

Analysis of payment priority for electricity consumed in industrial enterprises on the base of classified tariffs

Makhmanazar Fayziyev¹, Yunus Ochilov¹, Komoliddin Nimatov¹, Ruslan Mustayev^{1*}

¹Karshi Institute of Engineering Economics, 225 Independence Avenue, Karshi, Uzbekistan.

Abstract. The following issues are considered and resolved in the article: the advantage of using tariffs stratified by time to increase the efficiency of electricity consumption by industrial enterprises; Analysis of the tariff system in the electric power system of the Republic of Uzbekistan and the essence of the effectiveness of the application of differentiated tariffs; In order to justify the application of time-differentiated tariffs, the electricity consumption of the industrial enterprise is analyzed; parameters of electricity consumption are optimized according to different tariffs. In order to regulate the load schedule of the energy system using time-graded tariffs in the morning and evening "peak" periods, a method of reducing the load in "peak" periods is proposed in exchange for increasing energy consumption in the night periods.

1 Introduction

The population of Uzbekistan is increasing year by year, and today we are among the countries with a rapidly growing economy. Therefore, the demand for electricity and gas will continue to increase. In the new tariff reform of the energy network, every citizen of Uzbekistan will switch to a fair payment system for electricity and gas. The draft decision of the Cabinet of Ministers of the Republic of Uzbekistan "On changing the prices of fuel and energy resources" was submitted for public discussion. Based on the international experience and the interests of the poor and low-income society of the population, it is decided to implement the "social norm" system throughout the republic in order to increase the effectiveness of social protection. With the draft decision, starting from July 1, 2022, the prices for the republic were set based on the social norm, that is, two or more payments will be made for gas and electricity used in excess of the specified amount.

2 Current status and relevance of the problem being covered

The tariffs system directly regulates the relations between electricity producers and suppliers and electricity consumers. The 1, 2 and 3-shift work mode of many production enterprises, the electric energy system of the enterprise is in the operating mode at the peak of the electric energy consumption, which leads to stress [1]. The average electricity consumption during the night shift is 20-25% of the electricity consumption during the day shift. This, in turn, shows that electricity consumption is low at night and sharply increases during the day. One of the main problems of enterprises is to

adjust load schedules for normal and cost-effective energy consumption [1]. The introduction of time-differentiated tariffs into the energy consumption regimes of production enterprises makes it possible to reduce the excess of energy consumption in "peak" periods. Load periods are introduced into the energy system of time-graded tariffs to reduce consumption in "peak" periods. Day and night tariff system with two time periods (zones) is used for two periods of the day [1, 2].

Table 1. Seasonal periods of electricity consumption and time-differentiated tariffs

The seasons	Three-period residents need electricity			
	Morning peak	Daytime period	Evening peak	Night period
Winter time	From 06:00 until 10:00	From 10:00 until 18:00	From 18:00 until 22:00	From 22:00 until 06:00
	675 soums	520 soums	675 soums	250 soums
Summer time	From 05:00 until 9:00	From 9:00 until 17:00	From 17:00 until 21:00	From 21:00 until 05:00
	675 soums (0,614 \$)	520 soums (0,472 \$)	675 soums (0,614 \$)	250 soums (0,227 \$)

Taking into account the above tariff periods, the calculation of tariff periods stratified by time for electricity for three periods (zones) of the day is expressed on the basis of the following equation [1]:

$$ES_{orr} = S^p E^p + C^{yap} E^{yap} + C^T E^T \quad (1)$$

* Corresponding author: ruslanmustayev89@gmail.com

in which, S^p is the approved single-rate or average fixed tariff price for consumers; E – total power consumption of consumers; S^p , C^{yap} , C^T – A- "peak", "semi-peak" and night prices of daily electricity consumption; E^p , E^{yap} , E^T – A - peak, semi-peak and night time electricity consumption [1, 2].

It can be seen that the consumer's demand for electricity is in two different orders on working days and on weekends, and based on this situation, it is recommended to use a two- and three-period tariff system [3, 4]. A reduction of the payment for the electricity consumption at night by 1.5 times compared to the amount of payment for the electricity consumed during the day in residential premises will make it possible to smoothen the schedule of loads in the electric power system .

All wastes and energy consumption related to energy consumption in the classified electric balance of production enterprises belong to the main technological process. But the organizational structure of the electrical balance is much deeper and originates from the period of energy spent by each consumer on production [2].

The main part of the electrical balance of production enterprises is that most of the waste of electricity is in the network and transformers. Waste in the network cannot be determined by measurement, so the amount of waste is determined by calculation.

Daily electricity consumption modes of production enterprises are observed depending on the periods of the day with the help of consumption graphs. Daily load graphs provide the ability to regulate the operation of the enterprise's electrical equipment and analyze it for subsequent periods. It will also help to develop measures to clarify electricity consumption regimes in the near future.

The time-graded tariff load schedule is calculated based on the maximum and minimum hours of electricity consumption during the day and is used to determine the capacity. The graph of electricity consumption of production enterprises is characterized by a certain change of electricity consumption during the day [2].

The most complete monitoring period of electrical energy-consuming equipment in enterprises helps to work with accurate calculations, work at a uniform level of energy consumption, and improve the rhythm of production. Regulation of electricity consumption in production enterprises is one of the most important tasks for the electric power system: first of all, it is responsible for the rational use of fuel in the production of electricity, and it increases the reliability of the equipment at power plants.

A number of new measures on the rational use of energy are being accepted in the republic's electricity market. These measures are important for the renewal and modernization of the energy sector, as well as for encouraging the rational use of electricity by energy consumers. As a result of the use of time-graded tariffs depending on the volume of consumed electricity in the republic's electricity market, the possibility of technically and economically efficient use of electricity was created.

In the energy system of the republic, the information about the tariff differentiated by time is being explained to the consumers. As a result, consumers will be aware of the established tariff system. As a result, consumers who have a comprehension of tariffs will have the understanding that depending on the tariff periods, they will benefit greatly from switching to tariffs that are convenient for them [1, 2].

In order for consumers to use energy resources wisely, it will be necessary to conduct a lot of explanatory work on such tariffs [1, 2]. Otherwise, consumers will have a negative concept of the energy system. The demand for electricity consumption is formed on a daily, weekly, monthly, seasonal and annual basis. In addition, during the period of maximum loads ("peak"), the level of electricity consumption is much higher than the average load in the corresponding period [3, 6]. The capacity of the power system is determined by the period of maximum loads, the constant consumption of electricity to cover the period of maximum loads and to ensure the necessary power reserve [2, 7]. This, in turn, leads to the application of a system of time-graded tariffs [3]. The purpose of introducing time-differentiated tariffs is to move electricity consumption to low-load, night hours and encourage consumption during this time. In practice, the experience of foreign countries shows that several tariff systems are used to encourage the reduction of electricity demand during "peak" hours.

3 Application of 2 topics at the scale of industrial enterprises

The introduction of time-differentiated tariffs into the energy consumption modes of production enterprises makes it possible to reduce the excess of energy consumption in "peak" periods. Load periods are introduced into the energy system of time-graded tariffs to reduce consumption in "peak" periods. Day and night tariff system with two time periods (zones) is used for two periods of the day [4, 5, 6].

The consumer is ready to change electricity tariffs at any time, only when it is economically beneficial for the supply organizations and consumers. Nevertheless, the transition to time-graded tariffs requires solving serious legal issues. Determining and approving the norms of electricity consumption periods in production enterprises should be socially based[1, 11].

Consumers need to install electronic meters suitable for tariff periods (zones) that carry out accurate calculations of electricity consumption. Electronic meters that make accurate calculations will further strengthen the relationship between the power plant company and consumers [2, 12, 14]. Consumers who have switched to the differentiated tariff system, where the indicators of one-, two- and three-period (zone) tariff electricity meters are indicated in Appendix 8, can calculate their electricity consumption using two- or three-period (zone) tariff meters. they can make a book [1, 11, 13].

The electricity consumed by "NISHAN TEXTL" LLC, Karshi city, Kashkadarya region, was calculated and compared according to the same energy tariff and differentiated electricity tariffs, and the following result was obtained.

The annual maximum and minimum electricity consumption during the period of time until March 2021 in the process of electricity production of "NISHAN TEXTL" LLC was analyzed.

The maximum daily electricity consumption in the organization is $P_{his} = 178 \text{ kW}$, normal tariff (450 soums). During the day, the maximum amount of electricity $t_{day} = 16 \text{ hours}$ is observed, and during, the working day $n_{year} = 215$ the day

$$W = P_{his} t_{day} n_{year} = 178 * 16 * 30 = 85440 \text{ kW} \quad (2)$$

When the maximum monthly electricity of the Enterprise is found and calculated according to the normal tariff rate (450 soums), it is as follows

$$N = W * \alpha = 85440 * 450 = 38448000 \text{ soums} \quad (3495 \$)$$

Table 2. Power demand and prices of consumers by periods

Tariff times	Monthly consumption in kW*h	Consumption share, %	Tariff prices, soums/ kW*s	Costs are soums
From 06 Up to 10	10253	0,12	675	6920775
From 10 until 18	43575	0,51	520	22659000
From 18 until 22	6835	0,08	675	4613625
from 22 until 06	28195	0,39	250	7048800
General:	85440			41242200 (3749 \$)

Currently, the enterprise is considered a class II consumer and pays 450 soums for 1 kW*h of electricity it receives from the system.

$$85440 * 450 = 38448000 \text{ soums} \quad (3495 \$)$$

If the tariff system is not used correctly, the Enterprise Will be charged monthly for the day of electricity consumption:

$$41242200 - 38448000 = 2794200 \text{ soums} \quad (254 \$), \text{ Will suffer.}$$

The capacity of the power system is determined by the period of maximum loads, the constant consumption of electricity to cover the period of maximum loads and to ensure the necessary power reserve. This, in turn, leads to the application of a system of time-graded tariffs. The purpose of introducing time-differentiated tariffs is to move electricity consumption to low-load, night hours and encourage consumption during this time.

After the enterprise switches to a differentiated tariff, it is necessary to distribute according to the provided capacities [2, 3].

Table 3. The state of energy consumption after the transition to the system of differentiated tariffs

Tariff times	Monthly consumption in kW*h	Consumption share, %	Tariff price, soum/kW*s	Costs are soums
From 06 until 10	9398	0,11	675	6343650
From 10 until 18	23923	0,28	520	12439960
From 18 until 22	7690	0,09	675	5190750
From 22 until 06	44429	0,52	250	11107200
General :	85440			35081560 (3190 \$)

In the process of determining the electricity consumption of "NISHAN TEXTL" LLC, the maximum and minimum electricity consumption in one month of 2022 was analyzed. The following result was obtained when the maximum daily electricity consumption at the enterprise (June 1, 2848 kW·h) was calculated at the sum of the normal tariff (450 soums, as of 2022) in the 16-hour work mode:

$$85440 * 450 = 38448000 \text{ soums} \quad (3495 \$)$$

During the day of electricity consumption, if the enterprise uses the tariff system correctly, for one month: $38448000 - 35081560 = 3366440$ (306 \$) soums, it will benefit.

4 Conclusion

Electricity consumption costs of the enterprise were calculated using current tariffs and compared with differentiated tariffs.

- It has been proven that 3366440 soums (around 306\$) can be profited for the benefit of the enterprise every month in "NISHAN TEXTL" LLC with the correct use of differentiated tariffs.

If the differentiated tariff system is used continuously, this indicator will increase.

- Electricity consumption by consumers was carried out according to the indicators of the installed metering devices according to the normal tariff.

The dependence of the time-differentiated tariff system on EENHAT for calculating electricity consumption is studied. As a result, it was possible to increase the accuracy of the calculation of the cost of electricity consumption for each period.

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