LOWER THE ECONOMIC LOSSES IN ELECTRIC NETWORKS

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This article is dedicated to the reduction of economic (commercial) losses in electric networks, which may occur when power accounting system errors, failures of meters and measuring current and voltage transformers, billing retailing companies because of inaccurate data about subscribers, errors in determining the calculated (sealers) coefficients measuring complex fielding errors in the payment accounts, the demand for payment, payment due by the due date or the long term and bad debts and unpaid bills, electricity theft.

Keywords: electrical networks, electrical energy, power losses, reduced losses, theft of electricity, the economic loss, commercial loss

In the face of rising energy intensity of the national economy and strengthen state energy policy becomes important reduction in the so-called commercial losses in electric networks, which are one of the most significant energy saving potentials.

One of the most powerful components of the commercial losses of electricity theft are acquiring in recent years rampant. The largest number of thefts and kidnaps the largest volumes of electricity takes place in the domestic sector. The reasons for this are, on the one hand, the constant increase in electricity tariffs, while increasing the volume of consumption and reduced ability to pay, and on the other hand – the relative affordability and ease of implementation of a particular method of theft of electricity, inadequate design of metering devices, the primary and secondary circuits their switching, poor technical condition of current transformers (CTs) and voltage transformers (VTs), the lack of a legal framework to prosecute thieves electricity and so on. Curb the rise in electricity prices in the near future for a number of objective reasons not possible. Because of the structure of domestic electricity consumers can not affect the cost of electricity or the wholesale or the retail markets. In this case, due to the decline in industrial production has increased (in percentage terms) the share of electricity consumption in the domestic and small sectors.

A significant increase in power consumption in the residential sector causes significant congestion in the supply of district lines and transformer stations, which, in turn, contributes to (or threat of) accidents in electrical and fraught with undesirable consequences (fire, electric shock and etc.). When electricity theft is not considered part of the power that results in exceeding the maximum permissible load and, consequently, to network overload and disable automatic safety features consumers.

Many industrial enterprises also cannot cope with the increase in tariffs and moving into the category of non-payers, and some of them get in the way of electricity theft. Thus, there are massive defaults energy supply organizations from both the public and from the industrial sector. With this guide power supply companies generally believe that electricity prices in the domestic sector are too low (favorable). In this connection no longer any doubt as to further increase in electricity tariffs, which will cause a corresponding increase in its theft.

At present, there was another significant factor that encourages electricity consumers voluntarily connect to the grid without the permission of joining power and, therefore, without issuing the contract for technological connection to electric networks and energy supply contract: a significant increase in the amount of payment for the connection of power.

In accordance with the Federal Law on electricity for connection to the grid fee is charged only once. The amount of this fee is set by the federal executive authority. In this case, the inclusion of the service fee for the transfer of electrical energy is not allowed. Recently, the fee for connection to electric power grids supplying organizations has increased dramatically. Obviously, not every consumer of electricity in a position to pay a huge sum, and we can only guess what their number has to be connected to the grid illegally without the permission of the power supplier for connection to electric without signing her contract for technological connection and contract supply. Continuous growth in electricity tariffs leads to a decrease in the effectiveness of energy conservation measures, increasing the number of defaulters to the mass theft of electricity.

There is a downside to the problem: the growth of the scale theft of electricity, in turn, affects the increase of tariffs. In this method of theft of electricity is constantly being improved. As they appear to identify new and more sophisticated and covert ways are often not amenable to detection and prevention. The problem of reducing commercial losses became so important, that was under the control of the Government of the Russian Federation, who has commissioned the Ministry of Industry and

Energy of the Russian Federation in the three months to develop and approve the method for determining the normative and actual losses in electric networks. Loss ratios should be established by the authorized federal executive body in accordance with this procedure.

According to these recommendations Methodical loss calculations and optimization of electrical networks should be carried out using appropriate software systems. A special section is devoted to activities to reduce energy losses. The Concept strategy of RAO «EES of Russia» for 2008–2013 «5 + 5» states that the main measures to reduce commercial losses are:

– timely audit work [1];

– control checks of end users;

– improvement of commercial and process accounting on the basis of automated control systems, accounting and control of a power and automated process control of a power;

– automation and the introduction of information technology.

In applying the principles of accounting systems lies the need to identify commercial losses of electricity, and the development and monitoring of the balance of power and the power of individual nodes of electrical networks. How to reduce commercial losses of electricity are actively engaged professionals in the field. Based on the results of these studies have identified the following components of commercial losses [2]:

– loss due to system error of electricity due to an accuracy of measuring instruments and complex unspecified, conditions of work, defects metering and measurement of current and potential;

– loss billing retailing companies because of inaccurate data about subscribers, errors in determining the settlement (of counting) of the coefficients measuring complex fielding errors in the payment of accounts;

– loss in reclaiming payment, due to the payment by the due date or the long term and bad debts and unpaid bills. The presence of an unacceptably high number of defaulters was for power sales organizations are already commonplace;

– loss due to theft of electricity.

The share of the latter component – the theft of electricity – enough high commercial losses. Favorable conditions for the theft of electricity created by the following factors: lack of proper state controlled a commercial supply of electricity, the constant increase in electricity tariffs, availability and ease of technical implementation methods of theft of electricity (installation of switchgear front of metered electricity, the possibility of deliberate understatement of the calculated active power losses in the Installation of commercial meter on the side of low voltage transformers subscriber, access to the schemes of primary and secondary wiring of meters, etc.). It should be another negative factor: the unauthorized load is connected to the grid reduces the level of stress and other factors can degrade the quality of electric power. This leads to an additional loss associated with a reduction in equipment performance, deterioration in the quality of products, marriage, and in some cases – to the failure of some instruments that are sensitive to power quality deviations from the standardized values.

In addition, the theft of electricity saving and distort the statistics leads to increased imbalance between generated and supplied electricity. At present, an increasing number of power supply companies faced with significant imbalances in excess of the allowable values. Calculate, analyze and compare with the actual imbalance tolerance contribute to real quantifiable business losses in electric networks and allow you to control the reliability of electricity in all parts of the electricity system. All components of the balance sheet, except for energy losses in power transformers, meters shall be measured in the design and technical accounting.

In accordance with the standard instructions for electricity metering in energy production, transmission and distribution of the value of the actual imbalance in power networks should be determined by the formula [3]:

$$NB_F = \frac{W_P - W_O - W_{ON} - W_{HN} - W_{IU} - \Delta W_{TR}}{W_P} \cdot 100\%,$$

where W_P – the delivery of electric power substation on the bus; W_O – supply of electricity; W_{ON} – consumption of electricity for their own needs; W_{HN} – consumption of electricity for household needs substation; W_{IU} – consumption of electricity for industrial use; W_{TR} – the loss of electricity in power transformers substation.

For additional unreported growth imbalance causes an increase in the actual component W_O in the formula due to theft of electricity deliveries, and reporting data on energy saving in these cases are too low, respectively, the share of unrecorded commercial losses. Determining the actual unbalance regional electricity power grids of electrical networks in general possible if the calculated technical losses in networks of all voltage classes, including network and 0,4 kV.

In accordance with the requirements of these types of instruction value of the actual

imbalance must not exceed the permissible unbalance NB_D ($NB_F \le NB_D$), is determined using the following formula:

$$NB_D = \pm\sqrt{\sum_{i=1}^{m} \delta_{pi}^2 \cdot d_{oi}^2 + \frac{\delta_{p3}^2}{n_3} \cdot d_3^2 + \frac{\delta_{p1}^2}{n_1} \cdot d_1^2},$$

where m – total number of metering points, securing the largest inflow and out flow of electricity to large consumers of electricity separately; δ_{pi} – accuracy of measuring complex terms of electricity; d_{oi} – the share of electricity accounted point calculation; δ_{p3} – accuracy of measuring complex three-phase consumers (below 750 kV·A)); δ_{p1} – accuracy of measuring complex single-phase consumer; n_3 – the number of metering points three-phase loads (other than those recorded in m), for which the total energy of the relative permit d_3; n_1 – the number of metering points of single-phase consumers (except recorded in number), for which the total energy is a relative pass d_1.

If there is no methodology for assessing the economic impact of electricity theft, which is not possible to develop because of the lack of complete and reliable statistics on the facts of her theft, there is no reliable basis for even a rough estimate of actual damages from theft of electric energy a qualitative analysis alone, even a significant number of cases of theft of electricity (which is unknown until now and is unlikely to be known exactly and in the future), for the solution of the problem, of course, is not enough [4].

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