workflows is poised to grow significantly, aligning with the broader shift toward intelligent automation. Despite challenges in generalizing across diverse visual domains and dynamic content, the trajectory of CV-enhanced QA suggests a paradigm shift toward more resilient, scalable, and intelligent software testing methodologies.

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POTENTIAL IN STRENGTHENING UKRAINE'S ENERGY SECURITY THROUGH DIVERSIFICATION OF ENERGY SUPPLY SOURCES

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Abstract. *The importance of a reliable energy security system is substantiated. The definition of diversification of energy sources and the advantages of its application are given. Specific examples of the implementation*

of the above-mentioned policy of energy diversification and energy efficiency in developed countries of the European Union are given. A detailed description of the untapped potential of Ukraine in the context of the most promising sources of renewable energy against the background of a gradual reorientation to a more diversified structure and the abandonment of imported fossil fuels is given. Prospects for further research are voiced.

Keywords**:** *renewable energy; diversification; energy security.*

The energy sector is one of the key sectors of the national economy and has a direct impact it's growth. Energy independence is a priority for the development of both the Ukrainian economy and the country as a whole, but at the same time, national security challenges threaten plans for the gradual implementation of relevant initiatives. Despite shifts in the right direction, Ukraine still is highly dependent on energy imports, not to mention the problems of excessive environmental pollution due to the use of outdated production equipment, so implementing new, diversified energy system is becoming more and more crucial task.

Energy diversification means using different energy sources, suppliers and routes to reduce dependence on a single resource or supplier. A country that diversifies its energy mix insulates itself from energy disruptions and strengthens its energy security. The following aspects are among the undoubted advantages of a diversified energy system:

– political independence: dividing energy needs among different suppliers allows the importing country to reduce its dependence on a single supplier and strengthen its independence in global politics;

– economic growth: energy diversification promotes economic growth. Obtaining energy from multiple sources and suppliers insulates an importing country from energy disruptions when one source or supplier is unable or unwilling to meet demand;

– environmental protection: the development of renewable resources, such as solar and wind power, reduces the threat of energy shortages. Investments in renewable energy also stimulate innovation and employment growth.

Key component for an energy diversification nowadays is an active use of alternative energy sources. Full-scale invasion in 2022 only strengthen Europe's priorities on energy security and diversification. According to experts from the Ember climate think tank, their share is 50 %, taking into account other renewable energy sources such as hydropower. Experts predict that the total energy consumption in the EU will remain relatively unchanged over the next three decades. The International Energy Agency (IEA) estimates that by 2040, electricity demand in the EU will increase by 12–26 %.

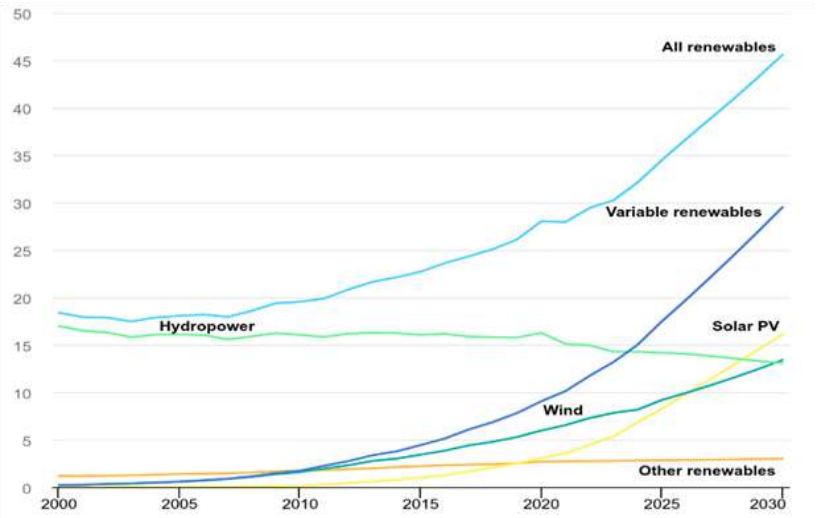

Fig. 1. Share of renewable electricity generation in EU, 2000–2030

Before full-scale invasion the most important aspect of alternative energy sources was its purity and environmental friendliness – unlike thermal power plants, solar, wind, and hydroelectric power plants produce almost no greenhouse gas emissions. But in current times, against the backdrop of the refusal to imported energy carriers using renewable energy sources is vital alternative to fossil fuels, as it can cover large part of energy consumption and has great potential for development. It is crucial for Ukraine to increase investment in the large-scale deployment of decentralized renewable energy sources, given that around 40 % of its energy infrastructure has been damaged by the fighting and the trend is unlikely to abate in the near future. The Kyiv School of Economics estimates direct losses in the electricity sector as a result of Russian attacks at USD 56.2 billion. The economic potential for the development of renewable energy sources in Ukraine remains quite significant – large areas of undeveloped territories, geographical and natural diversity create very favorable conditions for further diversification of the structure of energy generation sources.

The most promising for development in Ukraine are the following types of renewable energy: solar energy, wind energy, small river energy, geothermal energy and biomass energy. Effective diversification of resources and ways of obtaining them in the energy sector will help it reach a qualitatively higher level of functioning and, accordingly, reduce energy risks, increase profitability, etc.

Table 1

SWOT-analysis of alternative energy sources implementation in Ukraine

***Strengths*:** – Rich natural resources; – Growing interest in green energy; – Qualified specialists	***Opportunities*:** – European integration; – Growth of the global market; – Improving energy security
***Weaknesses*:** – Limited financing; – Old infrastructure; – Regulatory barriers	***Threats*:** – Political and military instability; – Competition with traditional energy sources; – Climate change

Ukraine has the promising potential of renewable energy sources, having vast territories with different conditions, despite the fact that full-scale invasion creates big challenges on the path to energy transformation. Nevertheless, it is advised to use develop alternative energy sector in order to diversify our country's power production and strengthen energy security and independence, which is more and more crucial for our benefit for the last few years. Such approach will provide an availing alternative to imported fossil fuels, which coincides with current government policies and eurointegrational process. But in order to increase effectiveness, there is a need for further research to improve the management process of energy generation sources. The following steps should be considered for the gradual introduction of a diversified energy supply system:

– establish a legal framework for energy policy that attracts investment, rewards entrepreneurship and innovation, and limits inefficiency and waste;

– enter into partnerships with the private sector to identify and develop alternative energy sources;

– work with experts to determine the best mix of available domestic and foreign energy sources;

– work with the international community to introduce and enforce environmental standards related to energy exploration and production;

– develop set of recommendations, in particular with the involvement of the latest information technologies.

Key element of promoting the development of the green energy sector is an implementation of an appropriate energy generation sources rational distribution model with implementation of the latest information technologies. Already existing tools, such as Multilayer Perceptron(MLP),

are used in energy sectors to solve different tasks such as creating a model of energy consumption, prediction of energy needs in different conditions and optimization of energy system overall, but it needs some adjustments and further researches to be effectively used for diversified systems with large dependency on alternative energy sources.

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FEATURES OF MICROCLIMATE SYSTEMS IN MUSEUM BUILDINGS

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Abstract. *This paper analyzes the creation of integrated microclimate systems for the preservation of cultural heritage in museum buildings. Heating, ventilation, cooling, humidification, dehumidification, and air purification systems*