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REDUCTION OF ELECTRIC POWER LOSSES IN 10(6) kV INDUSTRIAL ENTERPRISE NETWORKS

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Анотація

Наведено та проаналізовано формули для оцінки тривалості максимальних втрат під час використання максимальної потужності з метою їх застосування для розрахунку втрат.

Ключові слова: втрати електроенергії, ефективність, енергоспоживання, підприємство.

Abstract

Formulas for evaluating the duration of maximum losses during the use of maximum power have been presented and analyzed with the aim of applying them to calculate losses.

Keywords: electricity losses, efficiency, energy use, enterprise.

Introduction

Analyzing formulas for determining power losses in networks is necessary to understand where they come from, what they depend on, and how to minimize them. We will use the available textbook [1]. Sometimes there are cases when data for the calculation formulas are missing or inaccurate. Therefore, there is a need for experimental determination of these indicators.

The aim of the study is to analyze formulas for estimating the time of maximum losses during the use of maximum power and to determine the effectiveness and accuracy of these methods for calculating losses.

Results of the research

The analysis of maximum loss time involves several empirical formulas for evaluating the time of maximum loss through the use of maximum power consumption, for example:

The method of maximum losses over time. (τ)

$$\tau = (0.124 + \frac{T.м}{10000})^2 * 8760$$

Where, Tm – is the hours of maximum power usage.

After analyzing it, we understand that the time of maximum losses directly depends on the hours of using the maximum power, and as it increases, so does (τ). Let's perform several calculations with different values and record them in Table 1.1.

Table 1.1 - The ratio of maximum loss time to the hours of maximum power usage.

Тм, hr	1500	2000	2500	4000	4500	6000
τ, hr	657,7	919,6	1225	2405	2886	4592

There is also a method called the average load method, which is considered simplified. In this method, power losses are calculated for the average load regime, and these losses are calculated using the following formula:

$$\Delta W_a = \Delta P_c \cdot K_\phi^2 \cdot T$$

If we express the average power loss in terms of electricity consumption, then the expression for determining the energy loss will take the following form:

$$\Delta W_a = \frac{W_a^2 (1 + tg^2 \varphi_c) R_e}{U^2 T} K_\phi^2$$

Where, $tg\varphi_c$ - average reactive power factor;

R_e - equivalent network resistance;

K_ϕ^2 - square of the coefficient of shape of the annual load graph.

Note that the average reactive power coefficient, which reflects the amount of reactive power to active power, as we know, power imbalance causes many problems, including losses, as seen from this formula, the greater the coefficient, the greater the average losses. Therefore, conclusions can be drawn.

Conclusions

The results of the research on the formulas for calculating losses are key to our goal of reducing energy losses in industrial power grids of 10(6) kV. We have drawn the following conclusions:

1. The method of maximum loss time clearly shows that the time of maximum losses directly depends on the hours of maximum power usage.
2. The calculation by the method of average loads showed that reactive power affects losses, and therefore compensating for reactive power in the system will reduce the average energy losses.

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