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FEATURES OF PEAK LOAD FORMATION IN THE UKRAINIAN ENERGY SYSTEM

Summary. *The paper presents an analysis of the characteristics of peak load formation in the energy system of Ukraine in the recent period.*

Key words: *energy system, peak loads, formation features demand for electricity.*

Introductions. Economic development and ensuring a comfortable life for the population of any country are determined by the efficiency of the state's energy system. One of the most important criteria for evaluating the state of an energy system is its ability to control peak loads. The concept of peak load encompasses not only technical but also socioeconomic aspects [1-14].

The aim of the work is to analyze the main features of the formation of peak loads in the power system of Ukraine.

Formation of peak loads as a dynamic process. Before 2022 in the unified energy system of Ukraine there was a significant disproportion between average daily and peak consumption. According to data [15], the maximum load in the unified energy system in 2021 was recorded at 24,249 thousand MW (January 28 at 6:00 PM), while the average load for the year was 14–16 thousand MW. Regarding daily peaks, morning peaks were more pronounced. This is due, in part, to the start of production cycles. However, evening peaks were also significant. This pattern of electricity demand during that period is due to the large share of industrial consumption.

Table 1 presents information on the duration of morning and evening peak loads in various countries.

According to data provided by the relevant regional operators, there is significant similarity in the time intervals and duration of energy peaks in different countries around the world.

As can be seen from the data provided, peak loads in Ukraine's power system follow a general pattern. However, the typical morning peak in Ukraine is three hours, which is longer than in all the countries listed in the table except India. The evening peak in Ukraine is also the longest, reaching four hours, the same as in India.

Table 1

Duration of morning and evening peak loads in different countries of the world

Region	Country	Typical Morning Peak Time	Typical Evening Peak Time
Europe	Germany	8:00–10:00	18:00–21:00
	France	7:00–9:00	19:00–22:00
	United Kingdom	8:00–10:00	17:00–20:00
Asia	Japan	7:00–9:00	18:00–21:00
	India	9:00–12:00	18:00–22:00
America	USA (California)	8:00–10:00	17:00–21:00
	Canada	7:00–9:00	17:00–20:00
Ukraine	Ukraine	8:00–11:00	18:00–22:00

As for seasonal peaks, the greatest loads correspond to the winter months (January, February), taking into account the increase in electricity consumption by households and businesses with energy-intensive equipment [16].

It should be noted that Ukraine's energy system is characterized by certain characteristics of peak load generation. Following Russia's full-scale invasion of Ukraine in 2022, the demand structure has undergone significant changes. First and foremost, industrial consumption declined significantly due to the destruction or occupation of a number of industrial facilities in eastern and southern Ukraine. Internal and external migration, which significantly changed the geography of consumption, also altered of peak load formation. In addition, military actions have led to the influence of unpredictable factors on the formation of peak loads.

The restoration of Ukraine's energy system began in 2023 and 2024. The issue of covering peak loads has once again become relevant. According to the Strategy for the Development of the Unified Energy System of Ukraine until 2035 [17], it is necessary to achieve level of maneuverable capacity at least 10% of the system's peak load. This means introducing at least 1.5–2.0 GW of flexible capacity. Peak load coverage should be ensured through a combination of traditional and innovative technologies, although traditional technologies will predominate in the near future.

Conclusions. An analysis of a number of issues related to peak loads in Ukraine's energy system was conducted. Information is presented on the characteristics of these loads and their variations. Based on the analysis, the issue of covering peak loads in Ukraine's energy system has become increasingly pressing, given the increase in these loads for a number of reasons.

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