Analysis of the effect of the parameters of distribution transformers on economic electric energy transmission in low-voltage networks

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Abstract **The paper presents an attempt aimed at mathematical description of the effect of some modified parameters of modern power transformers, among others the magnetizing current and power losses in the core, on the power loss and reactive power during the electric power transmission, particularly in low-voltage networks.**

Keywords **Transformens, Electrical effectiveness**

1. INTRODUCTION

The Law of April 15, 2011, on "Electrical effectiveness" defined the objective of economical management of the energy. The Law recommends, among others, auditing the energetic effectiveness of various objects, aimed at power saving. In order to improve the energetic effectiveness, the Law mentions, among others, such undertakings as: reduction of the reactive power flux, reduction of the network losses in line sectors, and power loss in transformers.

2. CHARACTERISTICS OF THE PROBLEM

New types of transformer sheets designed for use in power transformers induced not only reduction of power loss in transformer cores but also significantly delimited intensity of magnetizing current in no-load state of the transformer. Unfortunately, the power loss in the winding, i.e. so called load loss, cannot be reduced. The power transformers, particularly the ones of adjusted number of winding turns under voltage-less state, are distinguished by the highest durability and reliability. Therefore, they are only rarely replaced with new ones, of improved operational parameters. High durability of the transformers, remarkably exceeding 30 years assumed during their designing, does not encourage to replacing them with new transformers of more advantageous parameters resulting in electric energy saving. Even the new standard „Standardized IEC voltages" introduced in 1999, that changed rated voltage values of the networks and AC devices from 220/380V to 230/400V did not result in replacing the transformers with the new ones. The change of rated voltage of the AC network induced the change of rated voltage values of power transformers from 230/400V to 242/420V. Admissible deviation equal to ±10%, defined by the standard, appeared to be insufficient reason for replacing the transformers of former values of rated voltages and former parameters with new ones. Transformer manufacturers still offer at present the units that do not comply with the standard requirements. It should be noticed that AC motors and generators of electric generating sets are manufactured incompatibly with the standard defining the rated voltages. Finally, irrespective of the lack of financial means, the requirements of the "Law of Electrical Effectiveness" related to replacing the devices with the units of lower energy consumption, are uneasy to be fulfilled.

3. EXAMPLE CALCULATION

Taking into account low admissible volume of the paper, only small its parts are presented. Fig. 1 shows the effect of the power factor on the value of active P and reactive Q power of the transformer of apparent rated power S_n = 1000kVA. Fig. 2. Presents the effect of the angle θ (the load) on the value of secondary voltage.

4. SUMMARY AND CONCLUSIONS

Parameters of power transformers significantly affect economic aspects of electric power transmission.

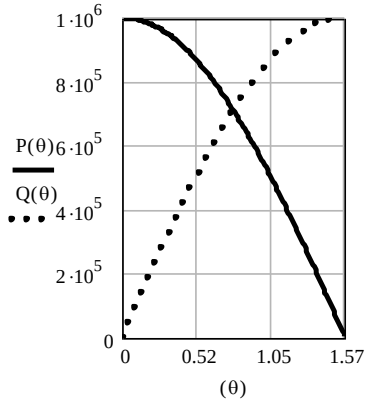

Fig. 1. The effect of the power factor on the value of active P and reactive Q power of the transformer of apparent rated power S_n = 1000kVA

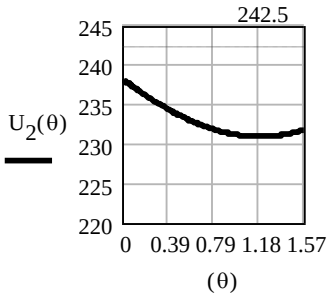

Fig. 2. The effect of the angle θ on the value of secondary voltage

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