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PRODUCTION AND CONSUMPTION OF ELECTRICITY IN THE NETWORKS OF WESTERN YAKUTIA

Volotkovskaya N.S., Efremova E.N.
Ammosov North-Eastern Federal University, Yakutsk, Russia

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Abstract. The issues of power supply and energy consumption in the western regions of the Republic of Sakha (Yakutia) are considered on the example of the Mirny electrical networks. The service area of electric grid facilities is 611 thousand square kilometers and the distance to the most remote service facilities from the bases of electric grids exceeds 100 kilometers, so the lengths of overhead and cable lines are measured in thousands of kilometers, and the number of district transformer substations and substations of local importance are measured in hundreds of units. The plans for the development of the energy consumption of the region were taken into account by PJSC Yakutskenergo for a period from 2021 to 2025. A comparative assessment of the production and consumption of electricity by the Mirny electrical networks for the period 2020-2022 is given.

ПРОИЗВОДСТВО И ПОТРЕБЛЕНИЕ ЭЛЕКТРОЭНЕРГИИ В СЕТЯХ ЗАПАДНОЙ ЯКУТИИ

Волотковская Н.С., Ефремова Е.Н.
Северо-Восточный федеральный университет им. М.К. Аммосова, Якутск, Россия

Ключевые слова: электрические сети, энергопотребление, инвестиционная программа, новые объекты, алмазодобывающая отрасль, Сила Сибири.
Аннотация. Рассмотрены вопросы электроснабжения и энергопотребление в западных районах Республики Саха (Якутия) на примере Мирнинских электрических сетей. Зона обслуживания объектов электрических сетей составляет 611 тыс. кв. км и расстояния до наиболее удалённых объектов обслуживания от баз электрических сетей превосходит 100 км, поэтому длинны воздушных и кабельных линий измеряются в тысячах километров, а количество районных трансформаторных подстанций и подстанций местного значения измеряются в сотнях единиц. Планы развития энергопотребления района учтены ПАО «Якутскэнерго» сроком с 2021 по 2025 гг. Приведена сравнительная оценка производства и потребления электроэнергии по Мирнинским электрическим сетям за период 2020-2022 гг.

Introduction. Back at the end of 2015, at a meeting of the Presidium of the State Council of the Russian Federation, issues related to the problems of production and consumption of electrical energy in Yakutia and related issues of pricing and subsidizing electricity were considered. As a result, long-term programs for the development of this industry for a long period of time were developed, but already at the beginning of the second period of the program, its implementation was faced with various factors that provoked an economic crisis both in our country and throughout the world. Started at the end of 2019 with quarantine measures, it is only deepening [1].

Western Electric Networks (WES). WES provide electricity to consumers in the western energy district, which includes the Mirninsky, Lensky and Olekminsky districts, as well as the Vilyui group of uluses (Suntarsky, Nyurbinsky, Verkhnevilyuisky, Vilyuisky and part of Kobyaysky). In the cities of Nyurba, Vilyuysk and in the village of Verkhnevilyuysk, there are backup diesel power plants, which are also part of the Western Electric Networks enterprise. The main consumers of electricity in recent years are oil pumping stations and the diamond mining industry. Over the past 10 years, the oil refining and gas industry of Western Yakutia has been intensively developing and is one of the largest consumers of electricity [2].

The service area of the objects of electric networks of the WES is 611 thousand square kilometers and the distance to the most remote objects of service from the bases of the regional electric networks exceeds 100 km, while according to the regulatory and technical documentation, the maximum distance is limited to 40 kilometers. The total length of air lines in service is 1,105.01 kilometers, including 922.54 kilometers on the balance sheet. The total length of cable lines under maintenance is 160.04 kilometers, including 160.04 kilometers on the balance sheet. The number of transformer substations and complete transformer substations – 287 units, incl. on the balance sheet – 214.

Development of energy consumption of the western region. Along with the commissioning of new facilities (capacities) of the oil and gas processing industry and the increase in energy consumption, PJSC ALROSA is reducing electricity consumption due to the closure of some facilities. It is planned to transfer the electric boiler houses of the city of Udachny to gaseous fuel, which will lead to a decrease in the electrical load at the Aikhal-Udachny bush, in addition, in 2021, the enrichment plant No. 8 and the Komsomolsky quarry were closed in the Aikhal village, which also led to a decrease in energy consumption. The discovery of the Verkhnemunskoye field at the end of 2018 did not affect energy consumption. The restoration of the Mir underground mine may be pushed back to 2030, which means that there is a decrease in energy consumption in the diamond industry, and if a new diamond deposit is not found within electric power reach in the near future, this trend will continue [3].

There is an investment program of PJSC Yakutskenergo, which provides for the construction of an all-metal power line to ensure reliable power supply to the Vilyui group of uluses. However, the specifications and deadlines have been repeatedly postponed. Now the last option is being considered in a single-circuit version with a voltage of not 220 kV, but 110 kV on metal poles along the Suntar-Nyurba route.

The world crisis, caused by the sanctions of Western countries against Russia and its friendly countries, introduces certain difficulties in the implementation of plans for the development and construction of industry [4].

For PJSC Yakutskenergo for 2021–2025 (without specifying a specific date) for the WES, the commissioning of the facilities shown in Table 1 was planned. The first phase of CS-2 has already been commissioned in February and the first

phase of CS-1 in November 2021, although they commissioning was scheduled for 2020, so the launch of the second and third phases of these facilities will apparently also be postponed. The dates of commissioning of the facilities listed below are indicative.

Tab. 1. List of facilities, the construction and commissioning of which is planned for the next five years

Year	An object
2021	Objects of MGP "Power of Siberia": CS-1 "Saldykelskaya" – 1.9 MW; CS-2 Olekminskaya – 2.27 MW
–	Objects of MG "Power of Siberia": Point of acceptance and delivery of crude oil – 10 MW (application under consideration)
2022	Objects of MGP "Power of Siberia": CS-1 "Saldykelskaya" – increase to 2.27 MW; CS-2 Olekminskaya – increase to 6.22 MW
2022	Sports and recreation complex with a swimming pool and a hockey court in Lensk – 1,261 MW
2023	Power of Siberia gas pipeline facilities: CS-1 Saldykelskaya – increase to 4.64 MW
2024	Objects of MGP "Power of Siberia": CS-1 "Saldykelskaya" – increase in capacity to 6.96 MW; CS-2 "Olekminskaya" – increase in capacity to 8.29 MW
–	Overhead line-110 kV in the metal version "Suntar-Nyurba", single-circuit, without taps (project under consideration)

Companies such as ALROSA (diamond mining), PTVS (heat and water supply company), KS-1 and KS-2 (compressor stations of the Power of Siberia main gas pipeline) are included in the list of the largest energy consumers of the Republic of Sakha (Yakutia) [5].

Despite a slight decrease in electricity consumption in certain areas of the diamond mining industry, the energy consumption figures for the WES are growing, for comparison, let's take the figures from 2020 to 2022 presented in Table 2.

Tab. 2. Comparison of planned and actual power consumption for the WES of PJSC Yakutskenergo

Year	Planned power consumption	Actual power consumption
2020	126199 thousand kWh per year	268888 thousand kWh per year
2021	126199 thousand kWh per year	282169 thousand kWh per year
2022	192000 thousand kWh per year	320000 thousand kWh per year (forecast)

Conclusion. As can be seen from the above figures, regardless of external factors, electricity consumption in the region of western electrical networks exceeds the plan by an average of 100%, and its distribution among national economy facilities requires further analysis.

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Волотковская Наталья Сергеевна – кандидат технических наук, доцент	**Volotkovskaya Natalya Sergeevna** – candidate of technical sciences, associate professor
Ефремова Елена Николаевна – студентка	**Efremova Elena Nikolaevna** – student
volotkovska_n@mail.ru	

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