MEASURING THE LEVEL OF THE PRODUCTS QUALITY FROM ENERGETIC POINT OF VIEW

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ABSTRACT: The total quality management principles are the following: satisfying the clients; good relationships with the providers; improving the work procedures; preventing the quality errors; leaders' development of the organizational culture; frequent measuring and assessing the clients' needs, the providers' activity, the competitors; training the employees; highly involving the employees and the team work by using the communication and by applying correctly the motivation (programmers for salary incentives, participation to the profit, awards for special contribution to quality, financing some training courses, flexible work program with the purpose of improving the quality of life related to work, etc.). The present paper deals with the current trends in addressing the issue of electricity quality, presenting the advantages and disadvantages of each of them.

KEY WORDS: energy, quality management, energetic efficiency.

1. INTRODUCTION

The word "quality" comes from the Latin „qualis", which means „manner of being". Leaving from this meaning, there are over 120 definitions given to the quality concept, without reaching a common point of view. A broader point of view accepted in defining the quality is represented by „the use value", which represents all the properties that make a product useful to man. A French norm defines the quality as the aptitude of a product or service to satisfy the users' needs [15].

The quality of a product or service represents an extreme complex notion, therefore it is required to take into account a high and diverse number of factors, but in the same time the notion must synthesize those characteristics which, in relation to the specifics of the product or service, have distinct weights and significations.

The quality of electricity supply service is determined by the following factors:

- the operational safety of the installation;
- the electricity quality at the delimitation point between the consumer and the provider;
- the electromagnetic compatibility of the installations with the environment they are operating in, in the shared connection point.

2. OPERATIONAL SAFETY

Through operational safety (reliability) it is understood the aptitude of a device or of an installation to perform its function specified in the given conditions, during a given reference period. Some include here the continuity and serviceability concepts.

Among the main indicators that characterize the operational safety, respectively the continuity in the supply of electricity to a consumer, at the delimitation point from the provider's network, we mention:

- the annual number (average/maximum) of stops eliminated through repairs, respectively through manoeuvres;
- the average duration of an interruption;
- the maximum recovery time;
- the total average duration of interruption per year.

The main factors that influence the powering continuity of the consumers are:

- the reliability of each element that enters the electrical supply installations;
- the configuration of the electric scheme and treatment of the neutral;
- the characteristics of the protections through relays (sensitivity, selectivity, rapidity, operating safety);
- the existence of automatic systems, type AAR, RAR şi DAS;
- exploitation quality.

The outages can be classified by their duration, respectively by their consequences. In table 1.1 the causes and effects of the power outages and also means of ensuring the continuity in supply are presented [4,8,11,13].

Table 1.1. Causes and effects of power outages and means of ensuring continuity in supply

Nature	Origin	Effects	Remedies
Long outages (t>1min)	**Provider:** permanent defects **Causes:** weather, protections	stopping the production, disorganization of production, product losses, reducing the operational safety	**Provider:** a denser network, underground lines, fault detectors on the airlines **Client:** electrogene groups, double power supplying, uninterruptible power supplies (SAN)
Short outages (1min>t>1s)	**Provider:** semi-permanent defects **Causes:** slow cycles of RAR on LEA	similar with the ones from the long outages, risk of equipment destruction	**Provider:** similar to the ones from the long outages **Client:** AAR on double power supply, SAN
Micro outages (t<1s)	**Provider:** transient defects on LEA	Computer -controlled system disturbances, stops of the technological processes, extinguishing the gas discharge lamps	**Provider:** lightning conductors, underground lines **Client:** protection of the command and control circuits, contactors self-retaining, SAN

2.1. Electricity quality

Through quality indicator it is understood a feature of quantitative assessment for the properties of a product, which is analyzed in terms of meeting the requirements regarding the elaboration, exploitation or consumption.

In what regards the electricity, the ideal purpose of any electricity supplier is to permanently make available to the consumers a sinusoidal alternative voltage, with an effective frequency and value maintained in particular limits that have been established through the contract, equal on the three phases of the network [6,12].

The system of electricity quality indicators must allow measuring/estimating the quality level in a particular point of the network on a given moment, and also comparing the obtained information with the level that is considered optimum or at least tolerable by most of the consumers connected to that electrical network.

In most of the countries, the system of the electricity quality indicators consists in some quantitative characteristics of the slow variations (deviations) or rapid variations (fluctuations) of the actual value of the voltage, the form and the symmetry in the three-phase system, and also the slow/rapid fluctuation characteristics of the frequency [1,2,5,7].

In Romania, up to the moment, there is no unitary quality standard of electricity. Some of the parameters that may present interest in defining the quality of the electricity are individually defined and normed, as follows:

- STAS 930 – specifies the nominal voltages and the permissible deviations of the voltage from these values;
- PE 124 – contains definitions and regulations regarding the rapid variations and the voltage asymmetry;
- PE 109 – defines the surges and the protection of the installations against them;
- PE 142 – regulates some aspects regarding the flicker;
- PE 143 – approaches problems regarding the non-symmetric and deforming regimes.

2.2. The main causes of the electricity quality deterioration

Providers cannot supply ideal quality electricity to their consumers, due to some constructive characteristics of the installations they have, on one side, and on the other side due to some disturbances that appear inherently in the operation of the energy systems; these may affect all the characteristics of the voltage wave: frequency, amplitude, the form and symmetry in the three-phase systems [9,14].

2.3. Energy monitoring

Energy quality analyzers must be placed in the locations determined through the planning and inspection process. Generally, in order to determine the quality of the energy offered by the provider, place the analyzer in the general point of supply. In order to solve a problem manifested at the level of sole equipment, place the analyzer as close as possible to the electric charge. It is important to monitor both the voltage and the current. By monitoring the voltage- the occurrence of a energy quality problem is identified and by measuring the current- the source of the problem can be determined, either downstream or upstream of the electric charge [3,10].

The 3 steps monitoring process, assumes: (1) using the way of visualizing the waveforms in order to visualize the corresponding current and voltage amplitudes and the waveforms, (2) using the settings of the time interval to register the background events and the slow variations and (3) using the limitation and sensitivity thresholds to register the perturbations and the events that may affect the monitored equipment or process. Periodical check of the registered data allows the user to "modify" the limit values in order to capture only those events that are important for the proper operation of the equipment. (why fishing an entire ocean when you are interested only in fish ?)

There are five simple rules that must be taken into account when conducting a study on energy quality.

1. Apply the "reasonableness test" on all the data and information. The Physic basic rules cannot be

temporary rejected in order to give credibility to a phenomenon.

2. Know the performance and safety limits of the monitoring and testing equipment.
3. Search the obvious things. Most of the energy quality problems can be solved step by step.
4. Do not fall for "paralysis by analysis". Establish reasonable monitoring thresholds, focus and start from high importance and magnitude events.
5. Probably the most important rule: start with the simple things. People are always surprised by the fact that seldom the energy quality problems are caused by simple things such as imperfect connections.

2.4. Quality analyser

Three-phase analyser for the energy quality Fluke 435.

Figure 1. Three-phase analyser Fluke 435

The cost of this device is approximately 5634 Euros [16,17].

3. ADVANTAGES AND DISADVANTAGES

3.1. Advantages

Generous data analyzing possibilities. Fluke 430 series II analyzers offer three ways of analyzing the measurements. The sliders and the instruments for adjusting the focal length can be used in real time while performing the measurements, or „offline" for the measured data. In addition, the memorized measurements can be transferred to a PC with the help of the included software in order to make personalized analysis and to create reports. The measured data can be also exported to common programmers that use spreadsheets. You store hundreds measured data sets and screenshots to use in reports (depending on memory capacity).

Easy to use. Due to pre-programmed settings and easy to use screens, testing the energy quality is very simple, exactly as you expect from Fluke. The high resolution colour screen updates on each 200 ms and displays the waveforms and the connection schemes in colours according to the standards in the field. The connection schemes, conveniently displayed on the screen, for all the three-phase and one-phase configurations commonly used, guide you to the connections.

It measures anything. You measure the values for true-RMS, the maximum voltage and intensity, frequency, outages and peaks, transient currents, interruptions, energy and energy consumption, maximum demand, harmonics up to 50, inter-harmonics, scintillation, signaling network, INRUSH technology and the disequilibrium.

3.2. Disadvantages

Lately, the people from the electricity field are grouped in two sides. The Traditionalists are embracing a certain point of view regarding the future of electricity, the Novators are embracing another point of view. Each side can bring convincing arguments to support their own point of view to the detriment of the other. But most of the controversies are rather centred on the short term advantages and disadvantages than on a long term vision. Rightly, the obvious lack of long-term

vision could be the most disturbing consequence of the recent changes.
The challenge is direct!

- „How can we make the electricity advantages available for everyone, in safety conditions and for a reasonable price, without causing major damages to the planet?"

A potential answer would be:

- Ensuring the quality and efficiency of using the electricity, a process in which measurement plays a decisive role. In this field too, as in any other field, the stimulant „Measure what is measurable and make measurable what is not", [Galileo Galilei] remains valid.

4. CONCLUSION

The current trends in approaching the problem of electricity quality are mainly focused in three directions:

- analysing the current quality parameters and developing some efficient monitoring programs, which are to be the basis of some correct relationships among the participants involved on the track production-consume;
- evaluating the deviation effects in connection with the limits recommended by the national regulations;
- establishing some efficient technical, organizational, contractual and juridical measures, to ensure framing the quality parameters within the limits imposed by the standards.

Ensuring a standard quality level for electricity (CEE) in the nodes of the electrical networks and monitoring correctly its parameters in these points are determining elements in ensuring the services provided by the provider.
Knowing the CEE parameters, the practical way of determining, the interpretation of the results obtained from their monitoring and knowing the allowed limits of the deviations, present a great interest for ensuring a high standard quality energy and for decisions regarding the measures that must be adopted in this purpose, for any of the network operators.
The electricity quality influences the operating conditions of the network, it has great technical and economic implications on the electricity consumption and on the security of the electro energetic system operation. The operation optimization can be assisted by a corresponding surveillance of the processes and by and adequate electricity management, both being directly dependent on electricity quality monitoring.
The CEE aspects must therefore target each participant in relation to the system and the Network Operator with which the consumer has an interface, in relation to the market participants.
The economic and financial implications of electricity quality problems, which cause annual losses of millions of EUROS at the level of the European countries, require finding effective solutions from the perspective of minimizing-eliminating these problems in order to increase the productivity. Monitoring the electricity quality remains the most affordable alternative to detect and diagnose the problems at the level of the system.
The current trend of developing decentralized electricity production, using renewable sources, which is generally uncontrollable, must be addressed. This makes monitoring and also developing construction elements and data base administration by CEE to be essential, which allow developing and maintaining the electricity quality control systems.

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