

Mykola TRYPUTEN, (Dnipro University of Technology)

Alisa KUZNETSOVA, (Oles Honchar Dnipro National University)

Maksym TRYPUTEN, (Oles Honchar Dnipro National University)

EVALUATING THE EFFECT OF ELECTRIC POWER QUALITY UPON THE EFFICIENCY OF ELECTRIC POWER CONSUMPTION

It is common knowledge [1] that any electromagnetic environment is formed as a result of a certain technological process. In the context of electric power process, power supply systems are distribution of electric energy, its transmission, and consumption. Every stage of the process is characterized by definite changes being a result of deviations from the determined operation mode, principle of electric equipment action etc. Electric energy characteristics (EECs) are the levels of electromagnetic compatibility of electric grid providing adequate performance of any electrical means connected to the grid if the EECs do not exceed permitted values.

In the context of general idea of electromagnetic compatibility of consumers within power supply grids, power quality is the topical problem of modern electric-power supply industry. Its solution effects heavily the improvement of efficiency of electric energy use. Development of basic tendencies intended to improve energy efficiency of electric power supply grid depends upon the identification of the reasons causing degradation of electric energy quality. Electric energy quality is the significant factor effecting performance capability of the efficiency of power system and consumers.

A problem to provide quality of electric energy within power grids is important since a number of new progressive technological processes and systems have been implemented recently. Thus, increase in nonlinear and unsymmetrical energy consumers is also available [2].

While selecting measures to improve the efficiency of electric equipment in the context of inadequate electric energy, it is first required to determine reasons of the situation; to identify actual values of the specified quality indices; and to compare the latter with the permitted ones. It should also be mentioned that despite the great consequence of the problem, information concerning integral assessment of electric energy quality within grids of Ukrainian industrial enterprises is not available.

The above does not concern studies of electric energy quality within workshop grids of Alchevsk Metallurgical Integrated Works [3]. Electric drives of rolling mills of roughers and semifinished mills are basic consumers at the enterprise as well as the other similar ones. Power of such drives may be up to 13 MW; it concerns the electric drive of blooming operating at ArcelorMittal OJSC (town of Krivoi Rog). Despite the fact that its upgrading, connected with generator-motor (G-M) system substitution for thyristor converter-motor (TC-M), resulted in the improved control characteristics of the latter, TC-E systems stipulated significant deterioration in the electric energy quality within the enterprises.

Paper [3] shows that the use of TC-E systems by the main drives of rolling mills results in significant distortion of workshop voltage. High harmonics (up to 23-38 order) are available within a grid; moreover, they are even harmonics and odd ones. Coefficients of certain harmonic components are 5-7 times more than permitted values.

Notwithstanding that the problem of TC-E systems effect on the electric energy quality has been under thorough analysis since the moment of the drives extensive use (i.e. since the 1970s) [4], [5], and [6], it is still topical although being one of the reasons of poor quality of electric energy in workshops of Ukrainian enterprises. Unfortunately, paper [3] considers TC-E systems only, and "classic" publications (for example, [5], and [6]) are turned to be old substantially since new processing plants have already been introduced and a structure of

energy consumption by enterprises has varied. Hence, more detailed study is required to analyze typical electric energy distortions as well as their qualitative and quantitative characteristics. It is the only basis for methods to select rational measures aimed at the improvement of electric energy quality.

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