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SELECTION OF THE COMPOSITION AND STRUCTURE OF THE ENERGY COMPLEX

Annotation. In this article, an assessment of the energy needs of the power supply facility is considered.

Keywords: hybrid power complex, power needs of the power supply facility

Objects of renewable energy due to dependence on natural conditions, diverse layouts, composition, way of production, interaction with the environment, in most cases are unique.

The choice of the optimal version of the project involves the consideration of many interrelated factors and is carried out through a series of sequential refining calculations.

The main parameters of the hybrid power complex, subject to justification in the design process are:

– The assessment of the energy needs of the power supply facility;

– Assess the economic potential of renewable energy resources (wind and solar radiation);

– U parameters of power equipment;

– The installed capacity of the complex and its components;

– Communication parameters.

At the stage of the feasibility study of the project, the economic calculation of the project and the assessment of its effectiveness are mandatory.

Assessment of the energy needs of the power supply facility

The objects of decentralized power supply differ in great variety in terms of installed capacity, power consumption modes, requirements for the quality of electricity, etc., and therefore, it is difficult to classify them. The most widespread decentralized power supply systems were used to supply the following groups of consumers with electric power:

– individual consumers of low power from units to tens of kW - cottages and country houses, weather stations, cell towers, field objects and expeditions, farms, border, radar and navigational posts, etc .;

– group nonindustrial consumers with installed capacity from tens to hundreds of kW - separate large residential buildings and microdistricts, various social facilities, trade enterprises and health care institutions, villages, villages, settlements of low-rise buildings, etc .;

– industrial enterprises with installed capacity from hundreds to thousands of kW - mainly enterprises of the oil and gas producing industries.

A characteristic feature of a decentralized consumer is a sharply variable schedule of electrical load during the day and year. As an example, Fig. 1 shows the daily consumption schedule of a small autonomous settlement [2], and in Fig. 2 - the annual graph. In order to provide reliable power to the consumer in such conditions, a simple, reliable, economical, maneuverable power supply is needed, which can be designed for a wide range of installed capacities.

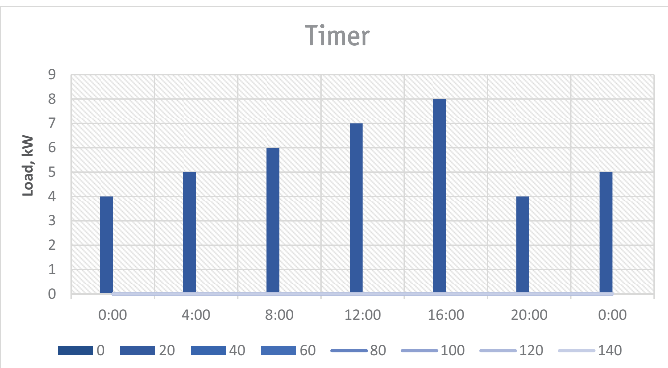

Fig.1. Daily electric load schedule for a small autonomous settlement

January	39040
February	32400
March	31840
April	31600
May	35600
June	31440
July	31520
August	36800
September	39840
October	42000
November	35600
December	36560

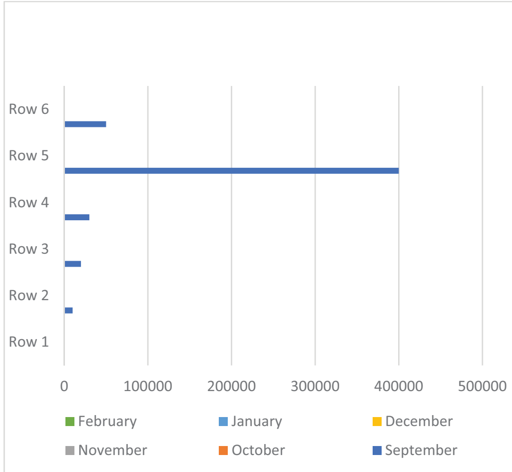

Fig.2. The annual schedule of electrical loads of the object of autonomous power supply

The estimated electrical power of an autonomous power supply facility is determined by known methods. So, if the enterprise serves as the object of electric power supply, then the method of ordered diagrams can be used. If the object is a residential building (of various types) or a complex of buildings (village, microdistrict), then the methods described in [2] can be used. It should be noted that before the calculations begin, it is necessary to analyze the installed electric receivers for the power consumption and conduct a set of measures to reduce power. For example, as lighting use energy-saving (LED) lamps, exclude such electric receivers as "warm floor", boilers, etc.

To model the electrical load of an object, one can use a probability-statistical model given by the expression:

$$P_{pi} = \bar{P}_i + \beta\sigma(P_i),$$

where P_{pi} is the calculated active load on the i -th hour of the daily chart;

$\bar{P}_i$- mathematical expectation of the load on the i -th hour of the daily chart;

β is the reliability factor of the calculation, which determines the probability with which the random load values will remain smaller than the assumed design value P_{pi} ; σ (P_i)is the standard deviation for the i -th step of the daily chart.

Under the normal law of probability distribution of load values, for $\beta = 2, \sigma(P_i) = 0{,}025$.

As a basic model of electric load, a typical schedule of the active load of rural dwellings (or small agricultural enterprises) [2] typical for decentralized consumers can be adopted (Fig. 3).

The graphs in Fig. 3 are presented in relative units and allow, according to the known value of the maximum load of the power supply object P_{max} (kW), to obtain the daily schedule of the design load of the facility for any day of the year:

$$P_{pi} = \bar{P}_i P_{max}(1 \pm \beta\sigma(P_i))\text{K}_c,$$

where K_c is the seasonality factor, the value of which is presented in Table. 1.

Fig.3. Typical daily load schedules for decentralized consumers

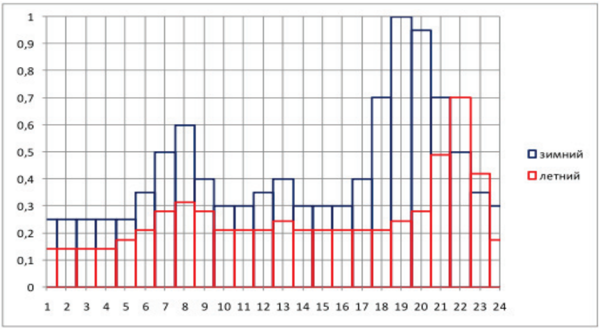

Table 1. - Seasonality factors for daily load schedules of decentralized consumers.

№	Month	Season coefficient, K_c
1	January	1.0
2	February	1.0
3	Mart	0.8
4	April	0.8
5	May	0.8
6	June	0.7
7	July	0.7
8	August	0.7
9	September	0.9
10	October	0.9
11	November	0.9
12	December	1.0

As an example, Fig. 4 presents a daily load schedule for a decentralized consumer for January, which shows the range of possible load changes at each hour of the day.

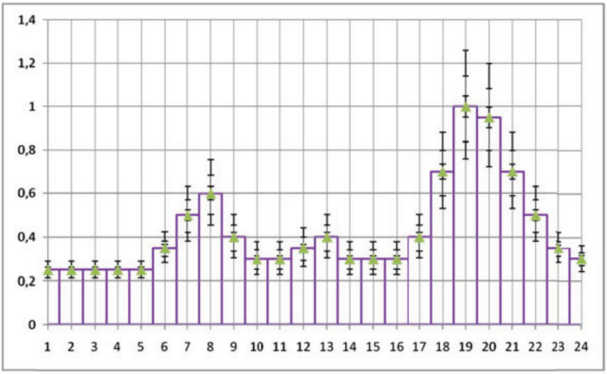

Fig.4. Daily load schedule for decentralized consumers for January

As a result, we obtain a simulation model of the electric load of an autonomous power supply facility, which can be used to determine the energy characteristics of a power supply system with renewable energy sources.

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