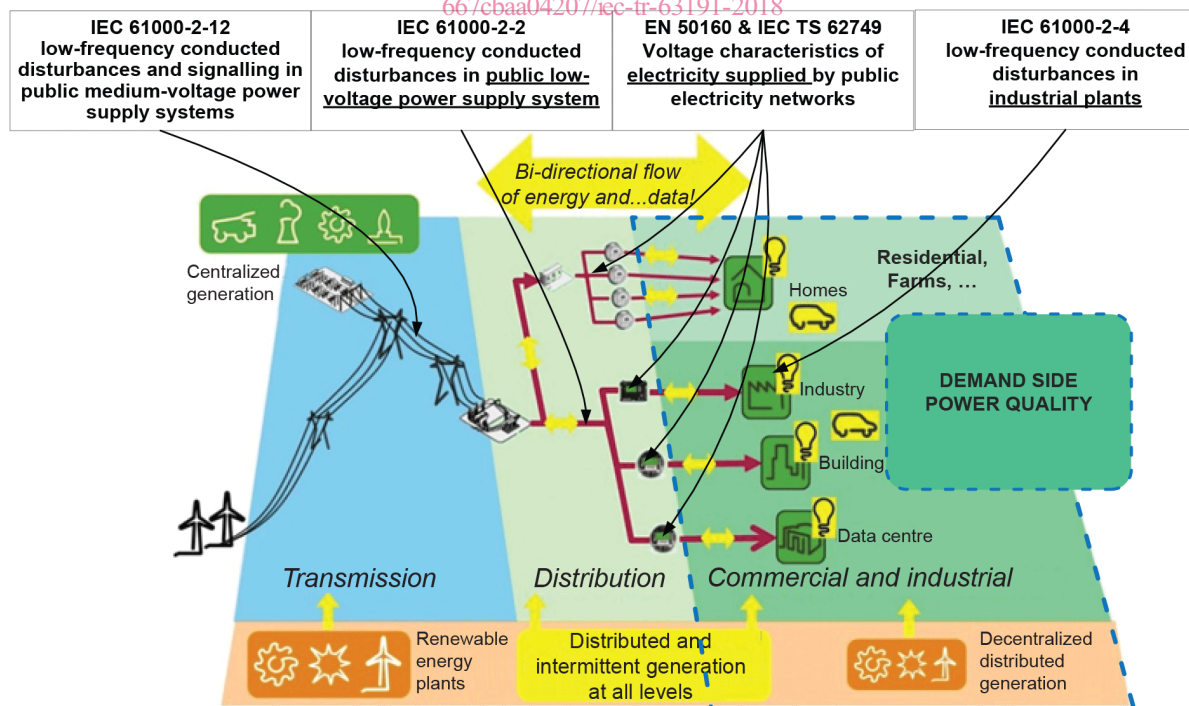


Figure 1 – Overview of electrical distribution system from supply side to demand side

While documents such as IEC TS 62749 or EN 50160 define the voltage characteristics provided by a public network (called power quality of the grid), this document gives guidance for qualifying the electrical quality of internal networks including voltage and current disturbances (called demand side power quality).

In this document, power quality on the demand side, related to buildings, industrial and data centres applications is referred to as demand side power quality (DSPQ).

See Annex D for a general statement on demand side power quality.

See Annex E for a discussion about grid evolution.

See Annex F for a list of standards related to demand side power quality.

See Annex G for definition of electrical parameters.

It is recommended that readers possess a minimum knowledge of power quality phenomena.

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# DEMAND SIDE POWER QUALITY MANAGEMENT

## 1 Scope

This document specifies recommendations about power quality measurement and assessment within installations.

NOTE 1 Most standards take care of power quality at the delivery point between energy providers and customers.

This document outlines the various phases needed for the establishment of a demand side power quality measurement plan for buildings and industry installations.

NOTE 2 The demand side is defined as the electrical installation, beyond the PCC (point of common coupling), which is under the jurisdiction of facility managers.

Such a power quality measurement plan will enable the optimization of the energy availability and efficiency, improve the assets lifetime and facilitate the resolutions of power quality problems. A power quality measurement plan encompasses the following stages:

- definition of the context, objectives and constraints;
- assessment of the initial power quality situation;
- definition of an action plan for the improvement of the power quality situation;
- implementation of the power quality measuring system;
- exploitation of the measurement system for the improvement of the power quality situation;
- maintenance of the measurement system.

This document will also help facility managers to tailor their measurement plan to the specific needs of the electrical system under their control. It addresses all the disturbances present in such networks, but does not cover the disturbances present in public electrical distribution networks (supply side) as they are governed by specific documents such as EN 50160 and IEC TS 62749.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

### 3.1

#### **demand side**

part of the grid where electric energy is consumed by end-use customers within their electric distribution system

**3.2****DSPQ****demand side power quality**

characteristics of the electric current, voltage and frequencies at a given point in an electric distribution system located on the demand side, evaluated against a set of reference technical parameters

**3.3****IPC****in-plant point of coupling**

point on a network inside a system or an installation, electrically nearest to a particular load, at which other loads are, or could be, connected

Note 1 to entry: The IPC is usually the point for which electromagnetic compatibility is to be considered.

**3.4****PCC****point of common coupling**

point of a power supply network, electrically nearest to a particular load, at which other loads are, or may be, connected

**3.5****flicker**

impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time

**3.6****interruption**

reduction of the voltage at a point in the electrical system below the interruption threshold

**3.7****interruption threshold**

voltage magnitude specified for the purpose of detecting the start and the end of a voltage interruption

**3.8****voltage dip**

voltage sag

temporary reduction of the voltage magnitude at a point in the electrical system below a threshold

Note 1 to entry: Interruptions are a special case of a voltage dip. Post-processing may be used to distinguish between voltage dips and interruptions.

Note 2 to entry: A voltage dip is also referred to as voltage sag. The two terms are considered as interchangeable; however, this document uses only the term "voltage dip".

**3.9****voltage swell**

temporary increase of the voltage magnitude at a point in the electrical system above a threshold

**3.10****voltage unbalance**

condition in a polyphase system in which the RMS values of the line voltages (fundamental component), and/or the phase angles between consecutive line voltages, are not all equal

Note 1 to entry: The degree of the inequality is usually expressed as the ratios of the negative- and zero-sequence components to the positive-sequence component.

Note 2 to entry: In this document, voltage unbalance is considered in relation to 3-phase systems.

[SOURCE: IEC 60050-161:1990, 161-08-09, modified – "phase voltages" has been replaced with "line voltages (fundamental component)", "consecutive phases" has been replaced with "consecutive line voltages" and the notes have been added.]

### 3.11

#### **transient overvoltage**

short-duration overvoltage of few milliseconds or less, oscillatory or non-oscillatory, usually highly damped

### 3.12

#### **power quality**

##### **PQ**

characteristics of the electricity at a given point on an electrical system, evaluated against a set of reference technical parameters

Note 1 to entry: These parameters might, in some cases, relate to the compatibility between electricity supplied on a network and the loads connected to that network.

### 3.13

#### **mesh**

group of electrical equipment powered from one or more circuits of the electrical installation for one or more zones including one or more services for the purpose of electrical energy efficiency or demand side power quality

[SOURCE: IEC 60364-8-1:2014, 3.1.8, modified – "or demand side power quality" has been added.]

### 3.14

#### **supraharmonics**

disturbances in the range 2 kHz to 150 kHz

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### 3.15

#### **power metering and monitoring device**

##### **PMD**

combination in one or more devices of several functional modules dedicated to metering and monitoring electrical parameters in energy distribution systems or electrical installations, used for applications such as energy efficiency, power monitoring and network performance

Note 1 to entry: Under the generic term "monitoring" are also included functions of recording, alarm management, etc.

Note 2 to entry: These devices may include demand side quality functions for monitoring inside commercial/industrial installations.

[SOURCE: IEC 61557-12:2007, modified – In the term and definition, "measuring" has been replaced with "metering".]

### 3.16

#### **power quality instrument**

##### **PQI**

instrument whose main function is to measure, record and possibly monitor power quality parameters in power supply systems, and whose measuring methods (class A or class S) are defined in IEC 61000-4-30

[SOURCE: IEC 62586-1:2017, 3.1.1]