Investments reduction on developing the generating capacity with differentiated electricity tariffs

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Abstract. The article presents the problems of cost reduction based on the use of a differentiated tariff in the power system. Information on the economic feasibility of the implementation and rational use of differentiated tariffs for various power systems is presented, concerning the introduction of one-rate and two-rate tariffs based on short-term and low-cost measures. It is shown that the transition to a differentiated tariff system plays an important role in increasing the energy efficiency in large industrial enterprises.

1 Introduction

Economic relations in electric power systems (between electric power producers and consumers) and in the branches of the country's economic system are regulated by electricity tariffs. The energy and economic security of the state depend on the perfection of these relations. The tariffs applied in Russia today are relatively simple due to substantial subsidies in the past. To make them market-oriented, an in-depth analysis of tariff systems is required.

In particular, due to the use of a differentiated tariff, the load schedule is smoothed (compressed) and the safe and economical operation of the power system is ensured. A differentiated tariff contributes to the formation of an optimal and sustainable structure of generating capacities, by accounting for the features of technical and economic characteristics of generating capacities.

Reducing fixed costs to cover a certain demand for electricity can be achieved by reducing the maximum load, or by providing an increase in electricity generation without additional investment in generating capacity; it is also possible to increase the reliability of the power supply system without additional costs. Leveling the load schedule can help reduce fuel costs and emissions.

Besides, in conditions of significant inflation, the costs of restoring fixed assets of the power system can significantly exceed depreciation deductions.

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2 Research methods

The methodological provisions are based on the results of theoretical and practical research, in a broad generalization of practical experience in assessing the total energy intensity of products, scientific works of TIIAME and the Scientific and Technical Center of JSC "Uzbekenergo". Practical research was carried out using standard and special developed techniques, the reliability of the results was evaluated by verifying the research results.

3 Results and discussion

In the electricity market, tariff policies are applied in different ways to regulate, as a result of which high prices can lead to the destruction of the monopoly, prices will be the same, suppliers will not cover the costs of the power plant. Foreign energy markets do not provide a clear development of investment; investment processes in market models are long overdue due to clear initial reforms in the process of electricity generation.

The form of tariffs, taking into account the electricity in order to cover the costs of electricity generation, will greatly help in solving the problem of formation. Moreover, to increase the cost of electricity, power plants are one of the most optimal management methods for generating loads. By saving electricity, it is possible to motivate consumers and increase the supply of quality and reliable electricity. Subsequent requirements are very high and will be one of the key factors in regulating the balancing of tariff policy.

The consumer is ready to change the tariffs for electricity at any time, only when it is an economic benefit for suppliers and consumers in this direction. Nevertheless, the transition to time-stratified tariffs requires serious legal production. Determining and approving the norms of electricity consumption cycles in manufacturing enterprises is socially justified.

Residents and settlements, industrial enterprises, manufacturing enterprises, factories and a number of electricity consuming organizations will be able to pay for electricity consumption at reduced prices as a result of the application of time-varying tariffs during non-peak hours of the day.

Determination of the so-called Short Run Marginal Costs (SRMC) represents the additional costs of the power system necessary to cover a short-run unit increase in electricity demand, i.e. the cost of generating additional electricity on the most economical generator at a given time. Using this concept, electricity tariffs are set differentiated in time and they reflect the costs of the power system for the generation, transmission and distribution of electricity.

However, tariffs based on short run marginal costs do not fully correspond to the real costs of the power system; in addition, such tariffs are stable only over time. These tariffs play an important role in regulating the power consumption by large industrial consumers [1-7].

Tariffs based on the determination of Long Run Marginal Costs (LRMC) are based on the determination of all costs of the power system in the long run associated with the need to ensure a systematic increase in demand for electricity; they take into account the costs of building additional generating capacities and transmission lines required to meet the growing demand for electricity.

The economic basis of electricity tariffs is the inclusion of various costs of the power system and a certain share of profits.

In the functioning of electricity tariff systems, the priority tasks are:

- reimbursement of real costs for the generation, transmission and distribution of electricity, and making a profit;
- stimulating consumers to improve the operating schedule of the power system;
- creating conditions for improving the environmental situation;

- stimulating consumers to participate in reducing the power deficit in the power system;
- stimulation of energy saving among consumers.

Differentiation of tariffs by the time of consumption is due to the fact that, in general, the demand for electricity turns out to be higher during the day, and the costs of generating electricity are also not constant. Therefore, it seems logical to apply different tariffs at night and during the day.

The corresponding contracts can also be applied to residential consumers. The metering of electricity consumption, and, accordingly, its payment can be performed using metering devices that separately record the amount of electricity. The contracts may indicate the values of the minimum and maximum power for both types of electricity consumption (night-rate and day-rate, see Fig.1).

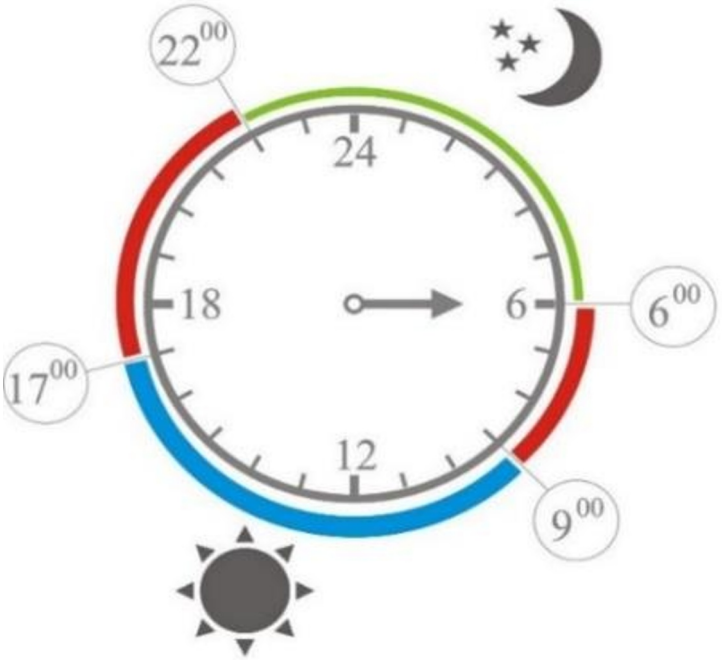

Fig. 1. Time-differentiated tariff rates.

The application of peak electricity tariffs means a significant increase in prices during a certain period of the year, when there is the highest electrical load in the power system. This requires the installation of additional equipment.

The introduction of hourly tariffication is associated with significant investment costs. As an alternative, tariffs could be used that allow for power outages. In exchange for lower average tariffs, large consumers agree (under certain conditions) either to reduce consumption at the request of the system operator or power supplier, or to pay a fine.

In all competitive wholesale electricity markets, it is possible to obtain information on prices either per hour or per half hour. Moreover, in many countries, tariffs for transmission and distribution of electricity are also differentiated. The exact hourly demand of electricity consumers is usually not known to suppliers, although there are general estimates of consumption. Therefore, it is quite possible that the single-rate tariff for a large end user will be either too high (then, in a competitive environment, the consumer will choose another supplier), or too low (the supplier will incur losses). This often happens when the

end user, who knows his undifferentiated tariff, wants to deviate from his typical (known to the supplier) load schedule. Therefore, if transaction costs (e.g. metering costs) are low enough, time-differentiated tariffs will provide the power supply company with a competitive advantage. Therefore, in an ideal electricity market, each contract between suppliers and end users should optimally balance the benefits of using a differentiated tariff and the transaction costs associated with it [8-16].

In general, it can be observed that the larger the end user, the more complex the tariff differentiation scheme, applied in the contract with the electricity supplier. Due to market liberalization, lowering the cost of modern electricity meters, new billing and payment options, and gaining experience, some suppliers are considering introducing real-time tariffs for residential consumers.

The differentiation of tariffs by the day time (day zones) is based on the following provisions:

- a system of tariff rates for electricity differentiated by time zones should help to optimize the use of the capacities of existing power plants and reduce the need for constructing new generating capacities;

-the total charge for consumed electricity in the initial mode of its use should not change after the transition from the existing one-rate or two-rate tariffs to the tariffs differentiated by time zones (Fig. 2).

Fig. 2. Two-period (zone) tariff system.

4 Conclusions

Electricity tariffs differentiated by day time solve the following problems, fundamentally important in market conditions:

- they establish a link between the cost and the actual expenses on the production and distribution of electrical energy and power;
• they increase the reliability of power supply, attracting consumers to manage their own load and load schedule of the power system;
• they ensure social security of the population;
• they stimulate energy saving, etc.

At the same time, the use of tariffs for electric energy differentiated by the day time will require studies to justify tariff rates and work out the conditions for their implementation.

To introduce a differentiated tariff into the unified electric power system, further work is required:

- gradual bringing the level of electricity tariffs for the population up to the actual cost of its production, transmission and distribution;

- improving the system of tariffs for the population, taking into account the standard of living of the population;

- substantiation and objective correction of tariff zones and tariff rates;

- development of the methods for calculating a reasonable level of tariff rates for the population (including rural areas and small settlements), taking into account categories of consumers and the elimination of discretion in increasing rates for electricity;

- development of a system for continuous monitoring of electricity consumption by different categories of population, including information in cities and among rural population [17-21].

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