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ANALYSIS AND JUSTIFICATION OF THE NEED FOR THE DEVELOPMENT OF LOCAL ELECTRICITY SUPPLY SYSTEMS IN UKRAINE

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Relevance of research. Today, countries are in a state of energy transition to technologies using non-traditional RES, approaching a decentralized energy system using Virtual Power Plant and the principles of rational use of energy resources by introducing Smart Grid. That is, the decentralization of electricity supply processes and the introduction of active local energy systems (ALES) are taking place.

For the operation of an active local electric power system, a local low-voltage distribution network is required, which unites one or more distributed generation facilities, most often using VPP, energy storage, fuel cells, a demand management system that can work in isolation or connect to the central power system [1, 2].

The purpose of research. Research and analysis of the development and functioning of local power supply systems, decentralization and introduction of active local energy systems.

Basic research materials. To analyze the effectiveness of RES potential, as well as the prospects of their roles in ALES, it is worth considering not only each resource separately, but also conducting a detailed analysis of the characteristics of the level of their provision.

When implementing ALES, preference is given to direct connection to the distribution electric network, or connected to the network from the side of consumers. An important element in the structure is "prosumer" (producer + consumer), or an active consumer - consumers who appeared due to the development of household energy generator technologies, who have the opportunity to become full-fledged market participants [3, 4]. The corresponding scheme is shown in Fig. 1.

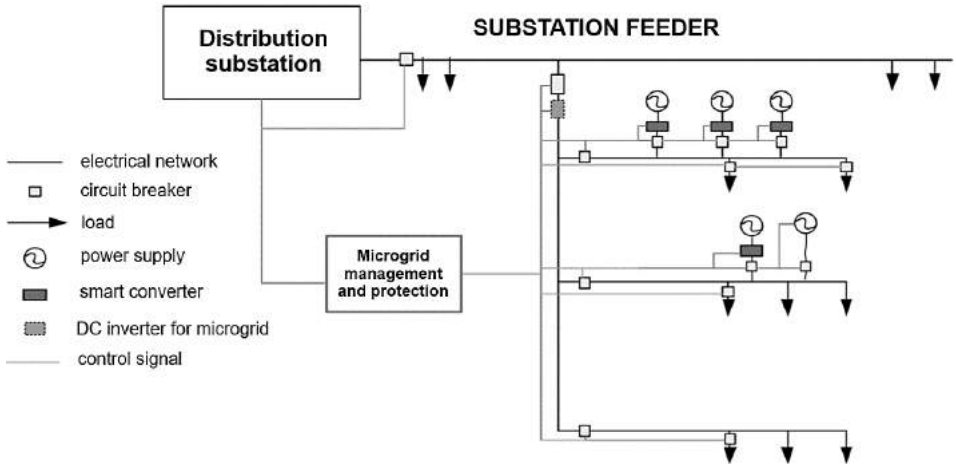

Figure 1 – Scheme of a working active local electrical system

Appropriate analysis can be conducted on the basis of various approaches to such a multi-criteria study. This approach is based on the fundamental provisions of the utility theory, which allows combining different methods of criteria analysis in the process of justifying a decision under conditions of various advantages.

It is possible to use the method based on the integral indicator according to the formula [5]:

$$I_j = \sum_{i=1}^{m}\left(\frac{\delta_i}{\sum_{j=1}^{m}\delta_i} \times \sum_{z=1}^{n}\frac{\delta_{iz}}{\sum_{z=1}^{n}\delta_{iz}} \times x_{ijz}\right) \quad (1)$$

Where x_{ijz} is the quantitative standardized estimate of the z-th local evaluation indicator of the i-th component of the j-th object, δ_{iz} - is the dispersion (entropy) of the z-th local evaluation indicator of the i-th component of the object, m - is the number of components with which the integral indicator of the object is estimated, n - is the number of local indicators, with the help of which the i-th component of the object is evaluated, I_j - is the integral index of the j-th object.

The use of the method based on the definition of multiplicity is applied to multicriteria problems that contain a final solution, many possible solutions, and have a large set of criteria to be minimized.

It is possible to reduce multi-criteria problems to single-criteria problems. This approach involves the use of a criterion in the form of a scalar function of a vector argument:

$$q_0(\mathrm{x}) = q_0(q_{01}(\mathrm{x}), q_2(\mathrm{x}), \ldots, q_p(\mathrm{x})), \quad (2)$$

where $q1(x)$, $q2$(x), ..., $qp(x)$ are criteria, x is an alternative from the set X.

The type of function q_o depends on the contribution of each individual criterion to the overall one. As a rule, in this case, additive and multiplicative functions of the form are used:

$$q_0 = \sum_{i=1}^{p}\alpha_i q_i \qquad 1 - q_0 = \prod_{i=1}^{p}(1 - \beta_i q_i), \quad (3)$$

where αi and βi are weighted coefficients.

The main difficulty of this method is the determination of weighting coefficients αi or βi. It is also possible to use the method of successive concessions. This method is based on the postulate that certain criteria are unequal and can be classified in order of importance [5, 6]. First, the important criteria are selected, and the remaining ones are set as restrictions. Under such conditions, an optimization problem is solved for the selected criterion. Then a concession is made on the determined optimum of the first criterion and the second criterion is optimized.

Conclusion. The existing power supply systems of local territories differ in essential features, which in most cases do not allow directly using the methodology developed for large power systems to justify their development. ALES are significantly more effective complexes in solving the growing needs for reliability, quality of energy supply and energy and environmental safety. The indisputable advantage of ALES is a significant reduction in energy losses during transportation, efficiency and consumer accessibility to reliable and high-quality energy supply. This is achieved due to the prompt switching of consumers between the general power grid and local energy sources in case of overloads, asymmetries and breakdowns.

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