THE QUANTIFIABLE COMPONENT OF QUALITY MANAGEMENT IN ENERGETIC INDUSTRY

CLAUDIA ISAC *

ABSTRACT: *The present paper intends to highlight aspects of the quality management characteristic to the energetic industry and particularly its distribution. The items listed are just a part of a more extensive research in this area and it focuses mainly on quantifiable items such as general and guaranteed performance indicators which prove that quality can be quantified and is not an unquantifiable component. The quality indicators presented demonstrate that the energetic system, including the quality management system can be included in the European trends and the alignment to these trends is compulsory considering the characteristics of the continuous product flow and of the non-stock items within this system.*

KEY WORDS: *quality management system; performance indicators; level of quality; the indicators of quality of electric energy; electric network.*

JEL CLASSIFICATION: *M 11; Q40.*

1. INTRODUCTION

The evolution of the concept of quality has been closely linked to industrial development, this being more prevalent in the last 20-30 years, when, the quality management systems may be considered 'modern weapons' and effective for the company management in the fight against competition.

Through quality management the managerial team seeks to meet expectations by offering products that comply with certain standards at competitive prices and by delivering them in effective terms. Inadequate quality of industrial production adversely affect the efficiency of the economic activity because it generates high costs with troubleshooting, it has the effect of loosing of customers, orders, and even minimize the prestige of the company.

* *Assoc. Prof., Ph.D, University of Petrosani, Romania, isacclaudia@gmail.com*

The definition of total quality management (T.Q.M) can be synthesized via the following definitions given by many researchers in recent years (Zaire, 1991; Oakland, 1989; Pfan, 1989; Pugna, 2002; Soare & Colceru, 1995):

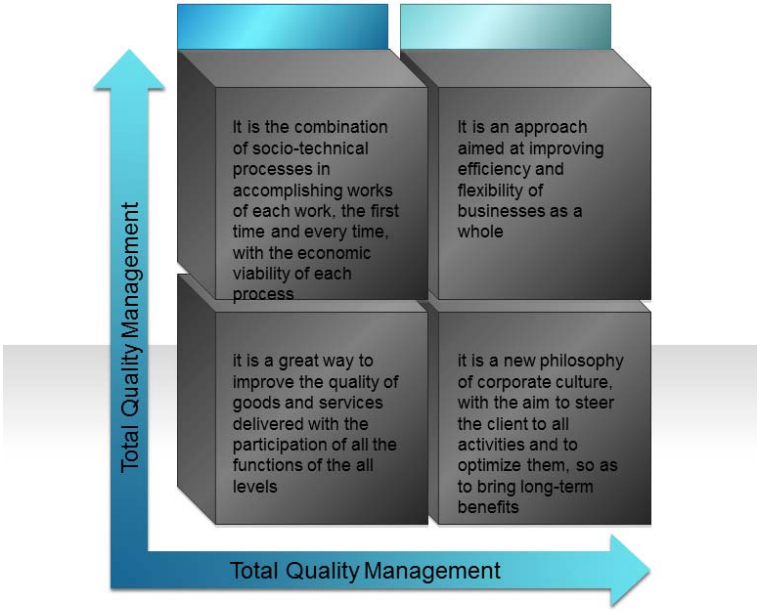

Figure 1. Definition of Total Quality Management

Total quality management is the concept of continuous improvement of products, processes and management at all stages and phases of existence and actions through the participation of all factors at all levels and in all functions of the organization within an organizational and improved operational system, characterized by clear relationships based on persuasion aimed at improving the quality, reliability and cost through innovation and by increasing efficiency and the effectiveness of business aimed at complying with the customer's requirements and exceeding his expectations (Popescu, 1998).

2. THE IMPORTANCE OF TOTAL QUALITY MANAGEMENT

The importance of quality has resulted in the emergence of total quality management as an all-embracing concept which provides a broad framework for action, leading to a process of continuous improvement by extending the requirements for quality of the products and processes and of the relationships, attitudes and beliefs, towards a new industrial culture, a culture of integration and quality. The main elements of quality models refer to:

- stakeholders. The results obtained during the economic processes are addressed not only to clients, even if they remain the most important category, but also to employees and to society. The total participation of employees is

considered to be an essential factor, and among the various causes of the success of these broad participatory activities, the importance of leadership exercised by top managers cannot be ignored.

- the factors and the results converted into a continuous process of learning and innovation, where knowing its own employees and the coordination of their activity is a key element;
- "management excellence", i.e. defining the 'targets', represents the development of an optimal approach in order to determine quality policies and strategies. A systematization of quality strategies – strategies for adapting the quality of products and processes to the requirements of market segments, strategies of differentiation by quality of the offers of competitors, strategies for diversification through quality and strategies for continuous improvement of quality – enables to highlight the various opportunities the company has in order to implement a system of quality management.

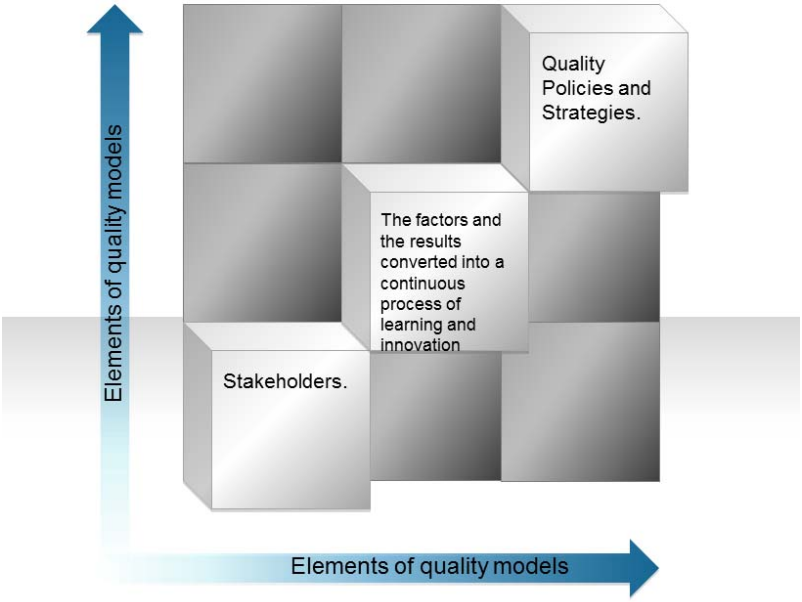

Figure 2. Elements of Quality Models

The energetic industry is a sensitive and complex area in the world economy, through its specific characteristic, given by the non-availability of finished product storage, by wide territorial spreading and last but not least by its importance for the development of the society. The restructuring of this industry and the introduction of competitive mechanisms in the production and supply of electric energy aims at increasing the level of satisfaction among consumers, which is obtained by two

coordinates, and increasing the quality of the service offered by lowering prices. Since the first coordinate is more difficult to quantify by consumers, and the quality of service can be proved after signing the contract, there is a risk that the reduction in price triggers a reduction in the quality of the service provided. For these reasons, in addition to supply licenses of electricity and heat and the components of a regulatory framework, in Romania, the National Authority for Regulations in the field of Energy has developed 'Performance standards for the supply of electricity at regulated rates' that includes quantitative indicators and qualitative levels for each activity included in the services related to electricity.

3. THE METHODOLOGY FOR THE CALCULATION OF INDICATORS OF PERFORMANCE

Performance standards intend to make providers ensure a minimum level of quality of the service supplied– thus establishing the guaranteed performance indicators - and ensure objective assessment of the performance of each supplier as well as making comparisons between them on the basis of general performance indicators. The most important *guaranteed performance indicators* for the supply of electricity consider the following aspects:

- according to the supply license, the supplier is obliged to meet any connection requirements of potential consumers, to ensure the measurement of the quantity of electricity sold to the consumer, to set up a system for recording, investigating and settling complaints etc.;
- granting price reductions for the electricity supplied with voltage deviations from standard limits;
- compensations for damages caused by the interruption of electricity supply;
- the commercial quality of the delivery service;
- supply continuity;
- the technical quality of electricity;
- setting up information desks or offices to serve consumers.

General performance indicators are designed to create an image of the quality of the service provided by each supplier, and the values specified by standards constitute a minimum limit of the quality of the service. These indicators refer to:

- the connection of consumers is reflected through two annual performance indicators:
- the number of requests of consumers to connection to the mains differs according to voltage levels and types of consumers;
- the number of requests for which the length of time for registering the connection request is less than 15, 30 or 60 days.

The measurement and management of electricity refers to the obligation of the supplier to measure the electricity sold in accordance with the type of rate selected by the consumer, to ensure the management of voltage measuring units and the installation, verification, maintenance, repair and the replacement of measurement units and low voltage electric meters;

- the measurement, billing and collecting the price of electricity supplied can be assessed by the following annual performance indicators: the number of complaints regarding invoicing by consumers, the number of complaints resolved within 10 working days, the number of complaints which proved to be justified, and the number of consumers disconnected/re-connected for non-payment of invoices;
- accidental interruption of electricity requires that the supplier ensures the arrival of the service teams within an hour in major cities, and within three hours in the rest of the towns and within 24 hours in rural areas.

The council for regulations in member countries of the European Union (CEER) has drawn up a report on the performance indicators of the delivery service, which fall into three categories: trade indicators, indicators for continuity in supply, voltage quality indicators. By imposing these standards follows CEER follows the convergence of the provisions within these standards so that the single market for electricity can be homogeneous in terms of the quality of the service provided.

In the energy sector there are various approaches of the term of energy quality. In the broad sense, the notion of energy quality can be interpreted as the quality of electricity supply service which has three aspects: the reliability of supply, the quality of energy supplied and a proper information circuit.

Although theoretically, specialized textbooks in the field of energy uses the term energy quality since the 1980s, a systemic approach of this notion was given a great importance in the last decade, both from managerial considerations due to the use of modern management methods in order to improve the quality of production and from technical point of view related to the existence of receivers sensitive to the changes in the quality of energy supply, the rapid expansion of digital telecommunications, computers and computer networks and last but not least the de-monopolization of the energetic industry, which leads to competition among companies within the chain of production, transport and distribution of electricity, one of the competitive factors being its quality.

The emergence of quality systems and the total quality concept has changed the nature of the relationship with their providers, currently requiring an appropriate system of quality and even surveillance and a systemic assessment of subcontractors. That is why in the case of energy production plants, especially thermal power stations, the problem of quality of primary energetic resources is especially important due to its influence on reducing specific consumption, the heat loss, dust emissions directly proportional to the percentage of the fuel ash etc.

In terms of coal, its quality is given by the calorific value, by the ash content and moisture and in the case of pit coal it is given by the quality of the dressing/preparation process.

In order to improve the quality of coal, one should make changes in various ways both in the case of the producer and in the case of thermal power pants. Thus, if the producer, in addition to improving the technological process meant to exclude the interstices of sterile and any water infiltrations, seeks to avoid the contents of xilite, and if the beneficiary, the thermal power station, respectively makes a selective coal reception by correct sampling and by using a performing laboratory equipment, the

ignition of the stored coal[1] can be avoided, coal would be dried before grinding and during grinding the diameter of coal particles can be as small as possible.

Improving the quality of electricity is an obligation of the supplier, for which it must make an analysis of the indicators of the quality of electric power. The indicators of quality of electric energy defined by the specialized literature in the country can be found in the directive of the European Community Council no. 89/336/EC concerning in particular the primary indicators that depend on the electricity provider:

- the frequency deviation (Δf) – represents the difference between the real and the nominal value of frequency:

$$\Delta f = f_{nom} - f_r \tag{1}$$

where:
f_{nom} – is the standardized nominal frequency of 50 Hz;
f_r – is the frequency of the network at any given time [Hz].

- voltage deviation (ΔU) – is calculated as the difference between the real and the nominal value of the voltage:

$$\Delta U = U_r - U_{nom} \tag{2}$$

where:
U_{nom} - is the nominal value of voltage [kV];
U_r – is the real value of voltage [kV].

- the amplitude of voltage variation is the difference between the amplitude or the real value of the voltage up to and after a single variation of voltage. Single variation of the voltage is the variation of the real or maximum value of the voltage between two adjacent levels of actual or maximum values or between the extreme value and the level that is maintained for a certain amount of time;
- the voltage gap and the duration of the gap which means a slump or a short magnitude of the actual value of the voltage in a range between two consecutive contrary voltage shocks;
- the electric shock is a sudden and isolated change of voltage, generally linked to a disruption of current as, for example, during the development of an electric discharge;
- the voltage impulse, i.e. the sudden voltage variation, on a timescale of a few microseconds to tens of milliseconds, followed by restoring the initial voltage.

[1] In order to avoid auto-ignition of the coal that is being stocked it is necessary to obey by some regulations regarding the breakage, the manipulation and the stocking of coal so that the temperature of the aggregation/stock should be less than 45°C and the density of the entire stock should be between 1,05 and 1,15 t/m^3.

In addition to these indicators, specialists use various *coefficients* for voltage fluctuations, non-symmetric coefficients of line voltage and circuit voltage, as well as of some auxiliary parameters regarding electrical power, such as the frequency of voltage variation, the time interval between two consecutive variations of voltage, the depth of the voltage gap or the duration of the voltage pulse.

The characteristic of the consumption within the electric network makes the assessment of the quality of electricity be carried out at large periods of time, usually one week, and checking the classification within the acceptable limits of the quality indicators has a probability of 95%.

Currently in Romania, not all equipment for the evaluation of quality indicators provide information in accordance with international standards, which is why there is the need of purchasing monitoring equipment for online tracking of voltage levels and disturbances, which re easy to use and to integrate into a centralized system as well as their reduced cost is reason enough for their implementation.

The use of equipment for tracking quality indicators of electricity and the processing of information on the basis of statistical algorithms in accordance with international standards enables the assessment of the level of disturbances determined by some consumers and affecting the quality of the electricity supplied to other consumers. Deviations from these indicators can affect the level of production, reducing the life of the equipment used and this may lead to rejections in the technological process.

The importance of the information obtained from the use of such equipment is greater if the quality of electricity from distribution networks may represent one of the important criteria in the selection of the supplier.

Damages caused by permanent deviations from the quality indicators of the electricity supplied to industrial consumers can be calculated as follows (Albert et al., 2001):

$$D = C_r - C_N \cdot p \cdot c_d + D_c + D_r \quad (3)$$

where:
D – is the amount of damage;
C_r - refers to production costs in terms of deviations from quality indicators;
C_n - represents production costs at quality indicators equal to the contracted ones;
C_N - means production costs at quality indicators equal to the contracted ones;
P – is the level of production in case of disturbances in the quality of indicators as opposed to contracted values;
C_d - is the life of equipment in conditions of deviations of quality indicators from the contracted values;
Dc – represents the damage caused by the reduction in product quality due to deviations from the agreed quality indicators and failure in delivering contracts;
Dr – refers to the damages caused by rejections in the production process.

Therefore, the reduction of the voltage at the input results in increased wear and tear on engines followed by a shorter life cycle, increased energy consumption, increased production costs.

4. CONCLUSIONS

The role of the Quality Management System is mainly to increase the level of performance for services of distribution and supply of electricity and for related services, a level which can be achieved through the continuous improvement of quality indicators. The benefits of approving the Quality Management System for this company are the following: increase our customers ' satisfaction - consumers of electricity; strengthening the partnership with suppliers of services and/or products; recognition of a powerful and competitive management; improving the image of the company in its relations with domestic partners as well as with external ones.

REFERENCES:

[1]. Albert, H.; Răşcanu, V.; Galovanov, N. (2011) *Monitoring the Quality of Electricity at Consumers*, Energetica, nr. 11
[2]. Barrie, G.D. (2003) *Managing Quality*, Lavoisier
[3]. Oakland, I.S. (1989) *Total Quality Management Heinemann Professional*, UK
[4]. Pfan, L.D. (1989) T*QM Gives Companies a Way to Enchance Position in Global Market Place*, Industrial Engineering
[5]. Popescu, D. (1998) *TQM, a Concept of Continuous Improvement,* Revista Română de Informatică şi Automatică, nr. 1,
[6]. Pugna, C. (2002) *Conceptul evolutiv al managementului calităţii,* Tribuna Calităţii, nr. 11-12
[7]. Soare, I.; Colceru, Al. (1995) *Organizarea şi conducerea sistemelor calităţii la nivel de întreprindere*, Ed. Tribuna Economică, Bucureşti
[8]. Zaire, M.; Simintiras, A.C. (1991) *The Sales Link in the Customer – supplier Chain Productivity*
[9]. http://www.biblioteca-digitala.ase.ro/biblioteca/carte2.asp?id=78&idb, [Accessed 12 october 2012]