

Power Quality Permanent Monitoring Systems in Romania

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1. Brief introduction

Transelectrica is the Romanian Transmission System Operator and at the same time, the Balancing Market and the Metering Operator of the wholesale electricity market. The power quality (PQ) aspects are very actual and important in this company activity at the interface with Electrica, the Distribution and Supply Operator, and with eligible customers. According to [1] and [2] Transelectrica has to monitor permanent or temporary in PCC and report monthly to ANRE the supply voltage quality regarding to: power frequency, magnitude, harmonic and unbalance.

In order to achieve those goals, for two years, Transelectrica has developed:

1) Since 2005, dedicated CT and VT measuring transformers have been installed in each metering points of wholesale electricity market.

2) Since February 2006, the first PQ monitoring system has been dedicated to the permanent monitoring of the interface between transmission and distribution power grid, at a voltage level of 110kV.

3) Since September 2007, the third PQ monitoring system has been dedicated to the permanent monitoring of the interface between the transmission power grid and the eligible customers, at voltage levels of 110kV, 220kV, 400kV.

Key words

Power Quality, Permanent Monitoring, System, Instrument, Point of Common Coupling.

2. PQ monitoring systems

A. The first PQ permanent monitoring system

The first PQ permanent monitoring system has been installed in the PCC, between transmission and

distribution power grid, at a voltage level of 110kV power auto/transformers. The system architecture of the first PQ permanent monitoring system consists of seven PQ instruments, type ION7650 [3] and one database server, administrated by the software ION Management, installed at central level, at the headquarters of Transelectrica Sibiu Subsidiary. The communication between site level and central level uses analogue modems, equipments for optical fiber medium.

The data collected by PQ instruments are readout on request to the central level, stored in a common database and exported to Excel or HTML files. On central level the statistical reports are automatically generated for weekly determination of cumulative probabilities 95% of power frequency, supply voltage magnitude, supply voltage unbalanced, voltage harmonics, total harmonic voltage, interharmonic voltage, long time flicker variations, as shown in figure 2.

Monthly the reports for PQ parameters with the admissible limits set for high voltage are sent to the National Dispatch and included in the reports towards ANRE. Also, the yearly reports of the supply voltage dips, overvoltages and interruptions are tabulate according to [4].

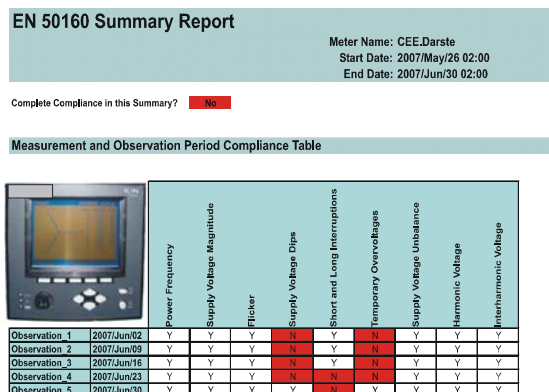


Fig. 1. The first PQ system report

B. The second PQ permanent monitoring system

The wholesale energy market in Romania has been 100% liberalized since 01.07.2007 and from September 2007 Transelectrica had implemented a permanent monitoring system at the interface between transmission power grid and all eligible customers supplied by transmission power grid. Special attention is required for customers supplied at very high voltage levels: COST Targoviste, the biggest plant in metallurgy industry, ALRO, the largest aluminum smelter in Central and Eastern Europe, DUCTIL Steel, Iron Plant Resita and MECHEL Campia Turzii focused on mining products, rolled steel, casting products.

The system architecture of the second PQ permanent monitoring system consists of fifteen PQ instruments, type ZMQ202, very high precision meter with dedicated PQ recorder module [5] and one database server, installed at central level, at the headquarters of Transelectrica OMEPA Sibiu Subsidiary. The main communication between site level and central level uses optical fiber medium and GSM modems, for backup.

The parameterization, measured value acquisition, event analysis and reporting are managed by Simeas Q PAR, Sicaro Q Manager and Sicaro PQ software [6]. 'Statistical analysis of network quality' reports according to [4], for admissible limits according to [1] are issued automatically for weekly analyse of cumulative probabilities 95%, maximum, minimum, and average values. Monthly these reports are sent to the National Dispatch. The reports are generated like an overview, presenting numerical and graphical analyses of the PQ parameters: power frequency, supply voltage magnitude, supply voltage unbalanced, total harmonic voltage, voltage harmonics, current harmonics, flicker P_{It} , slow voltage changes. All are exported to HTML files, with links for each PQ parameter, as shown in figure 2.



Fig. 2. The second PQ system report

3. Further Information

Further we propose future developments such as integration of the reports generated by the systems, which will provide access for different users like National

Dispatch, via internet browsers. The goal of this integrated system is to assist the dispatcher in taking the necessary action to keep the PQ parameters in admissible limits, adopt the configuration for single line diagram, or the connection of different voltage tap of autotransformer.

4. Conclusion

In Romania, in order to create a unitary system, the performance standards for transmission and distribution power grid need to be correlated. The scope is to define clear and complete the performance PQ parameters in the PCC. Continuous PQ monitoring systems are the necessary steps towards the development of PQ regulation.

On the wholesale energy market, the monitoring of the PQ parameters requires the use of class A performance PQ instruments. Also, the equipments/software needs to be used in PQ analysis together with a good knowledge of the measurement uncertainty, calculation formulas, and the implemented measurement, aggregation and ascertainment methods. In this field there is a need for qualified personnel.

The permanent monitoring of power quality parameters is used to verify the contractual requirements presented in regulations. Special attention is required for customers connected at very high voltage (steel and aluminum processing plants). Perturbations generated by their technological processes are transmitted over transmission power grid and affect PQ parameters, for other customers located at great distance about the PCC, like the voltage harmonics and flicker.

At the same time PQ has an important effect regarding network economic efficiency and represents a defining parameter for performance network evaluation. The PQ permanent monitoring systems presented above are used to monitor the performance evolution of a network during long periods, to compare different networks evolutions during the same period. Hereby we propose to extend the permanent PQ monitoring by implementing new systems that will optimize the power grid operating mode for network optimization, technical energy losses reduction and customer satisfaction.

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