Відповідно до наведеного, вже сьогодні ведуться інтенсивні роботи щодо залучення ДВЗ до циркулярної енергетики майбутнього, що забезпечує вимоги кліматично нейтральної енергетики при фактичній наявності процесів з вуглецевим слідом.

Циркулярна енергетика передбачає використання підходів, які базуються на застосуванні природних і штучних процесів зв'язування атмосферного CO_2 для отримання вуглецевих палив; синтезі безвуглецевих палив; уловлюванні CO_2 спалених вуглецевих палив з секвестрацією у нафтовий пласт.

На цій поданій основі базуються довгострокові перспективи використання транспортних ДВЗ в майбутньому.

Література

1. Парсаданов І.В., Марченко А.П., Строков О.П. Двигуни внутрішнього згоряння і навколишнє середовище. Двигуни внутрішнього згоряння. 2022. №2. С. 3-12.

2. Flexibility to future-proof the Ukrainian power system. Wärtsilä Corp – 2018. [Electronic resource] / available at: rb.gy/ic9eoq

3. Reitz R.D. IJER editorial: The future of the internal combustion engine / R.D. Reitz, H. Ogawa, R. Payri, T. Fansler et al. International Journal of Engine Research. 2020. № 21(1) : P. 3-10.

CONCEPTS OF THE DEVELOPMENT MICRONETWORKS OF DISTRIBUTED ENERGY RESOURCES

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The rate of development of solar energy is extremely high compared to other sectors of the economy. Thus, according to the results of 2021, solar energy in Ukraine accounted for about 6 % of the total electricity production [1, 2].

The entire territory of Ukraine is suitable for the location of solar power plants. The most favorable for this are the southern regions of Ukraine (Odesa, Mykolaiv,

Kherson, Zaporizhzhya and part of the Donetsk region, Autonomous Republic of Crimea), where more than 60 % of industrial solar power plants are concentrated. As of the end of 2021, the total capacity of solar power plants was 6320 MW (excluding temporarily occupied territories) (Fig. 1).

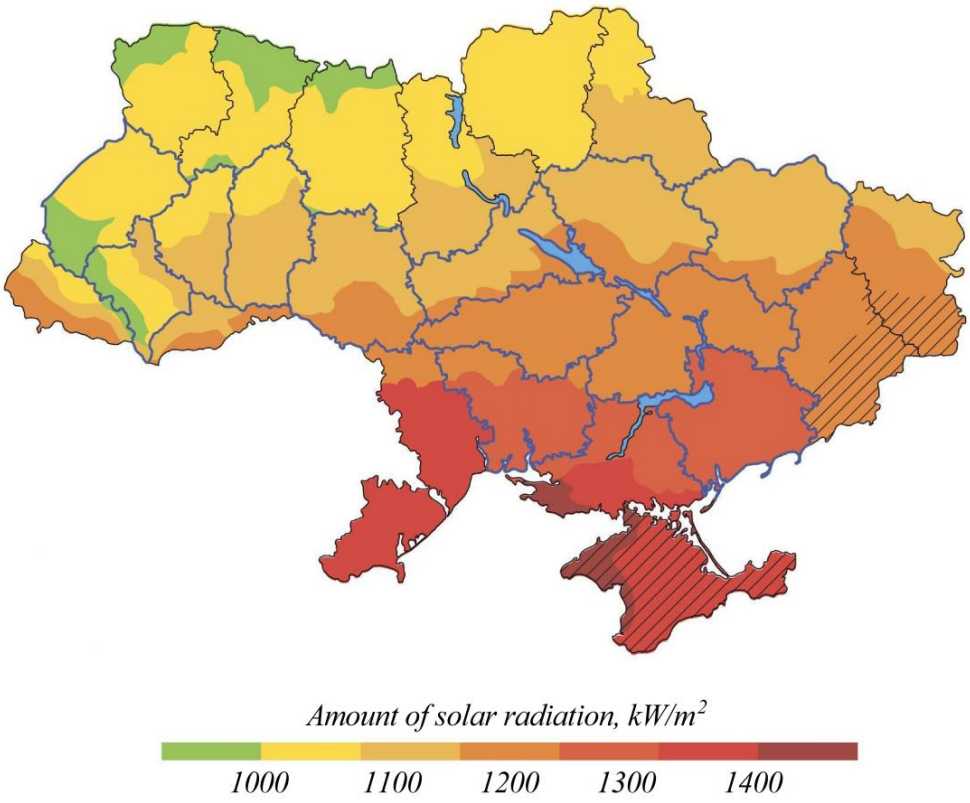

Figure 1 – Map of average annual solar radiation on the territory of Ukraine

According to the results of recent years, Ukraine had one of the highest rates of solar energy development in Europe. However, the invasion of the aggressor caused significant damage to the industry. Two-thirds of solar power plants in Ukraine are located in the south, where active hostilities continue today. According to various estimates, more than 30 % of solar power plants in the occupied territories were destroyed, which is approximately 1120...1500 MW of installed capacity. In addition, more than 25 % of non-industrial (private) solar power plants were destroyed.

The electricity market prone to liberalization, the presence of environmental problems regarding greenhouse gas emissions, the rapid development of transport technologies, not too high energy efficiency of energy sources – all these are the most important driving forces aimed at the spread of distributed energy resources in power supply systems. With the growing deployment of distributed energy resources, especially for small combined heat and power plants and renewable energy sources based on distributed generation units, distribution systems can no longer be considered as passive networks. The entire architecture of the future power supply system must be transformed in order to perform more complex operations. As a result, possible conceptual models of the micronetwork are envisaged.

The concept of micronetworks connects several customers to several blocks of distribution energy resources, including blocks of distributed generation. In the context of a micronetwork, customers and units of distributed energy resources may not only operate in parallel with the main grid, but also require a smooth transition to an intentional or unintentional isolated mode during abnormal network conditions. Unlike conventional distribution systems, such a grid structure has much more flexibility in managing blocks of distributed energy resources, and therefore the potential benefits of better power quality, more reliable electricity and dispatching, and higher capacity in terms of supply efficiency due to the optimal location of micro-thermal power plants.

Conclusion

The trend of the renewable energy system is to increase the nominal capacity, while reducing the cost and improving the efficiency of the power conversion systems. The characteristics of loads and blocks of distribution energy resources determine the stability of frequency and voltage in micronetworks.

References

1. Plakhtii O., Nerubatskyi V., Hordiienko D. Research of operating modes and features of integration of renewable energy sources into the electric power system. *2022 IEEE 8th International Conference on Energy Smart Systems (ESS)*. 2022. P. 133–138. doi: https://doi.org/10.1109/ESS57819.2022.9969337.

2. Nerubatskyi V. P., Plakhtii O. A., Hordiienko D. A., Khoruzhevskyi H. A. Study of the energy parameters of the system “solar panels – solar inverter – electric network”. *4th International Conference on Sustainable Futures: Environmental, Technological, Social and Economic Matters (ICSF-2023). IOP Conference Series: Earth and Environmental Science*. 2023. Vol. 1254. 012092. P. 1–12. doi: https://doi.org/10.1088/1755-1315/1254/1/012092.