TRANSFORMATION OF THE ENERGY SECTOR: DIGITALISATION, SOCIAL RESPONSIBILITY AND GREEN MARKETING

Monograph

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The monograph is dedicated to studying approaches and principles of transformation of the energy sector, development of sustainable responsibility of all subjects of socio-economic relations, and features of the use of economic and marketing tools for energy greening. The authors analysed the features of implementing green energy and green marketing, key trends in developing technopolis. Peculiarities of the formation of energy security processes during military time are investigated. In studying the impact on communities and the environment, the principles of strategic management of social responsibility of energy companies are proposed. The key aspects of environmentally responsible tariff formation were investigated within the framework of the integration of renewable energy flows into a single energy system. To develop the potential of resources and energy conservation, the sectoral aspects of the decarbonisation of the economy were studied. The monograph is generally intended for government officials, entrepreneurs, researchers, graduate students, and economic, medical, and other specialities students.

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INTRODUCTION

An integral component of the sustainable development paradigm is limiting climate change and ensuring sustainable socio-economic growth, strengthening the global transformation of the energy sector. Energy efficiency, expanding the use of renewable energy sources in the energy supply structure, decentralisation of energy production and supply, improvement of the energy storage system, and the introduction of intelligent technologies are key factors in the sustainable transformation of the energy sector.

The International Renewable Energy Agency (IRENA) calls on the world community for an urgent energy transition worldwide and convincingly proves that the new way of energy development is economically more profitable. The pace of renewable energy deployment must be increased at least sixfold worldwide to meet the goals of decarbonising the economy by 2050 and preventing catastrophic climate change, as set out in the Paris Agreement. This requires a large-scale increase in investments in renewable energy, introducing energy-efficient technologies and their wide deployment.

The monograph contributes to a deeper understanding of the approaches and principles of energy transformation, the development of sustainable responsibility of all stakeholders of socio-economic relations, and the peculiarities of using economic and marketing tools.

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CHAPTER 1. GREEN ENERGY AND GREEN MARKETING: THE KEY TRENDS FOR TECHNOPOLISES DEVELOPMENT

1.1. Green marketing as an approach to sustainable energy transformation

It should be noted that the consequences of the war, the capture of part of the territory, and the destruction have an impact on the development of the energy system of Ukraine. That is why it is necessary to focus attention on the construction of a new post-war energy system, and not on the restoration of the old one. For this, the country has all the necessary natural conditions. In particular, this concerns the favorable climate, the potential of solar and wind resources. Legislative initiatives and approximation to the standards of the European Union contribute to the active development of "green" energy, and the introduction of new technologies, such as storage systems and the integration of biotechnologies, opens opportunities for the introduction of innovations.

The results of the analysis of publication activity indicate that the level of interest of the scientific community in green marketing, tools and factors influencing the effectiveness of their implementation is growing every year. This is evidenced by studies of existing problems in energy policy and ways of improvement, which are paid attention to by many scientists around the world. To this day, research in the field of conceptual and practical models, as well as their use in the process of monitoring and forecasting the urgent needs of national energy policy, remains relevant (Allcott, 2014; Naill, 1992; Schmidt & Sewerin, 2018).

In the works of domestic scientists, research on the search for and implementation of mechanisms for the spread of renewable energy sources, improvement of the energy structure of the national economy, restoration of the state of the natural environment through the popularization of "green" energy are important (Cebula et al., 2018; Chygryn et al., 2018; Pimonenko & Luschyk, 2017; Zyabina et al., 2019).

The authors hypothesize that the development of energy policy depends on an integrated approach to all spheres of the economy. At the same time, attention is focused on the specific features of the economic sector and the effectiveness of the functioning of communications in the enterprise management system (Letunovska, 2017; Melnyk & Kubatko, 2013).

Based on empirical calculations, the authors determined that the development of alternative energy sources depends on the effectiveness of the country's energy policy, which is accompanied by the active involvement of marketing tools for the development of the country's decarbonization (Bozhkova et al., 2018; Cebula & Pimonenko, 2015; Letunovska et al., 2019; Palienko & Lyulyov, 2018; Panchenko et al., 2020). At the same time, scientists have determined that the efficiency of the energy sector affects the level of macroeconomic stability of the country (Doroshko, 2011).

The war of the Russian Federation against Ukraine, the possibility of an energy crisis due to the systematic destruction of energy infrastructure objects accelerates the development of "green" initiatives in technopolises (the share in the structure of production before the full-scale war was more than 13%). Thus, in the city of Lugano (Switzerland), Ukraine presented a vision of post-war reconstruction of the country, which includes more than 850 projects (Nakonechna &

Marchuk, 2022). One of the promising directions is the development of the energy sector, including the "green" economy. These can be solar power plants in Odesa, Mykolaiv, Kherson, Zaporizhzhia, part of Donetsk region and Crimea. Before the war, more than 60% of industrial solar power plants were concentrated here.

The Ukrainian Renewable Energy Association stated that half of Ukraine's "green" generation is at risk of destruction. According to the association, almost 90% of wind farms, 37% of ground-based, 35% of rooftop/facade solar farms and almost half (48%) of biomass plants are located in areas with active hostilities (Nakonechna & Marchuk, 2023). Note that at the end of 2021, the total capacity of solar power plants in Ukraine was 6,320 MW. It is planned that the enterprises will not sell the generated electricity to other consumers at the green tariff but will use it for their own needs. This is due to systematic missile attacks and rising energy prices. According to various estimates, more than 30% of solar power plants in the temporarily occupied territories (almost 1120-1500 MW of installed capacity) were destroyed. In addition, more than 25% of non-industrial (private) solar stations were destroyed (the Kharkiv region was the most affected).

Another area of energy policy implementation in Ukraine is the production of biomethane. According to the estimate of the Bioenergy Association, the country produces about 10 billion cubic meters of biomethane per year. It should be noted that the countries of the European Union intend to activate activities in the field of biomethane production, reaching a production volume of 35 billion cubic meters per year by 2030.

The concept of "green" marketing" should be understood as a method of promotion that emphasizes the positive impact of the company's activities on the environment (Mazur & Pustovoit, 2013). There is another definition of the concept of "green" marketing - it is the promotion of environmentally safe, that is, more environmentally sustainable products and technologies (Wahab, 2018).

Polonsky M., Rosenberger P. believe that "green" marketing is "a holistic, comprehensive approach that constantly reviews how firms can achieve corporate goals and satisfy consumer needs, minimizing long-term environmental damage." (Claspo, 2022; Polonsky & Rosenberg, 2001). (Peattie K. states that "green" marketing is used to develop marketing activities aimed at reducing the negative social and environmental impact of existing products, production systems and to promote less harmful products and services (Peattie, 2001). According to Banerjee S., "green" marketing is the marketing of products that are assumed (positioned) to be environmentally safe (Banerjee, 2011). Green marketing includes a wide range of activities, including product modification, manufacturing process changes, packaging changes, and advertising modification.

Pride W, Ferrell O. define "green" marketing as a concept that refers to an organization's efforts to design, advertise, price, and distribute products that do not have a harmful impact on the environment (Pride & Ferrell, 2004). Srivastava M. notes that "green" marketing should ensure the deployment of resources in such a way as to minimize the negative impact on the environment and ensure a healthier lifestyle (Srivastava, 2013). Therefore, the main guidelines should be the simultaneous provision of sustainable ecological growth and the development of technologies.

The main tasks of "green" marketing should include: reducing emissions, achieving energy and carbon neutrality; use of clean materials that do not contain harmful substances; reduction of resource costs for packaging and registration; compensation for damage caused in the production process; manufacture of repairable products; increasing the share of recycled materials; dissemination of information about environmental problems; choosing a responsible approach to advertising and communications; fundraising for specialized funds, etc.

Summarizing the above existing tasks, expert Grant J. in his work "The Green Marketing Manifesto" noted: "The main task is not to make standard products green, but to make green products the standard." (Grant, 2008). Developing in technopolises, "green" marketing can be applied when creating environmentally friendly products, promoting the green benefits of existing products, packaging products in sustainable ways, reducing perishable packaging, using recycled materials in the production process, using green energy, using sustainable business practices, reducing production waste, the use of environmentally friendly methods, as well as the production of reusable or recyclable products, etc.

In the conditions of war, the issue of "green" marketing acquires special importance for the development of not only private households, but also enterprises located in technopolises. In particular, they can install: solar panels or wind farms to generate their own electricity; heat pumps or solid fuel boilers - for heating; solar collectors - for heating water. In our opinion, it is important for Ukraine to research best practices in the development of "green" marketing on the world stage. So, for example, two systems operate in parallel in Germany. The country fulfills its obligations under the "green" tariff for "old" stations, and offers auctions for new ones.

The first pilot tender (2014) was organized based on the implementation of solar projects for systems installed on the ground, and later the procedure was expanded to other technologies.

The tender covers the following types of energy (Legal newspaper, 2018):

- Solar energy. Projects more than 750 kW. A single bid for ground-based systems cannot exceed 10 MW.

- Wind energy. Projects more than 750 kW, for pilot projects less than 125 MW.

- Biogas. Support is provided for 20 years for new power plants and 10 years for existing ones. New projects must be more than 150 kW. Tenders for new projects cannot exceed a capacity of 20 MW.

- Biomass. Support for 20 years for new power plants and 10 years for existing ones. New projects must be more than 150 kW, there are no restrictions for existing power plants; single tenders for new projects cannot exceed a capacity of 20 MW.

Examining the experience of Germany, we note that akonodavstvo requires the presence of permits issued by the Federal Ministry of Defense for projects, the presence of a security deposit and other documents related to the project, land plots for the project. Procedures for submission of applications are not defined at the legislative level. Therefore, it should be noted that the Federal Network Agency defines only formal requirements for submitting applications.

Unlike Germany, Denmark has a support mechanism through the auction system exclusively for offshore wind farms. Therefore, conducting bidding to determine the tariff for 1 kWh of generated electricity depending on the type of wind farm, the date of commissioning in general, as

well as individual wind turbines. There are three types of auctions in Denmark: Horns Rev 3, Horns Rev 2 and Nearshore areas. For some tenders, the Danish Ministry of Energy, Utilities and Climate may define selection criteria, specify tender offers, define specific deadlines. In addition, the system of fines plays an important role in this auction system. In addition, active construction of boiler and power plants operating on biomass processing products is underway in Germany and Denmark. To participate in the auctions, it is necessary to have data on conducting preliminary studies on the possibility of installing a wind farm, permits for the construction of a power plant and the operation of a wind farm with the determination of the total production capacity.

Since 2003, the Government of the People's Republic of China has introduced investment programs, the main direction of which is the development of wind energy. Let's note the fact that for projects with a capacity of more than 50 MW, investors are selected through an auction. The purpose of the implementation of such projects is related to the increase in the capacity of domestic production of wind generation systems, as well as the reduction of the cost price and the final price of energy produced from renewable sources.

The question of introducing auctions is actively spread in Ukraine. However, in our opinion, their application should be very balanced and the market should really be ready for legislative changes. Published Competitive selection and Support for Renewable Energy (2018), prepared jointly by the European Bank for Reconstruction and Development, need to be revised taking into account the best global practices.

A special means of stimulating the production of energy from alternative sources is also the provision of investment grants and loans. In some countries, there are special funds that provide preferential loans for the introduction of technologies that require stimulation. In particular, this applies to renewable energy sources. Thus, in Poland, the National Fund for the Protection of the Environment and Water Resources provides preferential loans for the implementation of "green" electricity projects (wind energy, biogas and hydropower) in technopolises. The size of the loan is 1-12.5 million euros, but cannot exceed 75% of the project cost. The borrower is exempt from paying up to 50% of the loan amount.

Therefore, in addition to the issue of "green" marketing, it is necessary to reveal the issue of its development in technopolises in modern conditions of globalization. When considering the structure of a modern technopolis, it can be said that it is a city that interactively connects the commercialization of technologies with the public and private sectors to stimulate economic development and diversification of technologies.

1.2. Technopolises in the frame of energy transformation processes

The modern approach to the definition of "techno" emphasizes technology, aimed at updating the industrial structure to advance the country towards the goal of becoming a "high-tech archipelago" in the 21st century. Another definition of "polis" is of Greek origin, which means a city-state aimed at the development of regions far from the leading industrial and cultural centers by accelerating the transfer of technology to regional industries and reflecting the balance between the public and private sectors (Eureka, 2023a). So, it can be noted that the word "technopolis" is a

territory where high-tech companies, research centers, incubators and accelerators, as well as infrastructure aimed at supporting innovative activities are concentrated (Eureka, 2023b). Below are several definitions of the concept of technopolis, presented by various companies and associations (Eureka, 2023c):

- "Technopolis is a territory where favorable conditions are created for the development of high technologies, innovations and business" (Eureka).
- "Technopolis is an area where industrial enterprises, research centers, universities and incubators coexist and interact, creating favorable conditions for innovation and development of high-tech companies" (OECD).
- "Technopolis is an area where ecosystems are created that bring together enterprises, research organizations, authorities and other interested parties to stimulate innovation and create new jobs" (UNESCO).
- "Technopolis is an area where conditions are created for innovation and development of high-tech companies, including access to financing, technology, scientific research and development, as well as qualified personnel" (European Commission).
- "Technopolis is an area where the development of high-tech companies and an innovative economy is based on a strong integration of scientific and technological skills and resources, as well as the support of the government and the business community" (National Governors Association).

The model of technopolis functioning in conditions of sustainable development includes information management. In particular, Robert Preer notes that "the constant theme and fundamental assumption of this analysis (of technopolises) is that the world is currently experiencing a great technological revolution, which is as deep and far-reaching as the industrial revolution or the Neolithic revolution" (Pinto, 2024a). In his research, Robert Preer defines a technopolis as "a region that generates sustainable and propulsive economic activity through the creation and commercialization of new knowledge" (Pinto, 2024b).

According to another specialist, Manuel Castells, "technopolises" should be considered as one type of industrial innovation environment. "The specificity of the innovation environment determines its ability to generate synergy, that is, additional value that is not the result of the cumulative effect of the interaction of elements present in the environment." According to Manuel Castells' definition, the type of commodity—information, goods, or services—is less important than the general attitude toward innovation and ingenuity that should characterize a technopolis. In contrast to previous interpretations of the definition of "technopolis", Raymond Smilor, George Kozmetsky and David Gibson in their work "Creating a Technopolis" describe the modern technopolis as one that "interactively links the commercialization of technologies with the public and private sectors to stimulate economic development and promote diversification of technologies" (Tufekci, 2012). Summarizing the above, it is necessary to emphasize that the key feature of the functioning of the technopolis is that high-tech industries generate the economic development of the country.

According to the existing world classification, the following types of technopolises are distinguished: innovation centers (development of new organizations with science-intensive

technologies); scientific and research parks (service not only for new, but also functioning organizations, establishing connections with universities, research institutes); technological parks (a network of knowledge-intensive organizations and industries); technological centers (service enterprises that contribute to the development of new high-tech firms); conglomerates (belts) of technological complexes and science parks (Taranenko & Kornovenko, 2014).

The administrative structure of the technopolis depends on the following factors: scientific and industrial structure; composition of investors; roles of universities/scientific and research institutes in management; ideas of technopolis management regarding the goal and task.The governing body in technopolises is a board (committee), which includes heads of the main structural and functional sectors (subdivisions), universities/scientific and research institutes, companies of the business center or chamber of commerce, as well as representatives of local authorities, banks, sponsors etc. The manager is the head of the main scientific and scientific research institute or unit. If technopolis is a joint-stock company, then its main management body is the management of shareholders. The board of the technopolis performs the main functions: planning (developing a development strategy, preparing business plans, drawing up marketing programs, allocating finances, etc.); creation of an organizational and functional structure, training of personnel; solving economic and organizational tasks related to the material and technical support of the technopolis, infrastructure development, building operation, sales management; control over the activities of the main structural divisions and the implementation of the board's decisions; establishing contacts with local authorities, banks, suppliers, business partners, etc.

An important issue is the system of providing benefits for the activities of technopolises, in particular: compensation of losses to foreign investors, which is carried out in accordance with the procedure established by law; the system of accelerated depreciation, which has a direct impact on the development of leasing; preferential lending to small and medium-sized companies; providing large loans to small research and venture firms. Financial incentives include grants for specific research programs, as well as "innovation grants" (support for new science-intensive enterprises) and grants to encourage researchers or purchase equipment and materials. Under the condition of effective creation and development of a technopolis, the following factors are important, among which the most relevant should be considered:

1. Achieving scientific excellence, aimed at the creation and development of research centers engaged in the development of new scientific methods and technologies. Such centers are distinguished by cooperation with universities and research institutes, enabling the exchange of knowledge and experience.

2. Development and implementation of new technologies that will allow the development of new sectors of the economy (information technologies, biotechnology, energy, etc.).

3. Involvement of large technological companies in the technopolis, which are engaged in the development and implementation of new technologies (high-tech production).

4. Creation of own technological companies that are engaged in development and implementation of new technologies. This type of company can be created as a startup or as a department within existing companies. In particular, it can be an intellectual cyber-physical technopolis, an innovative and active cluster.

The evolutionary aspects of the implementation of the concept of the development of technopolises reflect changes in the perception of science, technologies and innovations, which we considered in chronological order (Sutriadi, 2016):

1. The initial period (20s - 30s of the 20th century) is characterized by the manifestation of the first attempts to create technopolises (USA), the development of the industrial sector of the economy, the growth of technological industries, the emergence of research laboratories and industrial centers.

2. After the Second World War (40-60s of XX century), there is a growing need to implement new technologies and scientific discoveries in production, research and the emergence of the first technoparks (Stanford Technology Park, USA).

3. The end of the 20th - the beginning of the 21st century differs from previous periods in that attention is focused on the development of high and information technologies, biotechnology (Silicon Valley, USA).

4. The period of manifestation of globalization and technological revolution (since the 2000s) is characterized by the emergence of the Internet, the growth of global communications, and technopolises become global innovation centers (China, India).

5. Modern trends in economic growth are characterized by the fact that technopolises are becoming complex ecosystems that are able to combine scientific research, business incubators, high-tech enterprises and educational institutions. Therefore, they contribute to the creation of sustainable innovative development.

Researchers distinguish different classifications of the stages of development of technopolises. For example, Stupnytsky V.V., Sribna E.V., Stupnytska N.I. in their research, they single out the stages of development of technopolises in the international arena, the main characteristics of which are listed in Table 1.1.

Table 1.1 The main stages of the development of technopolises of the world

Stage	Years	Prerequisites	Characteristic
I stage "Becoming"	1960s	The impact of the industrial scientific and technological revolution. The beginning of interaction between science and production.	Emergence of technopolises (USA) and initial forms in Western European countries (Great Britain, France, Germany).
II stage "Lift"	1980s	Establishing the same value of scientific and production functions.	Formation of the second generation of technopolises in the USA and Western Europe. Technoparks appeared in Japan and other Asian countries.
III stage "Stable functioning"	2000s - to n.h.	Transition to the informational stage of society's development.	The formation of three centers in the field of high technologies (USA, Japan, Western Europe), between which there is a competitive struggle, which stimulates progress in the economy.

Source: created by the author based on (Stupnytsky, Sribna, & Stupnytska, 2020).

There is another approach to the evolution of the development of technopolises, shown in Tables 1.2-1.3. The differences between the three stages of the evolution of the technopolis concept can be seen in Table 1, but the development of the technopolis is focused mainly on the production of innovations and economic competition (Table 1.3).

As a result of the emergence and evolution of technopolises, the following models were formed: American, European and Japanese (Table 1.4).

Table 1.2. Stages of technopolis development

The first stage (1983-1990)	The second stage (1990-2000)	The third stage (2000 - until now)
Industrial structural shift from heavy and large-scale Fordist production to light and small-scale flexible production systems.	An increase in the number of enterprises located abroad, together with an increase in the rate of the local currency; the course of industrial restructuring.	The fourth industrial revolution, the transition from Industry 4.0 to Industry 5.0 based on intelligent cyber-physical and cyber-physical-social systems.
Period of financial recovery.	A wave of technological innovation and international competition for the power of technological development.	Periods of power alternate with protracted crises.
The approach of a technological nation.	Development of globalism.	Global competitiveness.
Requirements to revive the local economy.	Strengthening the foundation of the power of technological development (maturity of the first period of the technopolis).	Breakthrough innovations based on exponential development.
Increasing differences in technological capabilities between regions.	New information technologies and the spread of informatization.	Digitization and digital transformation.
Decline of local industry, concentration of high-tech industries in large cities, increase in regional inequality.	Promoting the soft economy and the service economy. Diversification and change of Japanese values and consciousness. Restoration of national financial strength.	Resistance to anthropocentrism". Smart economy.

Source: created by the author based on (Park, 2004; Sutriadi, 2016)

Table 1.3. Technopolis implementation strategies

The first stage (1983-1990)	The second stage (1990-2000)	The third stage (2000-- until now)
Strengthening the foundation of opportunities for technological development.	Emphasis on endogenous ways of development.	Technological sovereignty.
Transition to high-tech local industry.	Preference for individualism.	Common collaborative forms of cooperation.
Identifying local needs and making the best use of local supplies.	Formation of technopolis networks.	Development based on networks, platforms and ecosystems.
Technological innovations from scratch.	Adaptation to internationalization (open policy, technology transfer, network development).	Five innovative spirals.
Respect for the independence of settlements, emphasis on "soft" technologies.	Introduction of urban planning.	"Smart" megacities.

Source: created by the author based on (Park, 2004; Sutriadi, 2016)

On the basis of the analysis of the stages of the evolution of the development of technopolises, the factors of their successful functioning can be identified, in particular (Sutriadi, 2016):

1. Establishing partnerships between universities, research centers, industry and government.

2. Unification of clusters of small and medium-sized businesses, research and development in the field of the natural environment with a multidisciplinary university educational program based on the development of digital technologies, biological science and biotechnology, advanced materials, environmental technology, etc.

3. Creating intensive partnerships based on the five-fold innovation spiral between industry, government, universities, society and the surrounding natural environment ("pedestrian-scale" ecosystem).

4. Creation of advanced technological infrastructure for cooperation networks, digital platforms and ecosystems.

Table 1.4. Stages of formation of the functional structure of technopolises

Models of functioning of the structure of technopolises	Characteristic	Example
American model	Formation of innovative tenant enterprises and service firms.	"Silicon Valley" (California, USA).
European model	The basis of the technopolis is a business incubator that promotes the formation of new innovative enterprises.	Technopol “Sierre Switzerland” (Switzerland).
Japanese model	A structure based on one or more cities, including technology parks, business incubators, universities.	Technopolis "Tsukuba" (Japan).
Mixed model	Combines Japanese and American models.	Science Parks of France ("Sophia Antipolis").

Sourse: created by the author

The creation and development of technopolises is an urgent task for many countries, as it contributes to innovative development, the creation of high-tech industries, new jobs and an increase in economic competitiveness. International experience shows that successful technopolises have several common features that deserve further attention (Mazur & Pustovoit, 2013):

1. An integrated approach (the successful experience of the development of technopolises is related to the creation of an innovative environment as a complex task, which includes not only a scientific and research base, but also business incubators, technology parks, educational institutions and industry associations).

2. High quality of scientific institutions (the creation of a technopolis requires the presence of research institutions and universities that ensure the flow of high-quality scientific developments).

3. State support. Successful technopolises usually receive support from the state in the form of financial investments, tax incentives, and political support.

4. Interaction between business and science (the functioning of the technopolis contributes to the creation of a favorable environment for such interaction). 5. Global openness (technopolises that function successfully is open to global innovations and attracting foreign investments).

There are more than 400 technopolises in the world, which are spread over the territory of Australia, England, Belgium, Indonesia, China, Malaysia, Germany, South Korea, the USA, Thailand, the Philippines, France, Scotland, and Japan. The greatest interest in the world is caused by the network of technopolises in Japan - 19 units.

The diffuse process of technopolis integration has become widespread in such European countries as Germany, France, Belgium, the Netherlands, and Finland. Their rapid growth in Europe began in the 1980s of the last century. The Heriot-Watt University Research Park (Edinburgh), Trinity College Science Park (Cambridge), Louvain-la-Neuve University (Belgium) and many others were formed in technopolises.

Japan is distinguished by its successful experience in the creation and development of technopolises. In 1982, the national project "Technopolis" was accepted for implementation, which covers 19 territorial zones. The most famous of them is the city of Tsukuba, located 35 miles northeast of Tokyo. The population of Tsukuba technopolis is 215,389 people who work in 50 state research institutes and two universities. The technopolis is home to 30 of Japan's 98 leading public research laboratories, making it one of the largest scientific centers in the world. In contrast to classic technopolises, whose main goal is the commercialization of scientific research results, which involves specialization in applied research works, the city of Tsukuba is distinguished by the diversity of conducting fundamental research (Economic and Social Commission for Asia and the Pacific, 2019).

The "Science City" (Tsukuba), founded in the 1970s, includes two universities, laboratories, science centers, a space center, a library, a science museum, and a botanical garden. The following residents operate in the technopolis, most of which are municipal organizations: Japan Aerospace Exploration Agency Tsukuba (JAXA), National Agriculture and Food Research Organization (HAPO), scientific research institutes of industrial technologies, Research pharmaceutical company "Eisai Co.", “Nakayama Environmental Engineering Co.”, “Hodogaya Chemical Co.”, JARI Automotive Research Institute.

In our opinion, it is appropriate to note the fact that Japan's technopolises are being created in university cities, in particular mm. Akita, Utsunomiya, Naga-Oka, Hakodate, etc. Among the criteria for the placement of technopolises in Japan: proximity to the airport, the presence of a basic university, a balanced set of industrial zones, research institutes and residential quarters, an improved information network, and favorable living conditions are distinguished.

In the USA, the development of technopolises takes place under the influence of the manifestation of the integration of science, education and business, as well as the predominance of the public-private form of financing its participants and their indirect state support, through the provision of benefits and preferences. For example, the share of the federal government in financing innovative projects in the structure of research parks is 13.3%, state governments -

30.3%, local authorities - 2.7%, the private sector - 4.9%, students - 33.1 %. About 15% of the funds of the budget of the higher educational institution are their own funds and income (Voronkova & Natroshvili, 2020).

The main difference between the development of technopolises in Japan and technopolises in the United States is that the research university is mainly engaged in educational activities, while national laboratories act as centers of scientific research and innovative research and are recipients of grants from government structures and big business for the development of technological innovations.

In addition, there is a difference in the funding methods of American research universities and Japanese technopolises. If the former receive substantial state support and have multi-channel financing, Japanese technopolises are financed mainly from local budgets and private business. The most characteristic structure of financing sources for technopolises in Japan is as follows: about 30% - state funding, 30% - funds from municipalities, 30% - business and private individuals, 10% - foreign investors. A system of credit and tax support has been established for technopolises.

In China, there is a phenomenon of integration of education, science, and production, and there are also specific features of the system of formation and functioning of technopolises. At present, 53 national and 30 university technology parks operate within the technopolises of the PRC, the revenues from the export of products exceeding 4 billion dollars. USA. The core of a technology park is a research university or a high-tech company. The Chinese model of integration is fundamentally different from the American and Japanese models due to the fact that it is aimed at realizing the main goal of creating a favorable investment climate to attract domestic and foreign investors to high-tech sectors of the economy.

Practically all technopark residents (regardless of ownership) have both methods of indirect influence (numerous benefits and preferences to stimulate investors) and direct state aid (primary financing of innovative projects). The main benefits include: the personal income tax is reduced by 85% for enterprises developing high technologies, and by 90% for export-oriented firms, and such firms are also completely exempt from paying export taxes.

International experience demonstrates the significant contribution of functioning technopolises to the real sector of the economy as a result of diversification, the growth of competitive small and medium-sized businesses, and the growth of budget revenues at all levels. This is facilitated by a joint public-private form of their financing, implementation of indirect state support (provision of favorable tax, customs, credit regimes), etc.

As a result of the monitoring of the functioning of the world's technopolises, it should be noted that in all developed countries, technopolises were created on the condition that their legal status was approved at the legislative level. Existing legislation in Ukraine (Constitution of Ukraine, Laws of Ukraine "On higher education", "On scientific and scientific and technical activity", "On scientific and technical expertise", "On scientific and technical information", "On priority areas of development of science and technology ", "On innovative activity", "On the special mode of innovative activity of technological parks", etc.) does not provide that the University can act as a system-forming element of the technopolis; a mechanism of interaction

between innovative structures and executive authorities in the implementation of innovative activity.

Despite the imperfection of the legislation in the field of development of technopolises of Ukraine, in accordance with the Decree of the President of Ukraine No. 1023/2004 of August 30, 2004 "Issues of the National Technical University of Ukraine "Kyiv Polytechnic Institute", a technopolis in the field of high technologies was created on the basis of the university.

The purpose of creating a technopolis is to intensify the processes of development, production and introduction of knowledge-intensive, competitive products with the direction of coordinated actions of scientific organizations, new innovative forms (technoparks and business incubators), educational institutions, industrial enterprises and companies, investment and venture funds, business entities and entrepreneurship to meet the needs of the domestic market and increase the country's export potential.

According to the defined concept for Technopolis "Kyiv Polytechnic", the following priority areas of its scientific and technical activities are established: the latest energy-saving and resource-saving technologies; new and renewable energy sources; development of high-quality metallurgy, mechanical engineering and instrument engineering; new materials; nanotechnologies; information technologies; telecommunications; improvement chemical technologies, ecology, development of biotechnology.

Participants of the technopolis can be institutions, enterprises and companies that have strong scientific and technical potential, modern technologies, experience of working in a market economy and are able to produce innovative products that are competitive on the domestic and foreign markets. These can be educational institutions and scientific organizations, industrial enterprises and companies, technology parks, innovative business incubators, high technology centers and other business entities.

Technopolis partners can be leading domestic and international companies and organizations that provide services and promote the development of an innovative environment, namely: investment and venture funds, consulting and law firms, financial institutions, marketing centers and other business entities.

In order to join the technopolis, those organizations enter into the "Agreement on strategic partnership in the field of high technologies", in which they confirm their commitment to comply with the requirements of the "Regulations on Technopolis "Kyiv Polytechnic", and disclose the subject of mutual interest in a long-term partnership.

The management of technopolis activities is carried out under the leadership of the president, vice-president and the technopolis management body.

Therefore, the technopolis "Kyiv Polytechnic" is focused on the development of the Kyiv region and is an important component of the successful activity of innovative infrastructure.

It is worth noting that an important task for Ukraine in the war and post-war periods to ensure the sustainable development of the country is the creation of the technopolis "Pyatykhatka" (Kharkov), the purpose of which is the formation of market mechanisms, appropriate innovative infrastructure capable of transforming scientific and the technical potential of the region into the main resource of social production. Before the war with the Russian Federation, the largest center

of nuclear physics and solid state physics in the country was located within the territory of this territory - the National Scientific Center "Kharkiv Physical and Technical Institute" (NSC KhFTI), which included: "Institute of Solid State Physics, Materials Science and Technologies ", "Institute of High Energy Physics and Nuclear Physics", "Institute of Plasma Electronics and New Acceleration Methods", "Institute of Plasma Physics", "Institute of Theoretical Physics", "Scientific and Technical Complex "Nuclear Fuel Cycle", "Scientific and Production Complex "Renewable energy sources and resource-saving technologies". Institute of High Technologies and the Faculty of Physics and Technology of Kharkiv National University named after V.N. Karazin are also located on the territory of the technopolis, as well as numerous innovative companies.

So, after analyzing the activities of technopolises, we came to the conclusion that their activities contribute to the creation of new materials and other types of products; increasing the competitiveness of products on the world market; reorganization of labor resources in production related to automation and computerization of operations; increasing the welfare and standard of living of society.

1.3. State regulation of energy transformation processes: Ukraine trends and practices

Ukraine has taken an important step in the development of "green" energy in technopolises through the implementation of energy policy. The country's energy policy is represented by a number of normative legal acts that regulate issues in this area. In particular, this is the Law of Ukraine "On Alternative Fuels" (2000). It defines the main principles of state policy in the field of alternative fuels.

It should be noted that the Law of Ukraine "On Alternative Energy Sources" (2003) defines the basic principles of the development of alternative energy sources in Ukraine. It is also provided for the establishment of a "green" tariff - "a special tariff, according to which electric energy produced at electric power facilities, in particular at the commissioned phases of the construction of power stations (start-up complexes), from alternative energy sources (and with the use of hydropower - only micro-, mini- and small hydropower plants)" (Verkhovna Rada of Ukraine, 2003).

Transactions on the import of goods are exempt from value added tax if these goods are used by the taxpayer for their own production and if identical goods with similar quality indicators are not produced in Ukraine. In particular, this is inherent in equipment that works on renewable energy sources, energy-saving equipment and materials, means of measurement, control and management of fuel and energy resource consumption, equipment and materials for the production of alternative types of fuel or for the production of energy from renewable energy sources. It is also used for materials, equipment, components used for production: equipment that runs on renewable energy sources; materials, raw materials, equipment and components that will be used in the production of alternative types of fuel or the production of energy from renewable energy sources; energy-saving equipment and materials, products, the operation of which ensures economy and rational use of fuel and energy resources; means of measuring, controlling and managing the consumption of fuel and energy resources. The list of such goods with the codes of

the Ukrainian classification of goods of foreign economic activity is established by the Cabinet of Ministers of Ukraine.

It should be noted that in 2017, the Cabinet of Ministers of Ukraine adopted the energy strategy of Ukraine until 2035 "Security, energy efficiency, competitiveness". It consists of three stages: reforming the energy sector (until 2020); optimization and innovative development of infrastructure (until 2025); ensuring sustainable development (until 2035) (State Enterprise "Guaranteed Buyer", 2021). The main goal of the strategy is to increase the efficiency of the functioning of the energy sector of the national economy to ensure environmental, economic and energy security. However, the strategy was not perfect and needed updating.

It is worth noting the positive fact that the Association Agreement between Ukraine and the European Union has been ratified. It covers a number of obligations of Ukraine. In particular, in the sphere of approximation to standards and development of "green" energy, compliance with climate indicators, etc.

In 2021, the Updated National Determined Contribution of Ukraine to the Paris Agreement was approved. According to this document, Ukraine's climate goal is to reduce greenhouse gas emissions by 35% by 2030 compared to 1990. It is obvious that this plan needs to be updated to the new realities brought about by a full-scale war.

In 2022, the Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Development of Energy Storage Installations" entered into force. It is basic for creating a basis for the development of "energy storage facilities". This law introduced new concepts such as "energy storage system", "energy storage system operator" and "fully integrated network elements". In addition, it introduced new participants in the electricity market - operators of energy storage facilities, whose activities are subject to licensing.

In 2023, the Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Restoration and Green Transformation of the Energy System of Ukraine" was adopted, which provides for: determining the term of guarantees of origin, the main aspects of their issuance and circulation, implementation of the register; renewal of the "green" tariff system; introduction of new incentive systems (mechanism of market premium, mechanism of self-production, etc.); making changes to the auction support system, etc.

The Law of Ukraine "On Amendments to Certain Laws of Ukraine on Prevention of Abuse in Wholesale Energy Markets" (2023), which defines strategic directions in the energy sector, was also adopted. This law aims to implement the adapted Regulation of the European Parliament and the Council (EU) No. 1227/2011 on integrity and transparency in the wholesale energy market (2011) in accordance with Ukraine's European integration obligations. Therefore, an important part of innovative legislation is the implementation of the main principles of the European energy market in Ukraine, in particular the principles of integrity and transparency.

One of the key aspects of the new law is the definition of abuses in the energy market and the definition of sanctions for their violation. Abuses in the energy market include violation of established restrictions on the use of insider information; manipulation and attempted manipulation in the market; non-disclosure or disclosure of insider information in violation of the requirements established for the disclosure of such information; carrying out operations with

wholesale energy products without registration as a participant of the wholesale energy market in the electricity and gas markets, as well as liability.

It is worth noting that sanctions are provided in the form of fines. Tax-free minimum incomes of citizens can amount to significant amounts. In particular, up to 27,000,000 tax-free minimum incomes of citizens - for economic entities conducting economic activity on the natural gas market in accordance with the legislation in the field of functioning of the natural gas market (for violation of established restrictions on the use of insider information, as well as for manipulation on the market natural gas). Also, up to 2,700,000 tax-free minimum incomes of citizens (for economic entities conducting economic activity on the natural gas market in accordance with the legislation in the field of functioning of the natural gas market; for non-disclosure or disclosure of insider information in violation of the requirements established for the disclosure of such information).

In order to effectively implement the new norms of the law, the National Commission, which carries out state regulation in the spheres of energy and communal services, approved a number of important regulatory acts. In particular, the Procedure for registration of wholesale energy market participants and the Procedure for investigating abuses have been introduced. In addition, the methodology for determining the amount of fines for violation of license conditions and market abuse has been determined. The introduction of such innovations is an important step on the way to achieving stability and transparency in the energy sector of Ukraine. They will contribute to the development of a competitive and efficient wholesale energy market.

It is also necessary to mention the international obligations of Ukraine. In particular, the Concept for the implementation of state policy in the field of climate change until 2030 was approved, and the Low-carbon Development Strategy of Ukraine until 2050 was developed. Ukraine became a member of the Energy Community, which unites countries for cooperation in the energy sector. Another important development is that Ukraine has received observer status in the Association of Issuers' Bodies, which plays a key role in regulating the international exchange and trade of "green" energy. The European Union adopted the Green Deal Industrial Plan to ensure the transition of the European Union industry to climate neutrality, which includes the concept of the introduction of "green" energy in the European Union. For Ukraine, the Green Deal Industrial Plan is advisory in nature. However, it is important for Ukraine to monitor the implementation of the strategy in the European Union, determine global climate trends, analyze the impact of the Green Deal Industrial Plan on Ukraine, as well as develop its own concepts based on European strategies.

The "Energy Strategy of Ukraine until 2050" was presented in London (Decree of the Cabinet of Ministers of Ukraine of April 21, 2023 No. 373-r "On the Approval of the Energy Strategy of Ukraine for the Period Until 2050"), the new "Energy Strategy of Ukraine for the Period Until 2050" was approved 2050". During martial law, the document is closed, but a certain understanding can be formed from news and comments in open information sources. Thus, according to the Strategy, it is envisaged to restore the energy sector using the most modern technologies, strengthen the stability of the system and strengthen the energy security of Ukraine and the European continent as a whole.

The main vision of the Strategy is to transform Ukraine into the energy hub of Europe, which will help to get rid of dependence on Russian fossil fuels thanks to the clean energy produced in Ukraine. Therefore, the task is to increase capacities until 2050. In particular, this concerns wind generation - up to 140 GW, solar - up to 94 GW, energy storage - up to 38 GW, nuclear generation - up to 30 GW, thermal power plants and bioenergy capacities - up to 18 GW, as well as hydro generation - up to 9 GW.

As stipulated in the Strategy, the total investment opportunities for new energy capacities amount to 383 billion dollars USA. In particular, wind generation - 134 billion dollars USA, solar - 62 billion dollars USA, hydrogen technologies - 72 billion dollars USA, energy storage - 25 billion dollars USA, nuclear generation - 80 billion dollars USA, transmission systems - 5 billion dollars USA, as well as hydropower - 4.5 billion dollars USA (Ministry of Energy of Ukraine, 2023).

In the Strategy, a significant role belongs to the coverage of issues related to the consequences of the full-scale war of the Russian Federation against Ukraine, strengthening the role of energy security and strengthening the stability of the energy system; the results of joining the UES of Ukraine to the European network of operators of the electricity transmission system (ENTSO-E) and the deepening of the integration processes of the energy system of Ukraine into the European one; availability of the latest technologies, technical changes in the energy sector, world trends and innovative solutions, requirements for environmental safety in accordance with the norms of the European Union and accepted obligations of Ukraine. Attention was also paid to the issue of Ukraine's international obligations regarding energy efficiency and the use of RES, reducing greenhouse gas emissions, etc. A special role is given to the process of decentralization of electricity generation throughout the country in order to improve the stability and reliability of energy supply.

According to the resolution of the Cabinet of Ministers of Ukraine dated August 19, 2023 No. 924 "On the formation of the Interdepartmental Working Group on the Preparation of Proposals and Recommendations for the Development of the National Energy and Climate Plan", an important stage in the development of the national energy strategy - the formation of the National Energy and Climate Plan - has been initiated. This became necessary in the context of adaptation to the Regulation of the European Parliament and the Council (EU) 2018/1999 of December 11, 2018 on the management of the Energy Union, mitigation of the consequences of climate change, on amendments to the regulations of the European Parliament and the Council (EU) No. 663/ 2009 and (EU) No. 715/2009, directives of the European Parliament and the Council 94/22/EU, 98/70/EU, 2009/31/EU, 2009/73/EU, 2010/31/EU, 2012/27/EU and 2013/30/EU, Council Directives 2009/119/EU and (EU) 2015/652 and repealing Regulation of the European Parliament and Council (EU) No. 525/2013. It establishes requirements for the content and procedures of coordination, acceptance and approval of the plan. This plan is defined as a key road map for decarbonizing the country, achieving carbon neutrality and meeting energy and climate goals.

Decree of the President of Ukraine No. 737/2023 On the decision of the National Security and Defense Council of Ukraine dated November 7, 2023 "Regarding additional measures to

strengthen the stability of the functioning of the energy system and prepare the national economy for work in the autumn-winter period of 2023/24" aims to to ensure the stability and efficiency of the energy system of Ukraine in the coming autumn-winter period.

Ukraine recognized the critical role of nuclear power in the global effort to combat climate change by joining the COP28 Declaration on Climate, Relief, Recovery and Peace. One important issue is the tripling of nuclear power capacity by 2050 as a strategic step in achieving global zero greenhouse gas emissions.

Resolution No. 227 of the Cabinet of Ministers of Ukraine dated February 27, 2024 "On the introduction of guarantees of origin of electric energy produced from renewable energy sources" approved the Procedure for issuing, circulation and repayment of guarantees of origin of electric energy produced from renewable energy sources. Therefore, the specified legislative and strategic adaptations are based on the main European documents, as well as on the commitments made by our country within the framework of the Paris Agreement and other international commitments.

This course of Ukraine will contribute to a positive accession to the European Union, which means it will speed up the process of implementing the necessary legislation, increase the investment potential and increase the level of trust of the international community.

Ukraine actively interacts with international partners and uses European standards to increase the use of "green" energy. Opportunities for exporting green electricity should be considered attractive, which can become an important factor for attracting foreign investment.

In our opinion, it is also important to take into account the challenges of today. This concerns the war, the need for financial resources for new technologies and the introduction of European standards. With proper management and effective resolution of these tasks, Ukraine can become a key player in the "green" energy sector, ensuring the stability and independence of the country's energy supply in the future.

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CHAPTER 2. ENERGY SECURITY IN WARTIME FOR SUSTAINABLE DEVELOPMENT

2.1. Ukraine's energy sector in wartime conditions

The energy sector is an important and vulnerable component of any country's economy. Due to military aggression by the russian federation, Ukraine is experiencing increased challenges in this area. The loss of coal as an important source of energy is a serious challenge, as the temporarily entrenched Donbas has limited natural resources that do not provide sufficient energy sustainability. In this regard, the gas industry becomes one of the few available alternatives. However, significant dependence on natural gas imports increases risks for the country. Urgent reforms in the energy efficiency of the GDP require significant efforts in the structural restructuring of the economy, which, in turn, will significantly affect the socio-economic situation of Ukraine.

For Ukraine, the path to achieving energy independence began in 2015, when our state stopped importing Russian natural gas and switched to concluding contracts with the countries of the European Union. The next important stage was 2022. On February 24, Ukraine switched its energy system to autonomous mode after being disconnected from the power systems of Russia and Belarus. This disconnection was planned and was supposed to last three days to test how the Ukrainian system works autonomously, in order to later connect to the European system of electricity transmission operators - ENTSO-E (Zanuda, 2022) . That night, the Russian Federation began hostilities, invading the territory of Ukraine. However, the test was successfully conducted, and Ukraine finally refused to resume parallel work with the power systems of the Russian aggressor and Belarus. At the same time, Ukrenergo submitted an application for accelerated synchronization with the European energy system. Since then, for 20 days, the Ukrainian energy system has been isolated, but stable. The frequency of the network was maintained only at the level of 50 Hz. (Continental, 2022; Vatutina, 2022). The application for accelerated synchronization was supported by the energy ministers of the EU countries and the association of system operators ENTSO-E", and on March 16, 2022, Ukraine joined the energy grid of continental Europe. On January 1, 2024, Ukrenergo, the Ukrainian HTS operator, officially became a member of ENTSO-E (ENTSO-E Member, 2024). This historic step affected the country's energy strategy, strengthening the country's energy independence, its security, and expanding cooperation with European partners. This event is called obtaining "energy visa-free " with the European Union Grigorenko, (2022). Joining ENTSO-E gave Ukraine the opportunity to participate in joint projects and initiatives for the development of infrastructure and improvement of energy security in the region.

ENTSO-E (European Network of Transmission System Operators for Electricity), the European Network of Electricity Transmission System Operators, is an association for the cooperation of European Transmission System Operators (TSO). The TSO's 40 members represent 36 countries, which are responsible for the safe and coordinated operation of the European electricity system, the largest integrated electricity network in the world. ENTSO-E and its

members, as the European Community of Electricity Transmission System Operators, have a common mission: to ensure the security of the integrated energy system at all times at the pan-European level and the optimal functioning and development of the European integrated electricity markets , while enabling the integration of electricity , produced from renewable energy sources, and new technologies. ENTSO-E plays a central role in making Europe the first climate-neutral continent by 2050 by creating a system that is safe, sustainable and affordable, and which integrates the expected amount of renewable energy, thereby offering a significant contribution to development Europe's Green Deal. These efforts require sector integration and close cooperation between all actors.

Europe is moving towards a sustainable, digital, integrated and electrified energy system with a mix of centralized and distributed resources.

ENTSO-E acts to ensure that this energy system keeps consumers at the center of its operations, and is operated and developed with climate goals and social welfare in mind.

ENTSO-E's main responsibilities to perform include the following:

- Development and implementation of standards, network codes, platforms and tools to ensure a secure system and market functioning, as well as the integration of renewable energy;
- Assessment of the adequacy of the system in different terms;
- Coordination of infrastructure planning and development at the European level;
- Coordination of research and innovation activities of OSP;
- Development of platforms for transparent data exchange with market participants (ENTSO-E Mission, 2024).

2.2. Accession of Ukraine to European Network of Transmission System Operators for Electricity

Ukraine's accession to European Network of Transmission System Operators for Electricity (ENTSO-E) has a significant positive impact on the development of the country's energy system and its integration with European partners. First, joining ENTSO-E allows Ukraine to become part of the wider European energy system, which contributes to improving energy security, increasing the reliability of electricity supply and energy exchange with other countries. Second, Ukraine should adopt and implement the standards and procedures defined by ENTSO-E, which will improve the efficiency and coordination of the country's energy system. Thirdly, joining ENTSO-E gives Ukraine the opportunity to participate in the international trade exchange of electricity, which can stimulate the development of the energy market and ensure better prices for consumers.

The war that Russia has been waging against Ukraine for more than two years has a direct impact on the energy security and sustainable development of both Ukraine and the entire European energy landscape. The challenges faced by Ukraine's energy sector due to massive shelling of energy infrastructure have caused significant technological disruptions, resulting in long-term blackouts and undersupply of electricity to consumers. About 4% of the generating capacity was destroyed at the beginning of hostilities, another 35% of the capacity is located in the occupied territories. In particular, the largest nuclear power plant in Europe (Zaporizka) is under

constant pressure from the Russian occupiers. About 50% of thermal generation, 30% of solar generation, and more than 90% of wind generation were destroyed or are in the occupied territories. Gas production decreased by 10-12% during the time of the beginning of the full-scale invasion (Draft Recovery Plan, 2022)

These circumstances, as well as Ukraine's international cooperation in the energy sector, require immediate measures aimed at strengthening the safety and reliability of electrical networks and ensuring the sustainable development of the industry. We will define a system of measures that can contribute to economic security and sustainable development of the country:

- Modernization and reconstruction of existing electrical networks to increase their efficiency and resistance to failures.
- Implementation of modern systems of monitoring and management of electrical networks for timely detection and elimination of problems.
- Development and implementation of the latest technologies, such as smart grids and smart meters, which allow for greater automation and control of the energy system.
- Increasing investments in renewable energy sources and energy efficiency to reduce the burden on traditional electricity networks.
- Development and implementation of digital programs for prevention and response to accidents and disasters that may affect electrical networks.
- Increased investment in research and development of new technologies to improve the safety and reliability of electrical networks.
- Strengthening the legislation and regulatory framework that regulates the field of electricity supply and ensures appropriate safety and reliability standards.
- Protection of power grid infrastructure from possible military threats by installing barriers, protective structures and systems for detecting and deflecting attacks.
- Development of action plans and emergency response procedures for possible attacks on electrical networks, including evacuation and allocation of resources to restore power supply.
- Increasing the readiness and training of power grid personnel for the purpose of timely detection and response to possible threats.
- Development of systems for monitoring and controlling the state of electrical networks to detect abnormal situations and attacks on infrastructure.
- Cooperation with military and law enforcement agencies to ensure the protection of power grids during military operations and timely response to possible threats.
- Increasing the level of autonomy and redundancy of power networks to ensure power supply in case of damage or loss.
- Increasing attention to the cyber security of power grids and implementing measures to counter cyber attacks and other cyber threats.

This system of measures will help ensure the protection of power grids and reliable power supply during military operations, while maintaining the security and resilience of the energy infrastructure. After the end of the war in Ukraine, it is necessary to immediately move to the recovery phase, which is an important stage in the formation of a new and sustainable Ukrainian energy sector.

Below, some specific examples show the features of the formation of components for the formation of the energy security system.

2.3. Energy-efficient technologies and investments

Ensuring the stability of the energy sector becomes the key to achieving sustainable economic development and strengthening national security. The Government of Ukraine, together with the European Commission, created a broad platform for the recovery of Ukraine, which combines reforms and investments. This Platform is an open space that helps Ukrainians to recover and connects together countries, institutions, the private sector, civil society, business partners from around the world, European and international organizations, from the EBRD to the European Investment Bank, from the IMF to the World Bank. These efforts will allow Ukraine to move towards the future, in the direction of achieving climate neutrality, accelerate the digital era, build a modern and socially oriented market economy, where no person will feel abandoned (Zaryadzhai, 2024).

In order to successfully attract investments in the energy sector, it is necessary to create a favorable environment that would ensure the interest of investors and reduce the risks of their investment decisions. One of the key foundations for such an environment is the implementation of reforms, including demonopolization, ensuring transparency and improving legal and regulatory mechanisms.

First of all, the state must ensure the rule of law and the protection of investors' rights, which reduces the risks of their investments. Adaptation to European energy legislation will create uniform standards and conditions for participation in the European energy market, which will attract more investors to Ukraine.

The fight against corruption is an important step in building trust among investors. This will help reduce investment risks and ensure the stability of the economic environment.

Implementation of stimulating regulatory legislation and economically justified tariffs will create transparency and attractiveness for investors.

Conducting an active communication policy aimed at creating a positive image of the country among investors, providing them with information about advantages and opportunities in the energy sector, as well as supporting the establishment of long-term and mutually beneficial partnerships for joint development and success. Encouraging strategic and financial investors to enter the market will allow attracting additional resources and technologies for the development of the energy sector. Investment policy measures to strengthen the security and reliability of the energy sector are presented in Fig. 2.1.

The general goal of such measures is to create a stable and attractive investment climate that will contribute to the efficient functioning of the energy market and the development of the country's energy infrastructure.

The National Council for the Recovery of Ukraine from the Consequences of the War developed a draft plan of measures for the post-war recovery and development of Ukraine.

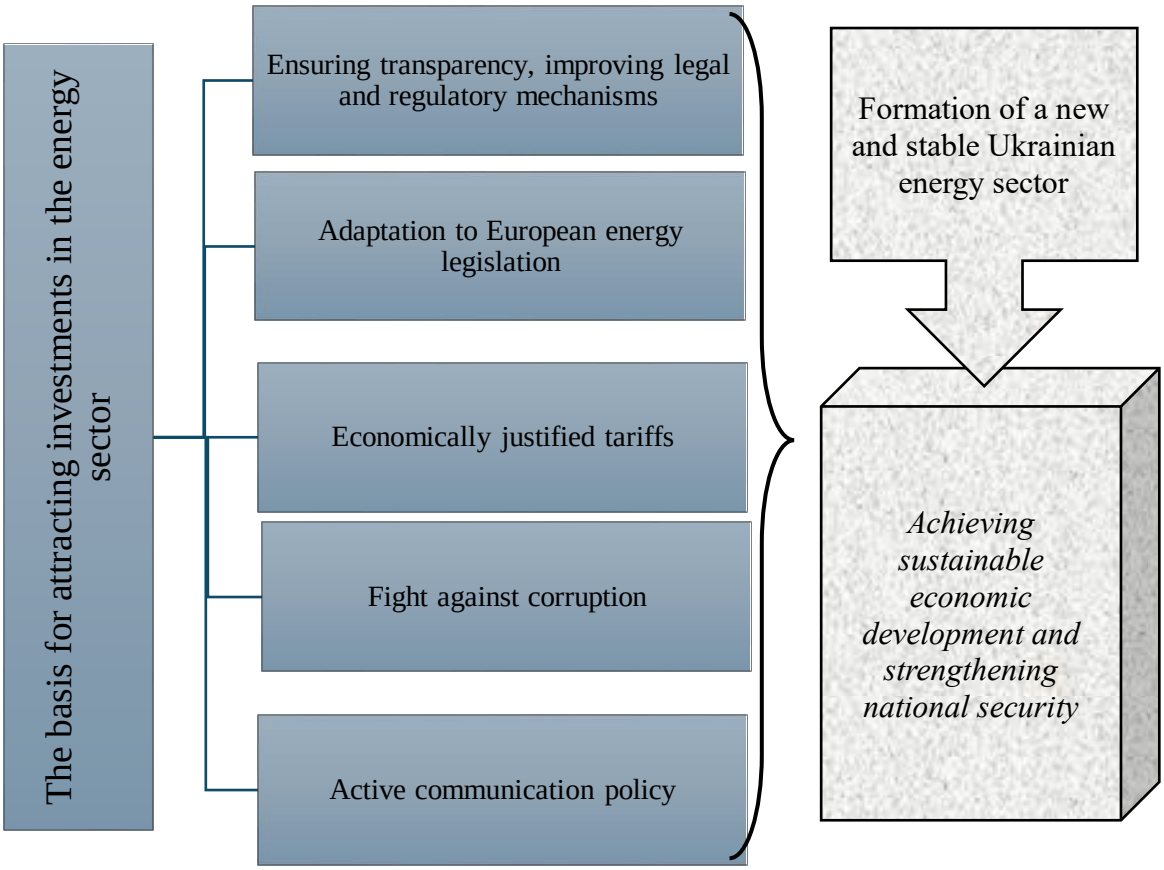

Figure 2.1. Investment policy measures to strengthen the security and reliability of the energy sector
Source: created by the authors

The vision of the Recovery of Ukraine: "A strong European country is a magnet for foreign investments" (Recovery Plan, 2022). The goals of the Recovery Plan of Ukraine are defined as:

- Ensure economic, social and environmental sustainability in the marathon to victory;
- Find effective solutions for the fastest recovery of the most important economic and social processes, and natural ecosystems;
- Develop a plan for the modernization of the country, which will ensure sustainable economic growth and the well-being of the population

The Recovery Plan of Ukraine is aimed at accelerating sustainable economic growth and is based on the following principles:

- Immediate onset and gradual development;
- Building fair welfare;
- Integration into the EU;
- Reconstruction of the better than it was, on a national and regional scale;
- Stimulation of private investments.

Within the framework of the Plan, a list of National programs for achieving key results is defined. The "Energy Independence and Green Course" program is aimed at strengthening energy security and sustainable development of the country (Projects national programs, 2022). The

restored energy sector of Ukraine should embody the most modern energy technologies and meet European energy efficiency standards.

The main directions of the Energy Restoration Program can be classified as follows:

1. Expansion of energy infrastructure based on:

- application of innovative electrical engineering technologies and IT to make the power grid more intelligent and efficient;
- construction of peak capacities and batteries;
- restoration of damaged energy facilities and modernization of the gas transportation system;
- construction of smart networks **(** smart grids).

2. Development of alternative energy sources based on:

- construction and development of renewable energy (wind, solar and hydroelectric power);
- development of infrastructure for hydrogen production.

3. Ensuring energy independence, which means the ability of a country to provide its own energy needs without dependence on external suppliers or political circumstances. To achieve this goal, it is important to take the following measures:

- an increase in nuclear power, which will increase domestic energy production and ensure the stability of energy supply in the country;
- formation of strategic reserves of oil and oil products that can be used in case of emergencies (interruptions in the supply of oil from abroad; negative changes in the world oil market);
- development and development of own gas fields, which contributes to reducing dependence on gas imports.

4. Sustainability and reliability of the energy system based on:

- modernization and optimization of the gas transport system;
- development and testing of transport infrastructure for the use of hydrogen;
- creation of reserves of oil and oil products.

Let's consider *the measures of technological reform* .

The application of the latest technologies for the modernization of the gas transportation system involves the introduction of innovative solutions and technologies to optimize and improve its operation. This covers a wide range of technologies that are used in various aspects of the functioning of the gas transportation system. Table 2.1 shows which technologies can be used.

The outdated energy system of Ukraine cannot withstand the loads of the new era. The high level of wear and tear of the main and auxiliary equipment of the power system and the uneven distribution of the load in the network often lead to emergency situations and outages of power supply to consumers. At the same time, Ukraine has one of the highest duration of emergency power outages in Europe: 696 minutes per year on average across the country. For comparison, this figure is 180 minutes in Poland, 104 minutes in Latvia, and 13 minutes in Germany. An effective mechanism for the development of the electric power system of Ukraine is the application of "smart grid" technologies (Smart Grid).

Table 2.1. Innovative technologies for optimizing the operation of the gas transportation system

Technologies	Description	Examples
Digital monitoring systems and management	The implementation of modern data collection, processing and analysis systems allows collecting large volumes of information about the state of the gas transportation system, receiving real-time data on pressure, temperature, gas consumption, etc., which helps to promptly identify and eliminate any problems	Siemens offers the SICAM system, which is used to collect data from sensors at various points in the gas pipeline and provides system operators with real-time information on pressure, temperature, gas flow and other parameters. This allows operators to quickly respond to any changes and identify possible problems.
Using drones for inspections of gas pipelines	The application of IoT in the gas transportation system allows connecting various sensors, devices and equipment to the network for data collection and process automation. This can be used to monitor the condition of gas pipelines, detect gas leaks or automatically regulate pressure.	Flyability company offers the Elios drone , which can inspect gas pipelines in hard-to-reach places (pipelines of complex construction). The use of drones makes it possible to effectively assess the condition of gas pipelines without the use of complex equipment and human resources
Intelligent management algorithms	The use of AI and data analytics allows analyzing large volumes of information collected from sensors and other sources to predict problems, detect anomalies, optimize service processes and manage resources.	General company Electric develops gas transportation system management systems based on artificial intelligence and machine learning. These systems can analyze large volumes of data and predict possible leaks, accidents or malfunctions in gas pipelines, allowing system operators to warn of events and take effective measures to avoid them.
Virtualization and cloud technologies	The application of virtualization and cloud technologies allows storing, processing and analyzing large amounts of data in real time without the need for large computing power on site. This facilitates data access and facilitates the implementation of additional analytical tools.	Schneider company Electric offers the EcoStruxure solution Gas , which allows remote monitoring and management of the gas transportation system. With the help of this system, operators can remotely control the operating modes of the equipment, as well as monitor the level of energy consumption and efficiency of the system.
Energy efficiency management systems	Implementation of energy efficiency management systems allows optimizing energy consumption and reducing losses, which is important for increasing productivity and reducing operating costs.	Honeywell manufactures smart sensors that are installed in various sections of gas pipelines to collect data on their condition and efficiency. These sensors are used to automatically control pressure, gas flow and detect any anomalies, which helps operators to respond in time to possible problems.

Source: created by the author based on (Siemens, 2024; FLYABILITY, 2024; Schneider Electric, 2024; EcoStruxure Geo SCADA Expert, 2024; Honeywell, 2024 *)*.

In the Law of Ukraine On Energy Efficiency (On Energy Efficiency, 2021), smart networks, defined as electric networks that connect in an economically expedient way the participants of the electric energy market and allow to manage the transmission of energy and its consumption in order to increase the reliability of the electricity supply and the uninterrupted operation of the energy system. In general, a smart network is a set of technologies that transform an old-style energy infrastructure into a modern digital system using innovative IT solutions. The network

integrates communication technologies, as well as technologies for collecting information on the production, transmission and consumption of electricity, effective control and management of the network. Smart networks are the basis of the development of modern energy. The goal of smart grids is to increase efficiency, reliability and economic benefit in the electric power industry.

The construction of such networks is based on the use of advanced technologies of data collection, analysis and transmission. Smart networks use automation systems that allow remote control of the electric network, remote disconnection and connection of consumers, control of substation and power grid operation modes to ensure optimal use of resources.

Monitoring and diagnostic systems, equipped with various sensors and sensors, ensure constant monitoring of the network condition. This data is used to detect and eliminate problems, predict energy consumption and optimize its distribution. Smart networks make it possible to effectively integrate renewable energy sources (solar, wind) into the general electric network, which ensures the stability of energy supply and helps reduce dependence on traditional energy sources, which contributes to environmental protection. Smart grids allow consumers to reduce energy costs and save money by monitoring energy consumption in real time and optimizing it according to needs. Such approaches in the power industry make it possible to create more stable, reliable and cost-effective power supply systems that correspond to the modern sustainable approach to the development of society (Fig. 2.2). Thus, the introduction of "smart networks" contributes to:

- development of the national electric power industry;
- improving opportunities for integration of renewable energy sources and distributed generation;
- increasing the efficiency of electric energy transmission and distribution networks,
- the creation of an electric grid as an intelligent system of transmission, distribution and supply of electric energy from electric energy producers to consumers, integrated with communications and information technologies, and one that ensures improved functioning of the energy system with high-quality service to its users (Concept, 2022).

Today, the largest programs regarding Smart Grid technologies and projects are implemented in the USA, Canada and all the countries of the European Union, especially in Latvia, Italy, France, and Germany. Implementation of similar projects in developing countries: India, Brazil, Mexico. Equipped with 100% smart meters in the USA, China, Brazil, and Japan.

The war has had a significant impact on the energy sector of Ukraine. The recovery of Ukraine from the consequences of the war requires bringing the energy complex to a fundamentally new, high-quality level of development. New approaches to energy regulation should be based on the basic principles adopted by the EU countries, taking into account the risks of external aggression, informational and hybrid methods of warfare, and non-military influences.

Figure 2.2. The results of the implementation of the "smart grid" technology
Source: created by the authors based on (Concept, 2022).

2.4. Bioenergetics development

Despite the fairly intensive *development of biomethane production* in EU countries, this direction is not developing properly in Ukraine. Ukraine has the largest area of agricultural land in Europe, and one of the best potentials of agricultural raw materials for the production of biomethane in the world. Ukraine can offer the cheapest raw materials for the production of biomethane, a developed system of gas networks (HTS and GRS) and compete with any countries on the biomethane market. The structure of agricultural enterprises is favorable for the production of biomethane (a large share of large and medium-sized enterprises). However, currently biomethane production in Ukraine is not competitive with the market price of natural gas and needs support. The figure 2.3 shows the barriers to the development of the biogas and biomethane sector and recommendations for the development of the biogas and biomethane sector in Ukraine (Biogaz, 2024).

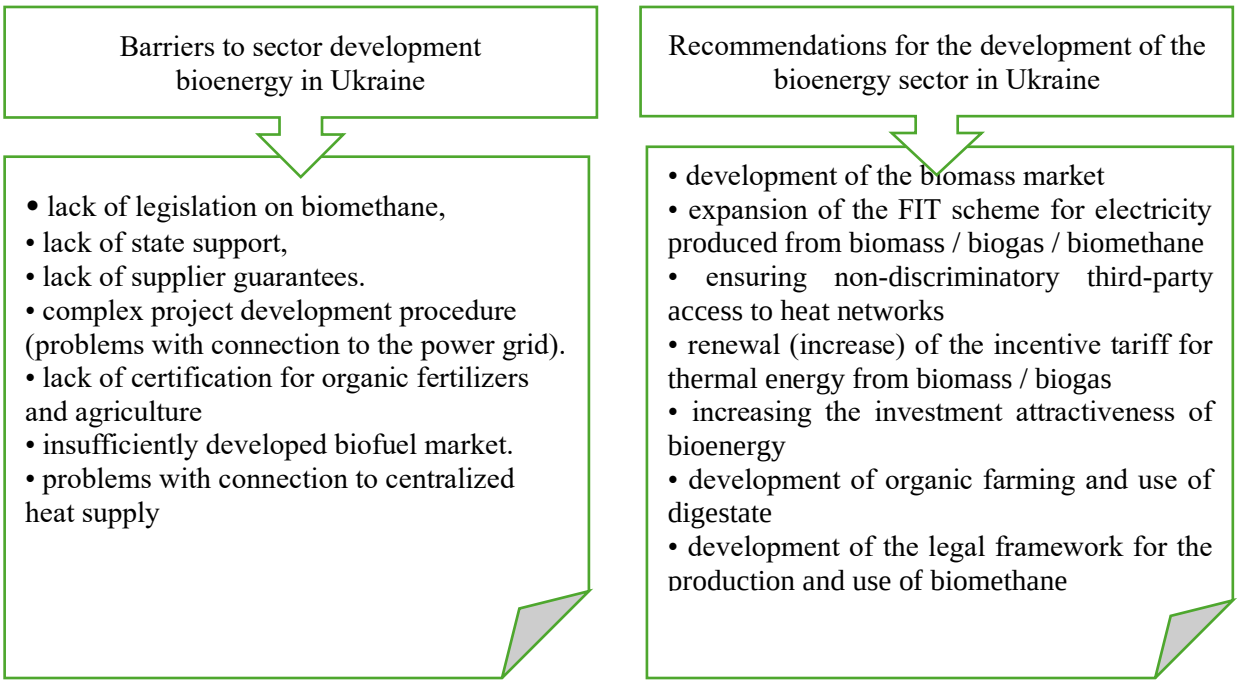

Figure 2.3. Development barriers and recommendations for the development of the bioenergy sector in Ukraine

Source: created by the authors based on (Biogaz, 2024)

Ensuring the supply of electricity to consumers, enterprises and objects of critical infrastructure with the help of small energy sources and the construction of small generation and cogeneration facilities corresponds to the strategy of decentralization of the energy system. This approach ensures greater stability and reliability of the system as a whole. In case of accidents or interruptions in operation of one source, others can continue to supply energy. Local production of electricity helps reduce dependence on imported energy and improve the energy independence of a country or region. Also, a decentralized system with small energy sources allows to reduce energy losses during transportation through the network. The construction of a large number of

small generation and cogeneration facilities is the basis of the decentralization of the energy system.

In response to the russian shelling, a system of distributed generation is being created in Ukraine, which should consist of hundreds of small power plants in order to diversify generation and protect energy facilities from large-scale damage. The scaling of such projects of distributed generation throughout Ukraine will increase the stability and flexibility of the United Energy System and will be a step towards European standards of work in the energy sector (Roshchyna, 2023).

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CHAPTER 3. STRATEGIC MANAGEMENT OF SOCIAL RESPONSIBILITY OF ENERGY COMPANIES: IMPACT ON COMMUNITIES AND THE ENVIRONMENT

3.1. Social responsibility in the energy sector

In recent decades, social responsibility issues of business have become particularly relevant, particularly in the field of energy. Energy companies, as key players in the global economic space, bear significant responsibility for the social and environmental impact of their activities. In Ukraine, this issue becomes even more important in the conditions of war and aggression on the part of russia, which systematically carries out missile strikes on energy facilities, destroying infrastructure and causing damage to both the environment and communities.

With the beginning of russia's full-scale military aggression against Ukraine, energy companies found themselves in extremely difficult conditions. The large-scale destruction of energy facilities due to missile attacks and sabotage created significant challenges for ensuring a stable supply of electricity and heat to the population and industry. In such conditions, the strategic management of social responsibility of energy companies becomes critical. The social responsibility of energy companies consists not only in ensuring a reliable and uninterrupted supply of energy resources, but also in supporting local communities, restoring infrastructure and implementing environmentally friendly technologies. In the conditions of war, these tasks are complicated, but they become even more important. Ukrainian energy companies, despite numerous difficulties, are actively involved in the restoration of destroyed facilities, introduce new technologies to increase the stability of the energy system, and also support local communities through humanitarian and social programs.

Strategic management of the social responsibility of energy companies is an important area of research that focuses on the impact of the activities of these enterprises on communities and the environment. In recent studies, such as the works of Harbar, Zh.V. and co-authors (2020), and Matskiv, R.T. (2014), issues of corporate governance and the development of social responsibility strategies that take into account the specifics of the energy sector are considered. In particular, scientists are investigating the implementation of environmental standards and initiatives aimed at reducing the negative impact on the environment (Polyanska, A.S., Bodnar, G., & Martynec, V., 2023Works Mykytenko, V.V. (2024) and Kushlyk, O.Yu. and Slonovskyi, O.R. (2016) emphasize the importance of the business ecosystem approach and the integration of social responsibility in the strategic planning of enterprises. In turn, international standards such as ISO 26000 (International Organization for Standardization, 2010) and SA8000 (Social Accountability International, 2014), provide practical recommendations for effective implementation of socially responsible practices. Research also notes the importance of corporate citizenship and social responsibility in building community trust and ensuring sustainable development (Carroll, A.B., 1999; Mirvis, Ph., & Googins, B.K., 2006).

This chapter aims to explore and highlight the importance of strategic social responsibility management of energy companies in Ukraine, especially in the context of challenges caused by

Russia's military aggression. The main objectives include analyzing the impact of missile strikes on energy facilities on communities and the environment, evaluating current social responsibility strategies and practices implemented by Ukrainian energy companies, and identifying opportunities to improve the effectiveness of these strategies in emergency situations. Also, this section seeks to emphasize the role of energy companies in supporting local communities through humanitarian and social programs, and the implementation of environmental initiatives that contribute to the recovery and sustainable development of the country.

Social responsibility is a key concept that reflects the interaction between business and society. This concept includes various aspects of the activities of organizations aimed at ensuring sustainable development, reducing the negative impact on the environment and improving the quality of life of citizens.

Corporate Social Responsibility (CSR) is defined as the voluntary commitment of enterprises to implement a policy that takes into account the economic, social and environmental aspects of their activities (Table 3.1). Scientists emphasize that social responsibility is an important element of the strategy of modern companies seeking to achieve sustainable development (Kushlyk & Slonovsky, 2016).

Energy companies have a special place in the implementation of the principles of social responsibility, since their activities significantly affect the environment. For example, reports from energy companies show that they are actively implementing energy efficiency and carbon reduction measures. Social responsibility has a positive effect on the reputation of companies, helps attract investors and increase customer loyalty. It also helps reduce operational risks and improve relations with government agencies and the public.

Table 3.1. Basic concepts of social responsibility.

Concept	Description
Sustainable development	Doing business in a way that meets the needs of the present generation without compromising the opportunities of future generations.
Ethical business	Adherence to high moral standards, including honesty, transparency, fairness and accountability.
Corporate social responsibility	Company initiatives aimed at supporting social, economic and environmental benefits.
Interaction with interested parties	Active involvement of all interested parties in the process of decision-making and management of the company.

Source: Okhrimenko & Ivanova, 2015

International standards and norms of social responsibility are important tools that help companies implement effective practices in this area. They provide guidance on how organizations can improve their social, economic and environmental performance.

One of the most significant international standards in the field of social responsibility is ISO 26000. Developed by the International Organization for Standardization (ISO) in 2010. ISO 26000 provides guidance for all types of organizations, regardless of size or location. It covers aspects such as corporate governance, human rights, labor practices, the environment, fair operating

practices, consumer issues and community participation. This standard is not certified, which means that organizations cannot obtain a certificate of conformity, but can use it as a guide to improve their social practices (International Organization for Standardization (ISO), 2010).

Another important standard is GRI (Global Reporting Initiative). It is an independent international organization that provides internationally recognized standards for reporting in the field of sustainable development. The GRI standards help companies understand and communicate their economic, environmental and social impacts. GRI reports cover a wide range of indicators, which allows companies to transparently demonstrate their activities in the field of sustainable development. Most large corporations use the GRI standards to prepare their sustainability reports, which helps them improve their reputation and increase credibility with stakeholders (Global Reporting Initiative (GRI), 2021).

The SA8000 standard is another important tool that focuses on issues of labor practices. It was developed by the organization Social Accountability International (SAI) and is one of the first international standards aimed at improving working conditions. SA8000 covers aspects such as child labour, forced labour, worker safety and health, freedom of association and collective bargaining, discrimination, disciplinary practices, working hours and compensation. Companies that meet the requirements of SA8000 can receive a certificate of compliance that confirms their efforts to ensure fair and safe working conditions.

The OECD Guidelines for Multinational Enterprises is another important document that sets standards for responsible business conduct. These recommendations cover a wide range of topics, including human rights, labor relations, the environment, anti-corruption, consumer protection, science and technology, competition and taxation. The OECD recommendations are voluntary, but compliance with them helps businesses avoid negative social and environmental consequences of their activities.

The United Nations Global Compact is a voluntary program for companies that seek to align their operations with ten universal principles in the areas of human rights, labor relations, the environment and anti-corruption. Participation in the Global Compact helps companies show their commitment to sustainable and responsible business. International standards and norms of social responsibility provide companies with tools to implement and improve social responsibility practices. They help companies not only respond to the challenges of the modern world, but also create added value for all stakeholders (Polyanska, Bodnar, & Martynec, 2023).

3.2. Management of the social responsibility in energy sector

Corporate social responsibility (CSR) encompasses a variety of models and approaches that differ in their structure, goals, and implementation methods (Table 3.2). The choice of the appropriate model depends on the specifics of the company, its industry, cultural and regional characteristics (Kushlyk & Slonovskyi, 2016).

Table 3.2. Classic models of social responsibility.

Model	Description	The authors
Economic model (Friedman's Shareholder Theory)	Maximizing returns for shareholders while staying within the law. Social responsibility is not a direct function of business, but is achieved through market mechanisms.	Friedman
Stakeholder model (Stakeholder Theory)	Taking into account the interests of all groups influencing the company's activities or subject to its influence. Balancing the interests of various stakeholders to achieve sustainable development.	Freeman
Integrative model (Integrative Model)	Integration of social responsibility in all aspects of the company's activities. Active participation in solving social problems through the concept of "Triple Bottom Line".	Elkington

Source: Mykytenko, 2024.

Social responsibility of business encompasses a variety of approaches, each of which has its own characteristics and methods of implementation (Table 3.3). These approaches can range from philanthropic initiatives to the integration of social and environmental issues into the strategic planning of companies. Below is a brief outline of the main approaches to the implementation of social responsibility (Matskiv, 2014).

Table 3.3 Approaches to the implementation of social responsibility (United Nations Global Compact, 2000).

Approach	Description	Authors and references
Philanthropic Approach	Focused on charity events and donations to support social initiatives. Increasing the company's reputation and strengthening ties with society.	Porter and Kramer
Ethical Approach	Adherence to high standards of business ethics, including honesty, transparency, fairness and accountability.	Crane and Matten
Strategic Approach	Integrating social and environmental issues into the company's business strategy to achieve long-term competitive advantages.	Porter and Kramer
Regulatory Approach	Compliance with all relevant legal requirements and standards governing the company's activities.	Moon

Source: created by the authors based on (United Nations Global Compact, 2000).

Social responsibility is an important component of the strategy of modern energy companies. Integrating social responsibility into business strategy helps companies not only fulfill their social and environmental obligations, but also increase competitiveness and ensure long-term sustainability (Polyanska, Bodnar, & Martynec, 2023).

The integration of social responsibility into the strategy of energy companies includes several main steps that provide a systematic approach to the implementation of socially responsible practices:

1. Assessment of the current state
2. Determination of key directions

3. Strategy development
4. Implementation of programs and initiatives
5. Monitoring and evaluation
6. Reporting and communication (van der Putten, 2005).

Energy companies today face numerous challenges related to sustainable development and responsibility to society and the environment. Implementing socially responsible strategies and policies not only helps reduce risks, but also improves corporate reputation and creates long-term value.

Let us highlight the following areas of social responsibility:

1. Environmental sustainability (implementation of initiatives aimed at reducing the negative impact on the environment).

2. Energy efficiency (modernization of equipment, introduction of the latest technologies and optimization of production processes to reduce energy consumption).

3. Social justice and labor practices (creating safe and healthy working conditions, ensuring fair wages, respecting workers' rights and supporting professional development).

4. Interaction with local communities (support of social and economic projects, participation in local initiatives and investment in infrastructure development).

5. Transparency and accountability (regular disclosure of information about the company's activities, including financial results, environmental indicators, and social initiatives) (Shmygol, Urusova, & Grinchenko, 2019).

The integration of social responsibility into the strategy of energy companies is a necessary condition for ensuring their sustainable development. This allows not only to fulfill obligations to society and the environment, but also to create added value for shareholders and other interested parties. The use of modern approaches and adherence to international standards help companies achieve high results in this area.

Energy companies face a variety of risks and opportunities. Managing these aspects is a key element of a social responsibility strategy, as it allows to minimize the negative impact and maximize the positive results for the company and society. The main risks for energy companies are environmental, regulatory and economic (Carroll, 1999).

Environmental risks involve air, water and soil pollution, which can lead to financial losses through fines and lawsuits. Managing these risks involves implementing technologies that reduce emissions and waste. For example, water filtration and purification systems reduce the negative impact on ecosystems.

Regulatory risks arise from strict requirements that may change over time. Non-compliance with legal regulations can lead to fines and loss of reputation. Companies must monitor changes in legislation and adapt their strategies in accordance with new requirements.

Economic risks are associated with fluctuations in energy prices, changes in the economic situation and instability in financial markets. Falling oil prices can lead to financial losses. To reduce economic risks, companies can diversify sources of income, invest in new technologies and implement effective financial management methods (van der Putten, 2005).

Along with the risks, energy companies have numerous opportunities for development. The introduction of innovative technologies, such as renewable energy sources and smart grids, allows reducing production costs, improving environmental performance and increasing the competitiveness of companies.

Globalization and growing demand for energy are opening up new market opportunities. This includes entering new geographic markets, expanding the range of services and products, as well as cooperation with other companies to implement joint projects. For example, the development of renewable energy sources in developing countries can become a significant source of income (Organisation for Economic Co-operation and Development (OECD), 2011).

The growing interest in social responsibility creates opportunities to improve corporate reputation and attract new customers. Companies implementing socially responsible practices can gain competitive advantages. This includes participating in social projects, supporting local communities, reducing emissions and implementing environmentally friendly technologies.

Energy companies have numerous opportunities for development and growth. Effective management of risks and opportunities is the key to ensuring sustainable development of companies and their success in the market. Innovation, compliance with regulatory requirements, development of new markets and increased social responsibility are important components of the strategy of successful energy companies (Matten & Crane, 2003).

Monitoring and evaluating the effectiveness of social responsibility of energy companies is critical for sustainable development (Table 3.4). The use of key performance indicators (KPI) such as emissions, energy consumption and community investment is essential to track progress. Regular audits, questionnaires and surveys provide independent assessment and feedback. Technological innovations, such as data management systems, automate the processes of data collection and analysis. Transparent reporting, in accordance with international standards, strengthens the trust of stakeholders. Effective monitoring and evaluation contribute to the long-term sustainability and success of companies (Carroll, 1999).

Table 3.4. Social impact of energy companies

Aspect	Positive consequences	Negative consequences
Economical development	Creation of jobs, growth of the local economy through investment, improvement of living standards	Displacement of local businesses, dependence on one branch of the economy is possible
Infrastructure	Improvement of infrastructure (roads, electricity supply), investment in social projects (schools, hospitals)	Destruction of local infrastructure due to construction and mining, temporary increase in load on infrastructure
Education and training	Investments in education and vocational training, improving the skills of local workers	Unequal access to educational programs, focusing on short-term training instead of long-term educational initiatives
Environmental impact	Introduction of environmentally friendly technologies, reduction of emissions and pollution, rehabilitation of polluted areas	Air, water and soil pollution, destruction of natural ecosystems, negative impact on public health
Social justice	Support of vulnerable population groups, promotion of social equality and inclusion	Inequality in the distribution of benefits, insufficient attention to the needs of certain population groups is possible
Cultural influence	Support of local cultural initiatives, preservation of cultural heritage	Destruction of cultural values due to urbanization and industrialization, assimilation of local cultures

Source: created by the authors based on (Social Accountability International, 2014).

Energy companies have the potential to make a significant positive impact on communities, including through economic development, infrastructure improvements and education support. However, there are also negative aspects, such as environmental pollution and social inequality, which require a responsible approach and constant monitoring. It is important that energy companies actively interact with local communities, take into account their needs and work to reduce the negative consequences of their activities. This will help ensure sustainable development and improve the quality of life of the population (Organisation for Economic Co-operation and Development [OECD], 2011).

Energy companies can make a significant contribution to the development of local communities through a variety of programs and projects. These initiatives may include economic support, infrastructure development, educational and social programs, and environmental projects. Below is an analysis of such initiatives in a table that demonstrates the diversity of approaches and their impact on communities (Table 3.5).

Table 3.5. Programs and projects aimed at the development of communities

Initiative	Description	Impact on communities	Examples of companies
Economic support	Financing of local businesses, job creation, entrepreneurship development	Growth of the economy, reduction of unemployment, increase in the standard of living	Shell, BP
Infrastructure development	Construction and repair of roads, electrification, water supply	Improving the quality of life, access to basic services, increasing the investment attractiveness of the region	ExxonMobil, Chevron
Educational programs	Scholarships, construction of schools, vocational training	Increasing the level of education, developing skills, ensuring future employment	TotalEnergies, Eni
Social programs	Health care support, cultural initiatives, assistance to vulnerable groups	Improvement of population health, preservation of cultural heritage, social cohesion	Gazprom, Rosneft
Ecological projects	Restoration of ecosystems, reduction of pollution, implementation of clean technologies	Preservation of the environment, improvement of public health, increase in environmental awareness	Statoil, Iberdrola

Source: created by the authors based on (Saprykina et al., 2011).

They have the potential to positively influence the development of local communities through various initiatives. Economic support, infrastructure development, educational and social programs, as well as environmental projects contribute to improving the quality of life, creating new opportunities for local residents and preserving the environment. Effective implementation of these initiatives requires close cooperation with local communities and consideration of their needs and expectations, which will ensure sustainable development and mutual benefit.

In the conditions of the war in Ukraine, the issue of cooperation between energy companies and local authorities and non-governmental organizations (NGOs) is of particular importance.

Such partnerships are key to ensuring community resilience, maintaining social stability and restoring critical infrastructure.

Energy companies play an important role in working with local authorities to ensure a reliable power supply, which is critical in a wartime environment. This cooperation includes the planning and implementation of projects to restore damaged energy facilities, modernize networks and introduce new technologies to increase system resilience. Coordination of efforts for rapid response to emergency situations is also an important aspect.

Non-governmental organizations (NGOs) play a significant role in supporting local communities in times of crisis. Energy companies actively cooperate with NGOs to implement social programs aimed at supporting vulnerable population groups, including refugees, children and the elderly. For example, joint programs with NGOs may include construction of temporary housing, provision of humanitarian aid and educational activities.

Cooperation with local authorities and NGOs also includes environmental initiatives aimed at restoring damaged ecosystems and reducing the negative impact on the environment. In the context of war, these initiatives become especially relevant, as military actions often lead to significant environmental destruction. Restoration of forests, purification of water resources and rehabilitation of polluted areas are important directions of such cooperation.

The current situation in Ukraine demonstrates that partnerships between energy companies, local authorities and NGOs are an effective mechanism for overcoming the challenges associated with war. Such cooperation allows to mobilize resources, join forces and provide a comprehensive approach to solving social, economic and environmental problems. It is important that these partnerships are built on the principles of transparency, mutual trust and shared responsibility (Matten & Crane, 2003).

Energy companies have a significant impact on the environment through a variety of activities, including resource extraction, energy production and distribution. One of the main types of environmental impact is the emission of greenhouse gases that cause climate change. Burning fossil fuels to produce electricity results in emissions of carbon dioxide (CO2), methane (CH4) and other harmful substances. According to research, reducing greenhouse gas emissions is a critical task for ensuring sustainable development. Another important type of environmental impact is water pollution. Energy companies can pollute water bodies through oil spills, chemical waste, and thermal pollution from power plants. This can have serious consequences for biodiversity, public health and water quality. For example, studies emphasize the importance of implementing water treatment technologies and minimizing industrial emissions (Polyanska, Bodnar, & Martynec, 2023).

Activities affect soils and vegetation. Mining and infrastructure construction can lead to land degradation, soil erosion and the destruction of natural landscapes. This is especially true for regions with rich biodiversity, where disruption of ecosystems can have long-term negative consequences. Companies should implement programs to remediate and restore disturbed land to minimize their impact. Noise pollution is another type of environmental impact, especially in areas where wind and thermal power plants are located. Constant noise can negatively affect the health of people and animals, disrupting their normal life cycles. To solve this problem, it is necessary to

implement noise absorption technologies and place energy facilities at a safe distance from residential areas (Matten & Crane, 2003).

Despite the potential negative consequences, energy companies can significantly improve their environmental impact by implementing socially responsible practices. This includes investing in renewable energy sources such as solar, wind and hydropower, which reduce dependence on fossil fuels and reduce greenhouse gas emissions. Research highlights that investments in clean technologies contribute to long-term sustainability and economic benefits. Another positive aspect is the implementation of energy efficiency programs that help reduce energy consumption and increase the efficiency of production processes. This includes equipment upgrades, implementation of energy management systems, and educational programs to increase employee awareness of energy efficiency.

Energy companies have a significant environmental impact, which can be both negative and positive. Effective management of these impacts is critical to ensuring sustainable development and improving the quality of life of the population. The implementation of renewable energy sources, energy efficiency programs and environmental initiatives contributes to the reduction of negative consequences and the creation of a positive environmental impact.

Energy companies play an important role in the implementation of environmental initiatives and projects aimed at preserving the environment and supporting sustainable development (Table 3.6). Such programs contribute to reducing the negative impact on the environment, improving the quality of life of the population and ensuring the sustainable use of natural resources (Mirvis & Googins, 2006).

Table 3.6. Environmental protection and sustainable development programs

Initiative	Description	Example
Renewable energy sources	Investments in solar, wind and hydropower development to reduce emissions and dependence on fossil fuels.	Iberdrola develops wind and solar power plants.
Energy efficiency programs	Implementation of modern technologies and methods of energy management to reduce energy consumption and increase efficiency.	General Electric and program "Ecomagination".
Reduction of water pollution	Implementation of water purification and wastewater management technologies to reduce pollution of water bodies.	Shell implements water purification projects.
Restoration of ecosystems	Reforestation, rehabilitation of contaminated land and preservation of biodiversity.	BP restores forests in mining regions.
Increasing environmental awareness	Organization of educational programs, seminars and trainings on issues of sustainable development and environmental protection.	Educational programs and trainings for employees and the public.

Source: created by the authors

Successful practices and case studies of leading energy companies can serve as important examples for other companies seeking to implement environmentally friendly technologies and social responsibility strategies. The analysis of such examples allows us to identify effective approaches and methods that help reduce the negative impact on the environment and support sustainable development.

The Spanish company Iberdrola is one of the leaders in the field of renewable energy. It actively invests in the development of solar and wind power plants around the world. For example, in 2020, Iberdrola launched one of the world's largest wind energy production complexes in South Texas, USA. This project helps reduce greenhouse gas emissions by providing clean energy to millions of households. In addition, the company invests in solar energy projects in Spain, which contributes to the reduction of dependence on fossil fuels and ensures the sustainable development of the energy sector.

Tesla is known for its innovative approaches to energy storage. Its Powerpack system allows you to store electricity generated from renewable sources and use it during periods of peak load or lack of production. One of Tesla's biggest projects is the Hornsdale Power Reserve in Australia, the world's largest lithium-ion battery. This system ensures the stability of the power grid and helps reduce the use of coal-fired power plants, which helps reduce greenhouse gas emissions.

Shell is actively developing hydrogen technologies as an environmentally friendly alternative to traditional fuels. In 2021, Shell opened one of the world's largest plants for the production of "green" hydrogen in Germany. Hydrogen is produced by electrolysis of water using electricity from renewable sources. This allows to reduce emissions of carbon dioxide and other harmful substances. Shell is also actively developing the infrastructure for hydrogen filling stations, which contributes to the spread of hydrogen transport.

ExxonMobil is implementing carbon capture and storage (CCS) technologies in its manufacturing processes. One of the company's successful projects is a carbon capture plant in Wyoming, USA. This plant captures carbon dioxide produced during energy production and stores it in underground storage. According to the company's estimates, this project allows reducing CO2 emissions by millions of tons per year, which significantly reduces the environmental impact of production.

General Electric (GE) has developed the "Ecomagination" program, which aims to create environmentally friendly products and solutions. As part of this program, GE implements innovative technologies to improve energy efficiency and reduce emissions. For example, the company has developed energy-efficient turbines for power plants, which allow to significantly reduce fuel consumption and greenhouse gas emissions. The "Ecomagination" program also includes the modernization of existing facilities and the introduction of new technologies on an industrial scale (Organisation for Economic Co-operation and Development [OECD], 2011).

3.3. Implementing the environmentally friendly technologies and social responsibility strategies: international practices

Studying the experience of other countries in the implementation of environmentally friendly technologies and social responsibility strategies is important to understand effective approaches and methods that can be applied in different settings. Comparative analysis of international experience allows identifying best practices and adapting them to local needs and specifics.

Germany is one of the leading countries in the field of renewable energy sources and energy efficiency. The program "Energiewende" (energy transition) is aimed at reducing dependence on

fossil fuels and increasing the share of renewable energy sources in electricity production. Germany actively invests in the development of solar and wind power plants, which allows to reduce greenhouse gas emissions and improve the environmental situation. In addition, Germany implements policies to support energy efficiency through subsidy programs and tax incentives for businesses and households investing in energy-efficient technologies.

Japan, which suffered from the accident at the Fukushima nuclear power plant, has taken a significant step towards the development of renewable energy sources and the introduction of energy efficiency technologies. Japan is actively developing solar energy, occupying one of the leading places in the world in terms of the installed capacity of solar power plants. In addition, Japan is implementing energy storage technologies such as battery systems to ensure the stability of the energy supply. Energy efficiency programs include supporting innovation in industry and construction, which helps reduce energy consumption and emissions.

Denmark is a world leader in the use of wind energy. About 50% of the country's electricity is produced by wind turbines. This achievement was made possible by long-term government support and investment in the development of wind technologies. In addition, Denmark is implementing an energy efficiency and emission reduction policy in the building sector, which includes strict energy efficiency standards for new buildings and modernization programs for existing facilities. Denmark is also developing infrastructure for electric vehicles, helping to reduce emissions from transport.

China, which is one of the largest producers and consumers of energy in the world, is actively investing in the development of renewable energy sources and environmentally friendly technologies. China leads in installed capacity of solar and wind power plants, and is also developing carbon capture and storage (CCS) technologies. As part of its "green development" policy, China is implementing energy efficiency programs in industry and construction, as well as supporting research and development in the field of renewable energy sources. Programs of subsidies and tax incentives stimulate the development of environmentally friendly technologies and contribute to the reduction of greenhouse gas emissions.

A comparative analysis of international experience shows that success in implementing environmentally friendly technologies and social responsibility strategies depends on an integrated approach, government support and investment in research and development. Germany, Japan, Denmark and China demonstrate effective development models that can be adapted to other countries taking into account their specific conditions. Studying the experience of these countries allows to determine the best practices that contribute to reducing the negative impact on the environment, improving energy efficiency and ensuring sustainable development (Mirvis & Googins, 2006).

In the conditions of constant strikes by Russian missiles, the energy infrastructure of Ukraine suffers significant damage, which creates challenges for ensuring stable energy supply and stability of the energy system. To overcome these challenges, it is necessary to implement effective strategies and innovative approaches. The development of renewable energy sources, such as solar and wind energy, will reduce dependence on fossil fuels and ensure the decentralization of energy supply, which will increase the resistance of the energy system to attacks. Investing in modern

energy storage technologies and implementing smart grids will contribute to the stability of energy supply, efficient management of energy resources, and cost reduction.

Active state support and international cooperation are needed to restore the energy infrastructure. Government funding and subsidy programs can stimulate investment in renewable energy and energy storage, and international organizations and partners can provide technical assistance and financial resources to modernize the energy system. An important task is the reconstruction of the damaged infrastructure using the latest technologies that take into account increased sustainability, energy efficiency and environmental safety. Educational programs and trainings for the population will contribute to the formation of the necessary knowledge for the development of a sustainable energy system.

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CHAPTER 4. INTEGRATION OF RENEWABLE ENERGY FLOWS INTO THE UNIFIED ENERGY SYSTEM: ENVIRONMENTALLY RESPONSIBLE TARIFF FORMATION

4.1. The main pillars of the "green" tariff system

The incentive mechanism of the "green" tariff was implemented in Ukraine in 2008, when relevant changes were made to the Law of Ukraine "On Electricity". The tariff contributed to the rapid development of renewable energy sources (RES) generation (Bilozerova L., 2024).

Thus, according to the data of NPC Ukrenergo, as of January 2022, the total installed capacity of wind turbines in Ukraine was about 2 GW, solar power plant (SPP) – 6 GW, hydro power plant (HPP) – 6 GW, thermal power plant (TPP) and biofuel stations – 6 GW. That is, the total capacity of "green" energy was about 20 GW. At the same time, the capacity of Ukrainian nuclear power plants at that time was 14 GW.

During the military years of 2022–2023, more than 660 MW of new capacities producing electricity from renewable sources were introduced in Ukraine. In particular, during 2022, about 312 MW of new RES capacities were built, and in 2023, about 350 MW were put into operation. These are solar and wind power plants, as well as biogas and small hydropower plants (Ukrainian energy, 2024).

Responsible tariff formation at different levels of integration of renewable energy flows into the unified energy system of Ukraine is based on:

- "green tariff" system;
- systems for stimulating the production of electricity from RES (through the market premium mechanism; the self-production mechanism);
- auction support system;
- guarantees of the origin of electric energy from RES;
- a mechanism for forming a tariff for electric energy transmission services;
- sale on the free market;
- preferential loans for the purchase of energy equipment for RES.

"Green" is a special tariff, according to which the state buys electricity from private and corporate entities. It is valid until 2030 and applies only to energy obtained from alternative sources. Solar energy is considered the most widespread and popular. By selling it, an active consumer receives a stable passive income. Rates decrease over time, so it is advisable to connect the "green" tariff in Ukraine as early as possible.

By buying solar batteries at a "green" tariff, individuals and legal entities also contribute to solving other pressing problems (Atmosfera, 2023):

–reduction of greenhouse gas emissions due to reduction of dependence on fossil fuels. All this contributes to reducing the amount of damage that has been done to the environment;

–diversification of the energy portfolio. Due to the diversity of energy sources, a more sustainable and reliable energy system is ensured.

According to the current limits, private individuals can install equipment with a capacity of up to 30 kW. For legal entities, there are no restrictions on the capacity of solar stations: the state guarantees the purchase of the generated energy in full.

Also, the state has determined the price of a kilowatt under the green tariff for private households, which is 16 eurocents (provided the station is put into operation by 2025).

For commercial enterprises, the cost of 1 kWh of energy for ground stations is 15 eurocents, and for stations located on roofs, it is 16.4 eurocents.

The rates of the "green" tariff in Ukraine will be valid until December 31, 2029. And from January 1, 2030, various mechanisms for the sale or offsetting of electricity are possible, which have already been adopted or will be approved in the future (Atmosfera, 2023).

For installations of private households put into operation from January 1, 2024, the "green" tariff is established and valid subject to the presence of buildings and other capital structures within the boundaries of the private household, as well as the consumption of electricity by the private household.

The Cabinet of Ministers of Ukraine approves the principles of the trade policy of the guaranteed buyer, which, according to expectations, can increase the profitability of the work of this market participant and his calculations according to the "green" tariff. The guaranteed buyer must take these principles into account when buying and selling electricity on the market and exporting it.

The obligation of the state in the person of the guaranteed buyer to purchase all electric energy produced from renewable energy sources under the "green" tariff is limited to the amount of electric energy that can be released in accordance with the established capacity of the electric generating equipment specified in the license for the production of electric energy. The excess of this amount will be purchased by the guaranteed buyer at the price of the value of the positive imbalance in the relevant period (Sayenko Kharenko, 2023 (1).

4.2. Scenarios of ecologically responsible tariff formation

The "green" tariff incentive mechanism was implemented in Ukraine in 2008 when relevant changes were made to the Law of Ukraine"On Electricity." The tariff contributed to the rapid development of renewable energy sources (RES) generation (Bilozerova L., 2024).

Thus, according to the data of NPC Ukrenergo, as of January 2022, the total installed capacity of wind turbines in Ukraine was about 2 GW, solar power plant (SPP) – 6 GW, hydropower plant (HPP) – 6 GW, thermal power plant (TPP) and biofuel stations – 6 GW. That is, the total capacity of "green" energy was about 20 GW. At the same time, the capacity of Ukrainian nuclear power plants at that time was 14 GW.

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Responsible tariff formation at different levels of integration of renewable energy flows into the unified energy system of Ukraine is based on the following:

- "green tariff" system;
- systems for stimulating the production of electricity from RES (through the market premium mechanism and the self-production mechanism);
- auction support system;
- guarantees of the origin of electric energy from RES;
- a mechanism for forming a tariff for electric energy transmission services;
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By buying solar batteries at a "green" tariff, individuals and legal entities also contribute to solving other pressing problems (Atmosfera, 2023):

–reduce greenhouse gas emissions due to a reduction in dependence on fossil fuels. All this contributes to reducing the amount of damage that has been done to the environment;

–diversification of the energy portfolio. Due to the diversity of energy sources, a more sustainable and reliable energy system is ensured.

According to the current limits, private individuals can install equipment up to 30 kW capacity. For legal entities, there are no restrictions on the capacity of solar stations: the state guarantees the purchase of the generated energy in total.

Also, the state has determined the price of a kilowatt under the green tariff for private households, which is 16 euro cents (provided the station is put into operation by 2025).

For commercial enterprises, the cost of 1 kWh of energy for ground stations is 15 euro cents, and for stations located on roofs, it is 16.4 euro cents.

The "green" tariff rates in Ukraine will be valid until December 31, 2029. From January 1, 2030, various mechanisms for the sale or offsetting of electricity are possible, which have already been adopted or will be approved in the future (Atmosfera, 2023).

For installations of private households put into operation from January 1, 2024, the "green" tariff is established and valid subject to the presence of buildings and other capital structures within the boundaries of the private household, as well as the consumption of electricity by the private household.

The Cabinet of Ministers of Ukraine approves the principles of the trade policy of the guaranteed buyer, which, according to expectations, can increase the profitability of the work of this market participant and his calculations according to the "green" tariff. The guaranteed buyer must consider these principles when buying and selling electricity on the market and exporting it.

The obligation of the state in the person of the guaranteed buyer to purchase all electric energy produced from renewable energy sources under the "green" tariff is limited to the amount

of electric energy that can be released by the established capacity of the electric generating equipment specified in the license for the production of electric energy. The guaranteed buyer will purchase the excess of this amount at the price of the value of the positive imbalance in the relevant period (Sayenko Kharenko, 2023 (1).

In order to stimulate the production of electricity from RES, a *market premium mechanism* is introduced - an alternative system for stimulating the production of electricity from RES for generation that has a "green" tariff (the producer from RES has the right to choose this support system) or that, as a result of the auction, has acquired the right to support (within the framework of the auction, manufacturers can receive only this support system). According to this system, the guaranteed buyer is proposed to pay the difference between the size of the "green" tariff/auction price and the estimated market price (Sayenko Kharenko, 2023 (1).

Suppose the estimated market price exceeds the amount of the auction price. In that case, the RES producer pays the guaranteed buyer the service cost under the market premium mechanism for the released electric energy by the relevant electric power facility.

Calculation of the cost of the service according to the mechanism of the market premium, provided by business entities that have established a "green" tariff, is carried out by the guaranteed buyer by the procedure approved by the National Commission for State Regulation of Energy and Public Utilities (NCREPU, the Regulator).

The price of the service under the market premium mechanism for a month for each electricity facility is determined depending on the value of the day-ahead market price indices for the base load for the estimated and previous month and the price indices under bilateral contracts concluded at electronic auctions for the sale of electricity by producers and Harpok (except some contracts) for the estimated and previous months for the base load (Sayenko Kharenko, 2023 (1).

In order to stimulate the self-consumption of electric energy by active consumers, *a self-production mechanism* is proposed – a support system, according to which the cost of the volume of electric energy supplied to the electric network by the generating units of such consumers and the cost of the volume of their withdrawal of electric energy from the electric network, taking into account the cost of transmission services and/or distribution of electrical energy. Such a support system is established for consumers whose generating units are connected to consumption electrical installations, provided that the installed capacity of such installations does not exceed the permitted (contractual) power of consumption electrical installations of such a consumer, namely (Sayenko Kharenko, 2023 (1); Ukrainian energy, 2023):

- solar and wind generators of private households with an installed capacity of up to 30 kW;
- solar and wind generators of small non-domestic consumers with an installed capacity of up to 50 kW;
- installations of other non-domestic consumers generating electricity from the energy of the sun, wind, biomass, biogas, hydropower, and geothermal energy, provided that their installed capacity does not exceed the permitted (contractual) capacity of such consumer's electrical installations intended for the consumption of electrical energy;

• generating plants of other non-domestic consumers put into operation before December 31, 2029, provided that their installed capacity does not exceed the permitted (contractual) capacity of such consumer's electrical installations intended for the consumption of electric energy.

The electrical capacity of an active consumer (except for domestic and small non-domestic consumers) permitted to be supplied to the network can be at most 50 percent of the permitted (contractual) capacity of such consumer's electrical installations. After meeting specific technical requirements of the distribution system operator/transmission system operator (which must be further determined), the electric power allowed for release to the network may be increased.

To implement such a support system, active consumers enter into an electricity purchase and sale contract based on the self-production mechanism with a universal service provider (the option is available only for private households and small non-domestic consumers) or an electricity supplier (all active consumers), by the model form approved by the NCREPU.

Suppose private households and small non-domestic consumers enter into a contract with a universal service provider (USP). In that case, the sale of released electric energy by consumers is carried out at a price on the market "a day ahead" at the relevant hour; in all other cases, the electricity sold by an active consumer is subject to free prices.

The offset of released and consumed electricity is carried out in the corresponding month, based on the results of which the obligation of the consumer or supplier to make payment based on the balance results is established (Sayenko Kharenko, 2023 (1); Ukrainian energy, 2023).

4.3. The economic mechanisms of the energy system transformation

Auction support system. Instead of guaranteeing the purchase of the entire volume of electric energy released by producers at the auction price, Law of Ukraine No. 3220-XX "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine" of June 30, 2023 establishes a guarantee for the purchase of services under the mechanism market premium, therefore, instead of a contract for the purchase and sale of electric energy based on the results of the auction, a contract for the provision of services based on the market premium mechanism is concluded.

The power to prepare proposals for the amount of annual support quotas is left only to the operator of the transmission system. In addition, the NCREPU provides the authority to prepare proposals for the maximum price offer of the auction participants for the next year for individual alternative energy sources.

Within the framework of the annual or additional annual support quota, the Government may additionally (Sayenko Kharenko, 2023 (1); (2):

• to determine the technical parameters (characteristics) of the energy storage facilities installed at the electric power plant, for which the right to support may be acquired at the auction;

• determine daily time intervals during which the right to support can be acquired based on the results of the auction;

• determine the load profiles of the electric power facility, in respect of which the right to support may be acquired at the auction;

- set the maximum price offer of the auction participant, but not higher than:
- 9 euro cents per 1 kWh – for auctions held until December 31, 2024, and 8 euro cents per 1 kilowatt-hour – for auctions held from January 1, 2025, for wind and solar generation,
- 12 euro cents per 1 kWh for RES, excluding wind energy, solar radiation, blast furnace, and coke gases, the energy produced by micro-, mini-, and small hydropower plants;
- to set the share of the auction price, fixed for the auction winner in euros, but not less than 50 percent of the auction price.

The list of documents that must be submitted for participation in the auction has been shortened, namely:

- documents on the right of ownership or use of a land plot/building for the location of an electric power facility that will produce electricity from RES have been shortened;
- an agreement on the connection of an electric power facility to electric networks;
- extract from the Unified State Register of Enterprises and Organizations of Ukraine (USREOU).

The documents provided for in points 1) and 2) must be submitted to the guaranteed buyer no later than six months from the date of conclusion of the contract for the provision of services under the market premium mechanism; otherwise, such contract becomes invalid, and the obligations under the guarantee of the auction winner are fulfilled in favor of the auction winner guaranteed buyer.

For solar generation, the term for the construction and commissioning of the power plant has been shortened – from two years to 18 months from the date of conclusion of the contract for the provision of services based on the market premium mechanism based on the auction results.

The term of support has been changed from 20 to 12 years.

The right to lease state and communal property without holding an auction by the Law of Ukraine No 157-IX dated 3.10.2019 "On the Leasing of State and Communal Property" is also granted to the winners of the RES support auction, under the terms of which roofs and/or facades of buildings and other capital structures (Sayenko Kharenko, 2023 (1).

Guarantees of the origin of electrical energy from RES. Law of Ukraine No. 3220-IX dated 30.06.2023 provides that the "guarantee of origin of electric energy produced from renewable energy sources" (in the future - the guarantee of origin) is an electronic document created based on information from the register of guarantees of origin, which confirms, that a certain amount of electricity is produced from renewable energy sources, confirms its ecological value and certifies the rights associated with the positive effect of the production of electricity from renewable energy sources.

Guarantees of origin confirm the origin of electric energy produced from RES (Sayenko Kharenko, 2023 (1); (2):

- a business entity that produces electric energy from RES,
- a consumer who installed a generating unit for his consumption or
- an active consumer.

Guarantees of origin are issued free of charge. The Cabinet approves the procedure for issuing, circulating, and redeeming guarantees of origin of Ministers of Ukraine based on the proposals of the NCREPU.

The guarantee of origin is a property of electric energy produced from RES; the circulation of guarantees of origin and the transfer of ownership rights to them can be carried out separately from the volumes of the corresponding electric energy from RES.

NCREPU is recognized as the authorized body for issuing, circulating, and repaying guarantees of origin, which ensures the functioning of the register of guarantees of origin, which is formed automatically on the basis of commercial accounting data.

NCREPU forms and maintains a register of electricity facilities and electrical installations of consumers (including active consumers) that use alternative energy sources to produce electrical energy per the procedure approved by the Regulator. The register of electricity facilities is a component of the register of guarantees of origin.

The guarantee of origin is issued for the 1 MW•h released into the network or produced and used for its electric energy consumption. Formation of more than one guarantee of origin for the same volume is prohibited.

The circulation of guarantees of origin is carried out within 12 months from the date of production of the amount of electricity for which such guarantee of origin was issued. At the same time, the owner of the guarantee of origin has the right to repay it within 18 months from the production date of the corresponding amount of electric energy, or it automatically becomes invalid after the expiration of this period.

The validity of the data submitted to the Register of Guarantees of Origin is verified by the NCREPU. If, according to the results of the inspection, the production of electric energy not from RES is revealed, the Law provides for the cancellation of the registration of the corresponding generating facility or RES installation for obtaining guarantees of origin for 6/12/36 months, depending on the amount of electric energy produced not from RES.

The purchase and sale of guarantees of origin are carried out on a market basis at free prices. Exceptions are guarantees of origin regarding (Sayenko Kharenko, 2023 (1); (2):

−volume of electricity sold to a guaranteed customer at a "green" tariff or for which a service is provided under the market premium mechanism,

−electric energy produced by generating units of private households with an installed capacity of ≤ 50 kW, sold to a universal service provider at a "green" tariff,

−which becomes the property of the guaranteed buyer/PUP simultaneously with the purchase and sale of electric energy/service. The cost of such a guarantee of origin is included in the electric energy/service purchased by the guaranteed buyer/ USP.

The guaranteed buyer/ USP has the right to alienate the guarantees of origin separately from the electricity/service purchased under the "green" tariff, and the revenue from the sale is directed to settlements with "green" generation.

The Law allows the circulation of guarantees of origin on electronic auctions of trading platforms; corresponding changes were made to the Law of Ukraine "On Commodity Exchanges,"

which allows the organization of trade on commodity exchanges not only in fuel and energy resources but also in their accessories.

The competence of the market operator is also established to approve the rules for the sale of guarantees of origin on the market operator's platform, to ensure the functioning of such a trading platform, as well as to set the price of services for organizing trades of guarantees of origin on such a trading platform.

The consumer, who owns the guarantee of origin of electric energy, has the right to alienate them and use it to confirm that the corresponding amount of electric energy consumed by him for his own needs was produced from renewable energy sources. The guarantee of origin certifies the rights of its owner to the ecological value and positive effect of producing electricity from renewable energy sources.

The Law includes (Sayenko Kharenko, 2023 (1); (2):

–Procedure for recognition in Ukraine of guarantees of origin issued outside its customs territory,

–the procedure for recognition outside the customs territory of Ukraine of guarantees of origin issued in Ukraine,

–Procedure for repayment of guarantees of origin outside the customs territory of Ukraine.

Law of Ukraine No. 3220-X of 30.06.2023 refers to the main tasks of NCREPU in the electric energy market to ensure the integration of the register of guarantees of origin of electric energy with the registers of the countries of the Energy Community, the European Union, and the Organization for Economic Cooperation and Development, as well as to promote Ukraine's acquisition of full membership in the Association of Issuing Bodies (AIB).

At the same time, if the NCREPU does not recognize the guarantee of origin issued in a state that is a Contracting Party of the Energy Community, the commission must notify the Secretariat of the Energy Community (Sayenko Kharenko, 2023 (1).

To improve the functioning of the electric energy market, there is a *mechanism for forming a tariff for electric energy transmission services*, which is the primary source of funds for calculations according to the "green" tariff. Thus, the possibility of financial support from the state budget for payments under the "green" tariff provided for by legislation in 2020 was considered when setting the tariff for the electric energy transmission service. However, it was never implemented, which also affected the insufficient tariff level for further " green" tariff calculations. Therefore, the Law of Ukraine No. 3220-IX, "On Amendments to Certain Laws of Ukraine Regarding the Restoration and "Green" Transformation of the Energy System of Ukraine," provides for the Regulator to take into account financial support from the state budget when setting the transmission tariff only if relevant market participants receive such support, which should improve the situation with tariff formation for the electric energy transmission service and calculations according to the "green" tariff (Sayenko Kharenko, 2023 (1).

Sale on the free market. The Law on the "green" transformation of the energy system of Ukraine No. 3220-IX, dated June 30, 2023, laid the foundations for the transition of energy producers from RES to the free market and became a key impetus for entering the wind generation market (Bilozerova L., 2024).

Law No. 3220-IX, dated June 30, 2023, defined a pricing system for "green" electricity, which can be freely sold on the market. Players who have entered the market and sell electricity independently, the "Guaranteed Buyer," must compensate the difference between the price they sold on the market and the "green" tariff rate.

Currently, RES energy producers can leave the "Guaranteed Buyer" balancing group and return to it, which is fixed by the suspension of the contract for the purchase and sale of electric energy and the renewal of the contract, respectively.

As of March 25, 2024, the "Guaranteed Buyer" settled with producers of "green" energy for almost 100% of 2021, for 2022 – 55%, 2023 – 77%, and energy purchased from the beginning of 2024 - 75% (Bilozerova L., 2024).

As of July 25, according to the data of SE "Guaranteed Buyer," the debt of NPC"Ukrenergo" to renewable generation amounts to UAH 16 billion (Gree, 2024).

Working on the free market, companies sell the produced electricity at market prices, and the effect of the "green" tariff is temporarily suspended for them.

As of January 2024, 78% of wind generation in the territory controlled by Ukraine came from the balancing group, and the key reason for making such a decision was the desire to receive funds for the generated electricity in a timely manner and whole, thereby ensuring the ability to cover its operational and financial costs in time war (Bilozerova L., 2024).

Advantages of working in the free market (Bilozerova L., 2024):

1) *predictability and the possibility of planning*. The main factor of the transition to the free market is the need to preserve and develop the company. For example, Elementum Energy, Ukraine's largest foreign investor in "green" generation, built the Dniester wind farm with a total capacity of 100 MW and also has a development portfolio of more than 200 MW and now continues to gain experience investing in martial Law. The Dniester wind park makes it possible to reduce annual CO2 emissions by up to 100,000 tons.

In the summer of 2023, Elementum Energy launched the first solar plant on market terms. The second stage of the Dniester wind farm, with a capacity of 60 MW, also joined the free market. The market pays in advance, almost all money arrives on the day or a day before the planned schedule, and credit risks and deferrals are acceptable.

At the same time, the profitability of the sun on commercial terms now loses in comparison with the "green" tariff for solar stations, which is significantly higher than the tariff for wind stations;

2) *energy traders successfully perform balancing*, but there are issues with limitations. To operate successfully in the market, the manufacturer must belong to a specific balancing group and be responsible for imbalances within such a group. The principle of operation of the balancing group is that the surplus of others compensates for some group members' electricity deficit in a specific period. Because imbalances are compensated within the group, its members save on purchasing electricity on the balancing market in case of negative imbalances, i.e., a deficit, and receive a higher price for excess electricity in the case of a surplus.

However, there are disadvantages to working in the free market (Bilozerova L., 2024):

- market generation is limited three times more than operating on the "green" tariff because nothing prevents operators from limiting "to zero," precisely that generation that entered the free market.
- security risks and significant probability of restrictions on energy production by system operators. If necessary, the operator sends a command to unload to balance the power system – and "green" generation is disconnected from the network. In this case, manufacturers on the "green" tariff receive compensation for idle hours, but this is not provided for participants of the "green" premium.
- producers cannot work on balancing the market independently without special knowledge and qualifications. Therefore, representatives of the energy companies advise manufacturers to join the balancing groups of those companies that are already traders.

Preferential loans are available for RES's purchase of energy equipment. The preferential lending program for purchasing energy equipment is intended for citizens and businesses.

The procedure determines the conditions, criteria, and mechanism for providing financial state support to individuals who install generating units from alternative energy sources and energy storage units in their households by reducing the cost of loans.

Such state support is provided in order to reduce the cost of loans associated with the purchase and installation of photovoltaic modules and/or wind power plants with an installed capacity of 1 kW to 10 kW, together with hybrid inverters capable of operating both autonomously and synchronously with an external network mode, and energy storage facilities with a capacity of 1 kWh for every 1 kW of the installed capacity of the generating facility.

This should contribute to ensuring the stability of the energy system throughout Ukraine and will stimulate the development of distributed generation in Ukraine thanks to the construction of hundreds of small power plants with a capacity of 5 to 30 MW (Ukrainian energy, 2024).

Another kind of activity on the market is foreseen - *aggregation*, which is connected with the unification of electrical installations intended for production (no more than 20 MW), consumption, storage of electrical energy for purchasing and selling electrical energy, provision of auxiliary services, and balancing services. This type of activity is licensed, except for the cases where the business entity – a market participant- has a license for producing, storing, and supplying electric energy to consumers for carrying out economic activities to perform the functions of a guaranteed buyer. An aggregation unit (a set of electrical installations intended for aggregation) functions in the electricity market as a single electrical installation. Aggregation activities are carried out based on the agreement on participation in the aggregated group, the essential conditions of which will be determined by the Market Rules (Sayenko Kharenko, 2023 (1).

The Law introduces a new term – an *active consumer*, who is a consumer-customer of an energy service that consumes and produces electric energy, and/or carries out energy storage activities, and/or sells surpluses of produced and/or stored electric energy, or participates in activities with energy efficiency and demand management, provided that these types of activities are not professional and/or economic activities. The consumer receives this status in case (Sayenko Kharenko, 2023 (1), (2)):

- conclusion of a contract for the purchase and sale of electric energy based on the mechanism of self-production or
- conclusion of an agreement with a guaranteed buyer or PUP on the sale of electricity at a "green" tariff,
- an energy storage facility will be installed for participation in organized market segments independently or as part of aggregated groups.

It is important that an active consumer with generating plants of more than 1MW can lose this status for one year if, in the previous year, the volume of production and supply of electric energy by his plants to the network exceeded 50 percent of the volume of his consumption. The Regulator must determine the consequences of canceling the status of an active consumer.

There is also a "*special group of consumers*", which includes (Sayenko Kharenko, 2023 (1):

- legal entities that carry out economic activity using current receivers of the first category for the reliability of electricity supply;
- or who are consumers and/or owners of electric networks and are not operators of the distribution system whose electric networks are used to distribute electric energy to other consumers
- and/or active consumers (except household consumers) who have installed generating plants or energy storage plants.

In the context of the procedure for conducting inspections and applying sanctions by the Regulator, such a special group of consumers is equated with business entities operating in the energy and communal services.

At the same time, the Regulator applies fines to entities belonging to a special group of consumers according to (Sayenko Kharenko, 2023 (1), (2):

- late provision of information to the Regulator,
- failure to provide information to the Regulator, or provision of knowingly inaccurate data,
- non-implementation or untimely implementation of the Regulator's decisions and offenses in energy and communal services.

Thus, the updated legislation provides better control, reduces environmental impact, and promotes clean technologies. Implementing the concept of the ecological value of electricity is particularly important for attracting investments in "green" projects and increasing consumers' environmental awareness. The changes in the legislation reflect the strategic directions of Ukraine's development in the context of European integration and the desire for a sustainable energy future. This demonstrates Ukraine's commitment to international obligations in the field of climate and energy, as well as its desire to strengthen energy security and independence through the development of renewable energy sources (Pugach V., 2024).

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CHAPTER 5. RESOURCE AND ENERGY SAVING – THE PATH TO SUSTAINABLE TOURISM

5.1. Tourism and economy decarbonization

The tourism industry is one of the largest and fastest growing industries in the world. According to the World Tourism Organization (UNWTO), in 2014, tourism accounted for 9% of global GDP (taking into account direct and indirect contributions from the industry) and 6% of global exports of goods and services. This sector employs about 100.9 million people; Every 11th job in the world is created in the field of tourism. In 2015, the number of international visitors reached 1.2 billion, with annual spending estimated at US$1.260 trillion. Recently, demand for tourism in Asia has been increasing, primarily in China and India. In 2016, 135 million Chinese tourists traveled the world and their annual spending reached US$261.1 billion. This figure exceeds the expenses of citizens of other countries included in the top ten leading outbound markets in the world. In 2016, more than 1,235 million international tourists traveled around the world, up from just 25 million in 1950. According to UNWTO forecasts, this figure will reach 1.8 billion by 2030. In 2015, tourism was the third largest volume of export earnings after the fuel and chemical industries. It is undoubtedly one of the largest and most dynamic economic sectors in the world. Despite a number of challenges, its growth is above average and the sector is a significant contributor to economic growth and development. However, growth comes hand in hand with responsibility. Tourism is estimated to be responsible for 5% of global CO2 emissions, 40% of which comes from air transport and 20% from hotels and other accommodations. The remaining 40% is associated with other transport segments (cruise ships, road, rail, etc.) and entertainment services for tourists. The transition to green and low-carbon technologies is vital to improve the sustainability and competitiveness of the sector. This requires long-term vision, innovation, rational planning and monitoring by all participants. In September 2015, UN member states adopted the 2030 Agenda for Sustainable Development and 17 Sustainable Development Goals (SDGs). The SDGs represent a comprehensive agenda for equitable, socially inclusive and environmentally sustainable development. They provide a common framework for addressing the most pressing economic, social and environmental challenges of today's generation, including the roles that all actors in our society must assume to achieve sustainable development (World Tourism Organization, UNWTO, 2021).

The Paris Agreement, adopted by parties to the United Nations Framework Convention on Climate Change (UNFCCC) in December 2015, is a critical step towards sustainable development. The main goal of the UNFCCC is to “keep the increase in global average temperature well below 2°C above pre-industrial levels and strive to limit temperature rise to 1.5°C”, and achieving this will require decisive action to reduce greenhouse gas (GHG) emissions in all sectors. In order for tourism to develop in line with the principles of low-carbon growth, the full participation of accommodation and transport clusters is necessary. Addressing this challenge includes the use of innovative energy and sources such as renewable primary energy, transportation to and within destinations, and changing consumer behavior.

Global measures such as these must be combined with new technologies and infrastructures that use clean, affordable and widely available renewable energy sources. It is no secret that renewable energy is the future of energy and, when combined with energy efficiency, it has the potential to transform our relationship with the energy our sector uses to continue to grow and prosper. However, ensuring travel and tourism fully transitions to a sustainable energy future while remaining competitive will require significant investment and everyone's efforts. The efforts of governments, transport companies, the hospitality industry and tourists themselves. That's why I welcome the Expo as an important platform to discuss and shape how the tourism sector can make a decisive choice towards the energy of the future.

5.2. The development of the tourism industry as a driver of energy consumption

In modern society, both from an economic and ethical point of view, the most pressing issue is the use of alternative energy sources, since it is obvious that fuel reserves are exhaustible, and their operation leads to significant damage to the environment. The main types of renewable energy sources today include hydropower, wind power, and solar power. In some regions of the world, wave and geothermal energy can be developed. The European Union countries are leaders in the development of these technologies. Many national and pan-European programs have been developed for the transition to alternative energy. And so the question arises: is it possible, given the current level of technology in the electric power industry, with such volumes of production, with such production costs, to transfer any industry in a single country to the use of only alternative energy? Based on this issue, we selected those EU countries whose economies in most cases are based on the service sector, including tourism, since this particular sector does not relate to energy-intensive production and, other things being equal, could well switch to the use of alternative energy: Portugal, Spain, Italy and Greece. According to WTTC estimates, the global tourist flow will constantly grow, increasing tourism turnover in global GDP. The European Union will also record growing rates in the countries we have chosen (Statistical agency. Statista. 2023). The growth of tourist flows and the increase in the number of tourists not only contributes to the economic well-being of the country, but also to its energy consumption. Since the growth of tourism activities is accompanied by an increase in energy demand across various functions, the importance of energy for the tourism sector is undeniable.

EU countries, like the entire international community, must act responsibly towards the environment, that is, be an active participant in sustainable development while conserving natural resources. This applies to all sectors of society, including citizens, their households, as well as industry, transport, economics and tourism. The current concentration of CO2 in the atmosphere is already on the verge of environmentally acceptable limits, and expected population growth and rising personal and social standards will result in increased energy consumption. This represents not only a huge challenge, but also a large economic cost. It is expected that the tourism sector will continue to grow and develop in the future, which in turn will contribute to an increase in energy consumption. Increased energy consumption caused by tourism development may have numerous negative impacts on environmental quality caused by climate change. This is confirmed

by the EIA forecast for global CO2 emissions, which are not going to decrease. Therefore, the main task will be to minimize them through the introduction of alternative energy sources (Statista Agency). In terms of energy demand, the services sector (and therefore tourism) will occupy a leading position due to the fact that in all selected countries it is the main source of GDP for the countries. Tourism has the most significant impact on the development of commercial services. Of the above countries, the service sector occupies the largest share in the Greek economy - approximately 68.07% as of 2019. However, in other countries this percentage also does not fall below 65.52% (Statistical Agency. Statista, 2023). In all observed countries, energy development is aimed at building capacity in energy management and measures with lower implementation costs. This led to significant energy savings and cost savings due to the fact that the development of alternative energy was initiated.

In Italy, primary energy production is equal to 1.48 quadrillion Btu, corresponding to 433,640,000 MW (Statistical agency Knoema). Portugal, Spain and Greece have 82,040,000 MW, 462,940,000 MW, 99,620,000 MW (Statistical Agency Knoema), respectively. Of these, the share of alternative energy for 2018 according to Eurostat in Portugal, Spain, Italy and Greece is 30.322%, 17.453%, 17.775%, 18.002%, respectively (Statistical agency Eurostat). Thus, Italy produced 77079742.7 MW based on alternative energy, Spain - 82185738.2 MW, Portugal - 24876168 MW, Greece - 17933820.6 MW. Next we need to look at final energy consumption, which covers energy consumption by end users, including in the service sector. It does not include consumption of the energy sector itself and losses arising during transformation and energy distribution (e.g. power plants, district heating stations, oil refineries, coke ovens, blast furnaces). Everything is also excluded non-energy uses of energy carriers (eg, natural gas used to produce chemicals, oil-based lubricants, bitumen used for road surfaces). Volumes delivered to international aviation and international sea bunkers are also excluded from final energy consumption: Portugal - 27359191.2 MW, Spain - 130078701 MW, Italy - 224902743 MW, Greece - 24367943.6 MW (Statistical agency Eurostat).

Based on the above data, it is possible to compare the amount of energy produced using alternative energy and final energy consumption. After analyzing the data, it becomes obvious that at the moment Portugal, Spain, Italy, and Greece are not ready to fully provide the service sector with alternative energy. Of all the countries we examined, the leadership of Portugal is most clearly observed. Of the 27359191.2 MW consumed, it already produces 24876168 MW using alternative energy, which is 90.92% of the energy consumed. The following places are located: Greece - 73.59%, Spain - 63.18%, Italy - 34.27%. In the future, the general environmental policy of Europe will be based on the transition of the entire economy to an alternative type of energy. However, within the framework of the study, it becomes clear that in the next 10 years it is not possible to transfer even one of the sectors to this type of energy supply. In modern realities, alternative energy cannot compete with traditional energy even in those industries that are not energy-intensive. In this regard, traditional energy will continue to remain important, even with a decrease in the total volume of its production.

The concept of “tourism” usually includes components that form the overall impression of a vacation: passive or active recreation, cultural pastime, familiarity with the gastronomy of the

region and general satisfaction with the quality and level of service. The traveler as a recipient of tourism services is aimed at receiving high-quality service and positive emotions from the trip, and the ultimate goal of the participants in the tourist and recreational complex is to make a profit by fully satisfying the needs of the traveler as the final consumer and winning his loyalty. Most modern technologies in the field of tourism have a high cost and require significant amounts of investment for their purchase, installation, correct launch and inclusion in existing systems. Of course, all costs must ultimately be covered by the economic effect obtained from the implementation of these technologies.

Many researchers studying the development of tourism talk about the global trend of the formation of "eco-clusters", which include "smart zones" of the recreational infrastructure of destinations: catering establishments, transport infrastructure and transport elements, leisure enterprises, shopping centers, bank branches, etc. (Han et al., 2019). As the results of a survey conducted by researchers at Cornell University show, a significant portion of respondents are willing to pay more for services and products that meet modern environmental standards (Han et al., 2019), which can be explained both by the growing awareness of consumers of services and their desire to make their vacation as safe as possible from an environmental point of view. The general trend is that in the service sector, along with qualitative changes, there is active quantitative growth. Considering the current state of affairs in tourism as one of the important sectors of the economy, it should be taken into account that more than half of domestic GDP is produced in the service sector. The tourism industry, being a key element of the international service system, has a direct impact on the economies of countries around the world, determines the vector of development and the direction of consumer activity.

The main idea that can be seen in the literature on energy consumption is the agreement of the authors on the need for the mass introduction of energy-saving technologies. This is due to the fact that energy saving can be considered as a factor in economic development. The implementation of measures to save energy costs and, if possible, reduce its use without obtaining practical benefits should be widely implemented in everyday practice. Such measures will help increase the number of direct use capacities, improve the economic situation and increase the level of responsibility of citizens in terms of rationalizing the use of energy as a resource (Titomyr et al., 2021).

Modern government policy in the field of regulation of pricing for energy resources is focused on equalizing domestic and world prices in the future. Scientific works express and substantiate the opinion that such measures will lead to a sevenfold increase in gas prices and a twofold increase in prices for oil and petroleum products. Naturally, this will be followed by an increase in the amount of payment for energy resources, which will affect the interests of all energy consumers.

If we talk about the relevance of introducing energy efficiency and energy conservation measures in the tourism industry, then it is worth indicating the main factors for the inappropriate use of resources:

1) at the state level: prohibitive level of energy intensity in GDP; harmful effects of energy-intensive components on the environmental situation; inappropriate use of distribution networks;

2) at the level of enterprises and organizations: high share of energy costs in the cost of services; excessive requirements for the capacity of distribution networks of enterprises; direct dependence on energy suppliers.

The main measures that can be taken at the state level with the aim of widespread implementation of energy saving can be considered (Titomyr et al., 2021):

1) development of a regulatory framework in the field of use of energy efficient technologies, based on the need to modernize the existing legislative and regulatory system based on the experience of countries leading in the implementation of energy efficient technologies;

2) development of economic incentive mechanisms. In world practice, a wide range of economic measures and mechanisms are used to stimulate the implementation of environmental technologies. The primary measure can be considered the adoption of environmental regulations and laws, which makes it possible to make the introduction of environmental technologies universal and mandatory and to establish clear criteria. Tax incentives and the provision of property and non-property benefits to individuals and legal entities are widely used. Tax incentives partially cover the costs of improving the energy efficiency of facilities. The integrated functioning of these mechanisms should be ensured by the development of a systematic approach to increasing the level of energy efficiency of tourism infrastructure facilities under construction and already put into operation. First of all, this applies to the objects of the hotel complex;

3) organizing a system of investment in energy-efficient industries and renewable energy. Consistent and widespread financial stimulation of the market for environmental technologies is necessary to minimize risks caused by fluctuations in the macroeconomics. In turn, reducing the level of macroeconomic risk will make it possible in the future to attract investors to implement energy-balanced projects;

4) use of internal audit to determine the effectiveness of the implementation of energy-saving technologies. As a set of measures of an organizational, legal, technical, technological, economic and other nature, an energy audit is aimed at reducing the volume of energy resource use while maintaining a beneficial effect. The beneficial effect can be measured as the volume of products produced, work performed, services provided;

5) involving the population in issues of resource-saving technologies. Reaching the majority of people, personal awareness, systematic introduction of market mechanisms that stimulate changes in consumer behavior in relation to environmental technologies should contribute to the adjustment of the social model of behavior and facilitate the adaptation of the population to the use of energy-efficient technologies.

It is impossible to imagine the tourism industry without a hotel complex, which is its most common, complex and energy-consuming component. As a fundamental component of tourism, hotel service enterprises are large consumers of energy resources and include lighting, heating, water supply, sewerage, telephone and Internet networks.

Saving money by increasing energy efficiency allows you to reduce the cost of hotel services, which subsequently has a positive effect on the financial performance of the hotel and, above all, on profit. The table provides a comparative analysis of the ratio of costs incurred by the large global hotel chain Radisson in implementing energy-saving programs and savings from the

introduction of energy-efficient and energy-saving technologies. Referring to research conducted by Front & Sullivan, the total cost of operating hotel facilities over 50 years exceeds its original construction cost by 4 times. Most of the costs are for lighting. Since 2011, at tourist infrastructure facilities, energy-saving lamps are replacing outdated incandescent lamps. However, in addition to lighting, organizations involved in the tourism sector are strongly recommended to pay attention to other sources of energy saving and energy efficiency. It's no secret that "smart" lighting systems are becoming more and more widespread. The main energy-saving effect is by automatically starting the lighting at those moments when it is really needed. The effect is achieved by operating a switch, which is equipped with an optical sensor and a microphone. During daylight hours and high levels of illumination, the system turns off. When dusk sets in, the microphone turns on. If noise occurs within 5 m (the sound of footsteps, shuffling or the sound of a door opening), the light will automatically turn on and the energy-saving lighting element will light up, which will illuminate the space as long as the person is in the room (World Trade Organization, 2022).

There are a significant number of organizations whose activities are aimed at developing and implementing environmental management systems. One of such organizations is British Airways Holidays (BAH) - one of the world's largest air carriers and tour operators. The company regularly monitors hotels in the Caribbean, which is a popular tourist region. Based on the monitoring results, VAN promotes accommodation facilities with good environmental management, and also monitors management technologies in the hotel industry. The company's activities aimed at preparing environmental management criteria are the first attempt to create uniform requirements for all hotels. As a result, the traveler should be able to independently and immediately determine the level of service and quality of services that he can count on at the hotel. At the same time, the undeniable advantage of the management system in terms of energy efficiency and quality is the possibility of membership in the specified organization and a free certification procedure (British Airways Holidays, 2023).

When considering special cases of resource saving in the tourist and recreational complex, it is worth turning to energy-saving fittings. Specific ways to reduce the energy intensity of life support systems at tourist infrastructure facilities can be the automation of electrical equipment, including the introduction of energy-efficient lighting systems, equipping bathrooms with motion sensors, installing automatic light switches, and installing a unified heating system. First of all, this kind of innovation is a well-thought-out system of resource and energy conservation, including strict resource saving standards and the widespread use of alternative energy sources. This feature is primarily associated with the insufficient resource supply of developed countries and active policies aimed at stimulating energy saving. Many hotels are already using solar energy not only for direct water heating, but also for generating electrical energy. Conducted studies show that thanks to the introduction and use of new environmental methods of work (for example, heating water using solar energy) and relatively small investments in the tourism complex, for example, restaurant and hotel business, it is possible to reduce energy consumption by 10-25%, water consumption - by 30% (Han et al., 2019).

The activities of hotels that have been certified under the Green Key program comply with the established list of mandatory and optional criteria, for example: reducing the consumption of

electricity, water, chemical products, reducing the amount of waste, transferring waste for recycling. Hotels participating in the program undergo an inspection conducted by an expert. Accommodation facilities certified by the program meet high environmental standards, are distinguished by a responsible approach to business and make an active contribution to environmental protection. Turning to general practice, it can be noted that the use of energy-efficient technologies at enterprises in the tourism industry can reduce costs in energy-intensive areas by up to 50%, which allows not only to maintain sufficient capacity, but also to reduce the amount of utility bills. The use of environmentally friendly materials makes it possible to increase the attractiveness of the package of services offered by accommodation facilities, since they meet the needs of satisfying customer requests in terms of increasing demand for so-called "green" materials and technologies. Currently, 30-40% of the expenses of any tourist destination are costs associated with paying for electricity, heating and water. Every year this load increases due to rising costs of utilities (Green Key International - Green Key International, 2023).

Tourism has been developing steadily for many decades, becoming one of the fastest growing sectors of the world economy. Currently, tourism keeps pace with, and sometimes even outpaces, oil exports, food processing and the automobile industry in terms of share of business transactions. According to the World Tourism Organization (UNWTO), tourism accounts for 10% of global GDP and 7% of global exports ($1.5 billion). The number of international tourists increased by 4.5% to 1.2 billion visitors. The average annual growth in the number of tourists in the world is 3-4%. Demand for tourism products is increasing in China and India. These trends open up new opportunities for the development of the global tourism industry. The future of tourism is inextricably linked to the industry's ability to implement alternative energy technologies and formulate sustainable development strategies.

In the post-pandemic period, there has been a recovery in tourism activity. However, the bright prospects of welcoming more guest travelers from near and far abroad than before the pandemic may be hindered by the problem of unprepared infrastructure. At the same time, we are talking not just about the availability of rooms, the quality of transport services, the practically absent entertainment industry, but mostly about the unpreparedness of the engineering and communal infrastructure to receive the declared tourist flow. In this context, the issue of energy supply to tourism facilities remote from centralized networks is especially important. The desire of private entities to be competitive in the regional and global markets of tourism services is a necessity. Today this is impossible without the introduction of green technologies and, logically, this desire should be supported by the state. To be competitive or not to be - each business entity decides for itself, but the priority task of the bodies responsible for economic development should be to take care of the competitiveness of the industry. It seems like a completely understandable task, however, almost all program documents contain measures to eliminate failures and gaps aimed at solving past problems.

All of the above allows us to assert that at present there is no policy of accelerated development, and the goals are either completely exorbitant or are not linked to the values of the consumer, citizen, and entrepreneur. As a result, low performance. Of course, you can continue to engage in industry development planning, talk about opportunities, and come up with various

marketing activities, but the time has come to introduce a new development model. And this model should be based on other values. Those that meet global sustainable development goals. And why all? Often people who report that the tourism industry is our everything forget about the most important thing - ensuring the quality of service and compliance with basic sanitary, environmental, construction and safety requirements, the need to use only environmental technologies, recycled water supply, as well as large-scale implementation green technologies. Many experts and individual citizens are concerned about the growth in tourist flows and the increased pressure on the environment. The endless pursuit of quantity without reducing the negative impact on nature will ultimately destroy both the environment and the tourism business. Most natural resources are limited, but nature itself is created and arranged in such a way that with reasonable consumption of resources, balance can be achieved.

What is the level of understanding of issues of respect for the environment among private businesses in the country? Especially those that directly or indirectly depend on the purity of water, glaciers and air, forests, and the level of conservation of ecosystems. Entrepreneurs “take” from nature for their production and earnings, but do they return to it in due measure what they once used? “In recent years, many entities in the tourism services market have increasingly been promoting green tourism products in a new quality: focused on the values of sustainable development. “Advanced” tour operators focus their attention on environmentally friendly activities and energy efficiency of tourism facilities designated with a green label. “In fact, the task is to introduce green standards, assess compliance and use the form for declaring compliance with “Eco” standards. This requires the development of self-regulation in the sector, when the subjects themselves accept obligations and monitor their compliance,” said national expert Kyalbek Abibulla uluu. - The so-called responsible tourism, reflecting all these priorities, is gaining momentum. Eco-tourism has become in demand in the world, people are talking not just about “attractive environmentally safe places”, but also about the compliance of the tourism sector with “green” principles and standards” (Central Asia 2007-2024, 2022).

5.3. Development of sustainable tourism and energy-saving approaches: analysis of successful projects and programs implementation practices

Today, the concept of sustainability in tourism includes several aspects: reducing the carbon footprint, reducing the impact on local ecosystems, increasing economic benefits for local communities. It is important to understand that costs for ecology and environmental protection measures are not just inevitable expenses, but investments in business. It is this attitude that allows you to benefit and make a profit. Investments in green technologies always pay off; the modern traveler is ready to pay for both comfort and ecology. In our article we will largely address the issues of energy efficiency, production and consumption of clean energy by small and medium-sized businesses involved in the tourism business that provides related services to tourists. Sustainable development and sustainable tourism is when you try to minimize the negative impact on other parts of the ecosystem. In this case, these are nature, population, resources, local rules and traditions. This means that such development is impossible without the use of “green

measures" in the tourism industry of Kyrgyzstan, without which it is impossible to ensure a climate-stable future.

It's good when they come to help. In this case, such assistance came from the European Union "SWITCH-Asia" program. As project manager Zarina Sagynbaeva said, the launched program has made great progress in the field of sustainable consumption and production (SCP) in 24 countries in the region. These include the Kyrgyz Republic. The launch event of EU SWITCH-Asia in Central Asia took place on July 5, 2019 in Bishkek.

The tourism sector is a priority for SWITCH-Asia Kyrgyzstan as it faces numerous challenges in transitioning to models that have less negative impact on the environment, natural resources and livelihoods of local communities. "For SWITCH-Asia, it is important to reduce the carbon footprint; the formation of policies and the development of industry strategies with the inclusion of "green sections" depend on this - in the name of sustainable development, promoting economic prosperity and poverty reduction, adaptation to climate change in Central Asia, and also promoting the transition to a low-carbon, resource-saving and circular economy," commented expert Uluk Kydyrbaev (Program of European Union of «SWITCH-Asia»).

From 2020 to the present, in three countries - Kyrgyzstan, Tajikistan and Uzbekistan - the regional project "Assistance in increasing energy efficiency and renewable energy production in the tourism sector at the community level in Central Asia" of the EU Program "SWITCH-Asia-II" has been implemented. The project focuses on achieving the following Sustainable Development Goals:

Goal 7: "Affordable and clean energy",

Goal 11: "Sustainable Cities and Communities",

Goal 12: "Responsible consumption and production",

Goal 13: Combat climate change.

Act more responsibly! - this is the slogan that most accurately reflects the European Union's approach to the consumption and production model and proposes to project its experience in the Central Asian countries. For the tourism sector, this means the development of large-scale local production and consumption of clean energy from renewable sources, the promotion of energy efficiency in all structures, both at the state level and among business companies and the professional community to ensure energy security and energy independence of the country. So far, no one is taking seriously the local initiatives of small-medium and very small businesses. The majority believes that everyone will not be able to build a system for themselves that completely covers the need, and are convinced that this is not economically feasible. Apparently, for such citizens, sitting around waiting for a miracle and a breakthrough in the construction of large-scale hydroelectric power plants is better than doing business in their industry, using the positive experience of other countries. For example, to create consumer energy cooperatives and obtain energy almost tomorrow. It is precisely such cooperation of citizens as an energy cooperative that makes it possible to combine resources and create conditions for the rational use of energy obtained from renewable energy sources. Almaz Nasyrov, national expert of the project "Assistance in increasing energy efficiency and production of renewable energy in the tourism sector at the

community level in Central Asia," spoke about such progressive European experience (Central Asia 2007-2024, 2022).

"The growing economy is experiencing a shortage of electricity. In the near future, an increase in domestic demand for this resource is predicted. Is the country ready for such a scenario? - asks Asylbek Rajiev, executive director of KATOS. And he immediately answers: "It is obvious that sustainability and competitiveness can result from a reduction in energy and resource consumption by business objects. And most importantly, this will help reduce carbon dioxide emissions into the atmosphere" (Program of European Union of «SWITCH-Asia»).

At the 26th session of the Conference of the Parties (COP-26) on climate issues, in his message, President of the Kyrgyz Republic Sadyr Japarov confirmed the commitment of the Kyrgyz Republic to the spirit and goals of the Paris Agreement: "Our participation in the global campaign to curb climate change will be responsible and comprehensive within the framework of the NDC until 2030. Over this period, Kyrgyzstan aims to reduce greenhouse gas emissions by 44%. And by 2050, Kyrgyzstan will try to achieve carbon neutrality on the platform of green development." The task is not easy and requires multilateral efforts. "The project "Promoting Energy Efficiency and Renewable Energy Production in the Community-Based Tourism Sector in Central Asia" is contributing to this solution. "Its members are different. This is an international non-governmental organization ACTED, whose work is based on the vision of the future "zero carbon, zero social exclusion, zero poverty," said ACTED representative Zarina Sagynbaeva. "The "analytical center" of the project was the BizExpert Public Foundation from Kyrgyzstan. The remaining partners were the Association of Microfinance Organizations (AMPO of Kyrgyzstan, AMFOT of Tajikistan, NAMI of Uzbekistan) and the tourism sector (Uzbek Association of Private Travel Agencies APTA, Tajik-Norwegian Center for Sustainable Development "Tajnor", Mascontour from Germany) (Central Asia 2007-2024, 2022).

Funded by the EU program SWITCH Asia-II, the Project over the course of 3 years has done a lot of work with the governments of three countries and representatives of government agencies, with businesses in the tourism sector, manufacturers and suppliers of renewable energy sources and E/E technologies, with business associations, with local communities and opinions of all participants in search of adequate and effective responses to common challenges.

Work was hampered by the pandemic, the political landscape was changing, and the system of public administration was changing. However, within the framework of the Project, it was possible to quickly conduct a detailed "Analysis of the state of the business environment," including making an economic analysis and assessing the actual use of renewable energy and energy saving technologies in the tourism sector and small-scale energy. The expert group identified a lot of problems, both in the field of implemented policies and directly in the real sector. The objective conclusion was to explain the dependence of energy efficiency growth on one's own production and consumption of clean energy for one's business. It is important that the clean energy producer itself is based on a completely new approach to determining the energy efficiency of its business, which can be expressed by the definition: "Energy efficiency is the rational use of energy resources to obtain the necessary types of energy from renewable energy sources, with minimal or zero impact on the environment!" (Central Asia 2007-2024, 2022).

The work of the Project was also supported by the main government body designed to promote the development of the tourism industry in Kyrgyzstan - the Department of Tourism under the Ministry of Culture, Information, Sports and Youth Policy. Deputy Director of the DT and head of the Interdepartmental Working Group Kyyal Kenzhematova initially set the task of comprehensively considering the problems of developing the production and consumption of clean energy, increasing energy efficiency in the tourism sector, and the correlation of recommendations with the goals of sustainable tourism. The expert group and members and participants had to go beyond the sectoral approach, touch on the activities of other areas and sectors of the economy and answer the questions (Central Asia 2007-2024, 2022): "Why is there no proper development, no mass implementation?" "Who does implementation depend on and what resources need to be involved?" "What hinders development?"

Recognizing the scale of the problems was already worth a lot, and multifactorial cross-sectoral analysis made it possible to reveal almost all aspects of existing relationships, from market failures to policy gaps. Expert analytical work carried out with the support of the Project made it possible to identify the most important priorities that require solutions and are in the areas of responsibility of various authorities and institutions.

The following areas of regulated legal relations were identified:

a) land use for the placement of small-scale energy engineering facilities based on renewable energy sources for tourism entities (micro-sites are needed and a transformation procedure is not needed);

b) regulation of territorial development planning, taking into account the opportunities and needs for development and the use of renewable energy sources to obtain clean energy (legal regulation of the permitted use of land plots outside populated areas).

Also, the legal regulation of the activities of microgeneration entities separately identified the problem of the lack of adequate support for the development of the use of renewable energy sources by non-core business entities from the state.

According to Nurzat Abdyrasulova, director of the Unison Group, today we are witnessing climate change happening all over the world: heat, droughts, a decrease in the volume of water at hydroelectric power stations, which leads to an energy crisis. The way to reduce the rate of climate change is to switch to alternative energy sources: sun, wind, water, biogas and others. By converting them in special installations, their energy is converted into thermal or electrical energy. Therefore, solar panels, collectors, wind energy, and heat pumps are also relevant in the tourism sector. However, the trend towards the use of alternative energy sources in the country is only 1% of the total energy balance." "This is negligible," says Tatyana Vedeneva, head of the "Renewable Energy Center of the Kyrgyz Republic," "Although there is potential for the use of renewable energy sources. There are also domestic developments that use the energy of the sun, wind, biomass, and small watercourses. There are also enterprises for the production of bio-installations" (Central Asia 2007-2024, 2022).

"It's time to think about saving," says Gulzat Kokonbaeva, chief specialist in the renewable energy and energy saving sector of the Ministry of Energy of the Kyrgyz Republic, "That is, to analyze the main "pain points" of the tourism sector that have the greatest impact on the costs of

small and medium-sized businesses." With significant potential for developing sustainability projects, we can save non-renewable resources and still realize significant financial savings. But despite these opportunities, when we talk about "greening" business, we continue to cling to "brown energy resources."

Economists have a common expression: "Don't put all your eggs in one basket." It very accurately describes the current situation in the energy sector. Considering the forecasts of environmentalists that by 2100 Kyrgyzstan may lose most of its glaciers, in general, an emphasis only on the development of hydropower does not seem far-sighted. Other RES resources can become the very sought-after alternative. But whether they will - this depends on almost everyone - consumers, producers and ordinary citizens. Objective economic feasibility is the use of hybrid technologies, hybrid energy supply systems, heat pumps due to the conversion of renewable energy sources. Our sun shines almost 300 days a year, but it doesn't warm your pocket?! "But solar energy can cover the needs for hot water by 90% for 8-9 months, for heating up to 50% during the heating period; can provide backup power supply to up to 30% of villagers, save traditional fuel and provide power supply to all low-energy consumers located in a decentralized zone, says independent expert Rajap Bayaliev (Central Asia 2007-2024, 2022).

We can make money from the wind, but are we throwing money down the drain?! "Wind energy can provide electricity to household consumers, cover up to 5-7% of the electricity needs of the rural population, and provide additional irrigation of farmland through the use of wind-driven hydraulic pumps where winds often blow," says energy engineer Emil Tursunov. "It is impossible to purchase a small-sized wind generator on the market, while there are patented inventions, but no production." "It lies and smells," Alexey Vedenev, a specialist in biogas plants, points to the organic waste from livestock, "But it could bring double benefits: biomass can provide 30% of rural residents with household gas, at the same time it will fertilize 1 million 300 thousand hectares of arable land, and increase productivity fields by 15-20%, will reduce CO2 and CH4 emissions by 100 million m3 and reduce the consumption of traditional fuel" (Central Asia 2007-2024, 2022). By the way, the interdepartmental working group explored the possibilities of using mobile biogas plants and systems for storing and local gas consumption (gas holders). In fact, we can say that science and technology, technologies should bring benefits, and this approach, based on an understanding of consumer values in the value chain from the waste processor into a resource - biogas, can become a priority. Either mobile processing or a combination of gas tank mobility and production. The model is completely customer-oriented, the installation follows the raw materials, and the gas goes to the consumer.

Everything would be fine, but the problem of the system of technical regulation and security goes beyond the national level. "This creates a large time lag in making appropriate decisions, hampering the development and implementation of technologies," explained Uzak Kydyrbaev, national consultant of the project "Assistance in increasing energy efficiency and production of renewable energy in the tourism sector at the community level in Central Asia," and added that in the country Previously, local gas supply systems (gas holders) were actively used; they were also in Bishkek (Central Asia 2007-2024, 2022).

"Small watercourses through micro-hydroelectric power stations are able to provide technical output of up to 5-8 billion kWh. In our country there are 172 different small watercourses with a water flow of 0.5¸50 m3/sec. If today the construction of 92 small hydroelectric power stations with a total capacity of 22 MW is carried out, then the cost of the energy received will be 8¸28 tyyn/kWh. The payback period for microhydroelectric power plants is short: a maximum of 7-10 years at tariffs of 1.0¸1.5 cents," says expert Alaybek Obozov. So it's not water that's leaking away -it's the missing kilowatts and money that's leaking away from us (Central Asia 2007-2024, 2022).

"Mobile micro-hydroelectric power plants are not serious," the energy sector argues, declaring that the generation deficit cannot be covered and assures that only economies of scale allow for a reasonable return on investment. It is obvious that the goals and model of development of the energy sector today are in no way oriented towards decentralization and even enter into some kind of economic contradiction between the producer-seller of energy and independent producers who are reducing purchases from traditional sources. An interesting conclusion in the Roadmap was the recommendation to consider the feasibility of developing the energy sector based on a mixed model (centralized with elements of decentralization of generation). It should be noted that the law "On RES" adopted in mid-2022 laid the foundation for the development of decentralization, local generation and consumption. It is also important that the position of non-interference in the activities of entities producing clean energy from renewable energy sources for their own consumption is reflected in this law (Central Asia 2007-2024, 2022).

The created Interdepartmental Working Group (IWG) of 28 specialized specialists, experts, representatives of the business community, regional representatives of the government (Cabinet), etc. performed substantial research work; conducted an assessment and analysis of legislation, as well as an assessment of the impact of implemented programs and strategies, and expert consultations. 11 public meetings of the Interdepartmental Working Group were organized and held, where stakeholders were given the opportunity to speak. There were long discussions and disputes. A particular stumbling block turned out to be the regulatory parameter of defining what "microgeneration" is, how to measure, limit power or not, and how to tie it to existing standards. Important for the development of the IWG was the question initiated by a representative of the office of the government plenipotentiary representative in the Issyk-Kul region "on the large-scale application of technologies for the use of hydro- and geothermal resources to produce heat and hot water in order to extend the season and year-round operation of tourism facilities, reduce the load on electrical networks". "As a result of our work, 80 legal acts, 5 program documents and 5 legal acts initiated by other departments were reviewed. The result was the development of a "Road Map" for the development of green tourism, as well as for the introduction of energy supply to tourism facilities through the production of clean energy from renewable energy sources, increased energy efficiency, and reduction of emissions in the tourism sector," says Andrey Dogadin, executive director of the BizExpert AC (Central Asia 2007-2024, 2022).

The roadmap contains recommendations for solving problems and eliminating barriers to the development of production and consumption of clean energy in the tourism sector, and the development of microgeneration based on renewable energy sources in TPS subjects. For the first

time, approaches from the non-core sector were proposed along with the energy sector. It is no longer possible to hide the fact that today the situation with energy supply in general is bad in the country; approaches to the development of energy supply in industries have been practically lost: there is no capacity and no resources for their increase, and therefore communities are meeting their needs according to the "Help yourself" principle!

"The desire of tourism business entities to be competitive forces them to look for different ways to use "green" energy through the prism of developing types of entrepreneurship that are not related to the energy sector. It is microgeneration for oneself or the creation of local energy supply systems in the tourism cluster today that can become that very saving straw for MSMEs," says Elvira Borombaeva, president of the Association of Legal Entities "Association of Small Hydroelectric Power Plants". The tourism development program contains the task of providing various types of tourism services and improving the service, and for this - the development of tourism infrastructure, including the energy supply of tourism facilities at the TOS level. However, the entrepreneurial initiative to use renewable energy sources had not previously been identified, problems had not been identified, and needs in economic sectors had not been identified. Therefore, the point of the "Green Economy Development Program" was never implemented, where one of the tasks was the development of microgeneration in tourism and obtaining sustainable benefits.

Aerobatics is when all energy-efficient technologies are combined and a "smart home" appears. But for this it is necessary to add norms and regulations "On Hybrid Technologies" to the industry legislation; develop a draft law "On the development of microgeneration"; take a number of other policy measures aimed at supporting clean energy producers and suppliers of energy-saving and energy-efficient technologies. Those on which development, and therefore the reduction of emissions, the sustainability of local energy supplies and the promotion of both domestic and foreign tourism depend (Central Asia 2007-2024, 2022).

"Why implement and talk about sustainable practices? This is cost savings + adding value to the travel service + joining the growing trend of ecotourism + increasing the satisfaction of company employees + adhering to the principles of "greening" MSMEs to obtain greater benefits for future generations," say representatives of the JIA Association. At the same time, entrepreneurs complain about the lack of professional information about renewable energy sources among entrepreneurs and do not see support from government agencies for the introduction of a circular economy. Entrepreneur Igor Egorov especially emphasized the fact that thanks to the involvement of microfinance organizations in the Project, it was possible to identify opportunities for sustainable financing and search for resources to finance "green" projects. "And this is very important for the introduction of renewable energy sources!" he says. "There are many problems, it's impossible to count them all so quickly. It is important that the Project worked seriously to improve the regulatory framework and tried to build a much-needed dialogue between business and government agencies today in order to find possible mechanisms for the introduction and larger-scale use of renewable energy sources, - Eleonora Kazakova, Chairman of the Association of Renewable Energy Sources of the Kyrgyz Republic, is optimistic, - We will see the results, I'm sure in the near future. This has already entered our lives. Every year, installations using renewable

energy sources are increasingly being used by different segments of the population" (Central Asia 2007-2024, 2022).

A simple analysis of Internet resources in the kg zone allows us to conclude that technologies have entered our market; The supply of equipment and systems has increased and services are appearing. Perhaps this is a “White Book” document, reflecting everything that the members of the IWG have outlined to achieve their goals - the development of mass production of clean energy from the level of households to business entities. Of course, some tasks are already being accomplished, but there are still many unresolved tasks ahead. It is important that they are already clearly marked. First of all, the direction of targeted measures of state support to business entities on which the introduction of production and consumption of clean energy depends. So far, the reality is that only energy sector entities and business entities specializing in the production and sale of energy are beneficiaries of state support. Regulatory policies also have gaps and barriers for those wishing to implement RES and EE technologies to realize benefits. Also, representatives of tourism based on CBT, despite their great interest in the development of sustainable tourism, continue, by inertia, to remain in the category of energy consumers, rather than interested subjects. Thus, they practically cannot influence the state policy for the development of small-scale energy.

The White Book also contains a number of recommendations for the draft law “On Tourism” and the industry program for the Tourism Development Strategy until 2026; recommendations for improving the regulatory framework and regulating relations when selling surplus to third parties through a centralized energy system. To program the development and implementation of RES and E/E technologies, it is necessary to think about developing a program for the development of microgeneration; it is assumed that the draft law “On Energy” in the new edition will include procedures and provisions will not be adopted that limit the initiative to receive and consume energy from RES (Central Asia 2007-2024, 2022).

In short, the members of the IWG showed in practice, and not just in words, their fruitful activities for the benefit of promoting renewable energy sources in the Kyrgyz Republic. Now we need concrete steps in this direction from decision makers. The uniquely beautiful nature, rich historical and cultural heritage of Kyrgyzstan attracts an increasing number of tourists from all over the world every year. Due to its high potential and dynamic growth, the tourism sector has been identified as one of the priority sectors for the development of the country’s economy. In addition, the tourism industry has a tangible positive multiplier impact on other sectors of the economy, the well-being of society and the environment. However, despite the great potential, key representatives of the sector - hotels, cafes and restaurants - face a number of challenges that hinder their dynamic and sustainable development. The main obstacles include unreliable power and water supplies, lack of funds to improve energy availability and energy efficiency, and consequently high operating costs (English PERETO, 2022).

Given the urgency of reducing operating costs and reducing environmental impact, the PERETO project primarily seeks to support the promotion of sustainable production and consumption (SCP) practices and energy efficiency among small medium-sized businesses (SMEs) in the tourism sector of Kyrgyzstan. To solve these problems, PERETO cooperates not only with SMEs, but also with their business associations, government agencies, financial

institutions, suppliers of energy saving technologies and services, as well as with universities, local communities, and tourists themselves. The project is being implemented with funding from the European Union within the framework of the SWITCH-Asia program by the American University of Central Asia (AUCA) in a consortium with partner organizations: UNISON Group (Kyrgyzstan), Technopolis Group (Belgium), Collaborating Center on Sustainable Consumption and Production - CSCP (Germany) (Green Enterprises. PERETO, 2022). The goal of the project is to promote energy security and sustainable growth through the promotion of sustainable production and consumption (SCP) and energy and resource efficiency (ERE) practices among small and medium-sized enterprises (SMEs) in the tourism sector of Kyrgyzstan (Green Enterprises. PERETO, 2022).

Project objectives:

• raising awareness among consumers and SMEs in the tourism sector about SCP and ERE;

• building the capacity and technical readiness of tourism SMEs to take action on SCP and ERE;

• promoting private sector initiatives aimed at developing and achieving the goals of the green economy in the Kyrgyz Republic;

• development of new green finance products tailored to the needs of SMEs in the tourism sector;

• promoting national dialogue and developing policies for the implementation of SCP and ERE.

Expected results (Promoting energy and resource efficiency in the tourism industry of Kyrgyzstan, PERETO):

• 300 small and medium-sized enterprises in the tourism sector were informed and provided with technical support for the implementation of SCP practices and ERE solutions;

• improving access to green financing for the implementation of energy efficiency solutions for small and medium-sized enterprises in the restaurant and hotel sector

• 50 small and medium-sized tourism enterprises demonstrate increased concern for sustainable development by obtaining voluntary certification in the field of energy efficiency, developed with the support of the project together with business associations;

• line ministries are equipped with tools to promote SCP and energy efficiency practices;

• consumers (tourists and SME visitors) are aware of SCP in the tourism sector;

• reduction of energy, material and other resource costs of SMEs.

Within the framework of the PERETO project, much attention will be paid to raising awareness among SME representatives. To achieve this goal, both an online self-assessment platform and various training modules will be used, which will allow representatives of the tourism industry to more easily and quickly adapt to more sustainable consumption practices and a green lifestyle. In addition, trainings and consultations will be organized throughout the country, the participants of which will subsequently be able to undergo green certification. At the same time, it is planned to select several pilot small and medium-sized hotels/guest houses/hostels from various regions of the country, where energy- and resource-saving technologies will be introduced in practice and sustainable lifestyle practices will be instilled. By the end of the project in 2024, it is

expected that 300,000 tourists and local residents will be reached through digital communication products and at least 20% of SMEs from the tourism sector will have implemented resource-efficient activities. It is also expected that the project will contribute to expanding SMEs' access to green finance and creating an enabling environment for relevant policies at the national level (PERETO: Supporting sustainable tourism in Kyrgyzstan).

It is worth noting that the PERETO project is one of six projects under the SWITCH Asia program in Central Asia, launched in March 2020. in Tashkent, Uzbekistan. François Bego, Head of the European Union Cooperation Department in the Republic of Uzbekistan, during his welcoming speech, noted that SWITCH Asia is aimed at supporting the implementation of the UN SDG Agenda for the period up to 2030 and promoting cooperation in the field of climate change, mitigation and adaptation (Paris Agreement) in partner countries of Asia, including Central Asia (SWITCH-Asia). The implementer of the PERETO Project will be UNISON Group (Kyrgyzstan), together with the American University of Central Asia (Kyrgyzstan), Technopolis Group (Belgium) and Collaborating Center on Sustainable Consumption and Production (Germany). The project is being implemented with the support of the European Union SWITCH-Asia program for sustainable consumption and production - EU SWITCH-Asia Programme (SWITCH-Asia).

Sustainability remains high on the travel agenda, and the pandemic has highlighted the impact people have on the environment and local communities, inspiring many to be more thoughtful about their future travel destinations. More and more tourists place great importance on being able to visit different places while minimizing harm to the environment.

PERETO has launched a voluntary environmental certification ECO KG among HoReCa enterprises in Kyrgyzstan, the presence of which will inform customers about what green technologies and sustainable development methods the cafe/hotel/hotel has already implemented. The pilot scheme for voluntary eco-certification ECO KG was developed within the framework of the PERETO project with financial support from the European Union within the framework of the SWITCH-Asia program. “Eco-certification is a significant step in promoting sustainable tourism, which will contribute to additional demand for the use of green technologies in HoReCa properties, which will reduce the impact of the business sector on the environment,” - Maksat Damir uulu, Program Manager, PERETO project (News PERETO launched voluntary environmental certification ECO KG among HoReCa enterprises in Kyrgyzstan).

“At the request of entrepreneurs, in a pilot format, in 23 hotels, cafes and restaurants throughout Kyrgyzstan, certified experts in energy and resource efficiency conducted an eco-audit and today we awarded those enterprises that successfully passed it with confirming certificates and special quality marks in the categories “ Bronze” (9 enterprises) “Silver” (9 enterprises) and “Gold” (5 enterprises),” - Nurzat Abdyrasulova, Program Manager, PERETO project (PERETO, 2023).

Main criteria for eco-certification:

- environmental management;
- water conservation and wastewater management;
- waste management;
- energy saving and implementation (RES);

- environmentally friendly management of material resources;
- eco-transportation and eco-mobility;
- eco-approaches in organizing the supply of products;
- environmentally friendly practices in surrounding areas (if applicable);
- Social responsibility;
- eco-approaches in organizing the supply of products.

For the convenience of entrepreneurs, PERETO is developing a mobile application ECO KG, which will allow you to pass a test to self-assess the state of an enterprise for environmental friendliness and, based on it, apply for an eco-audit from anywhere in Kyrgyzstan. Certificates of conformity are included in the unified register of certified objects of the performing organization and partner of PERETO - the Green Alliance of Kyrgyzstan and are valid for 2 years. "This is our first certification. Today our hotel received "Bronze," but we will continue to create amenities for our guests with care for nature, and strive for the highest award - the "Gold" category," shared Shayirgul Abdyrakhmanova, owner of Tes Hotel in Osh (News PERETO launched voluntary environmental certification ECO KG among HoReCa enterprises in Kyrgyzstan).

On September 9, the PERETO (Promotion of Energy and Resource Efficient Technologies in the Tourism Industry of Kyrgyzstan) project held its first event - an introductory seminar. The project is unique for Central Asia, as such an integrated approach to sustainable energy and sustainable use of natural resources in the tourism industry has not yet been seen in the region. The event was attended by the main partners and those for whom the project and its results are intended - government agencies, the HoReCa sector (hotels, restaurants, cafes, hostels, guest houses) and business associations, suppliers of green technologies, higher education institutions. The project received full support from the relevant government agencies - the Department of Tourism under the Ministry of Culture, Information and Tourism of the Kyrgyz Republic and the Ministry of Economy of the Kyrgyz Republic, whose representatives took an active part in the event. The project is being implemented by the American University of Central Asia (AUCA) together with three partner organizations - UNISON Group (Kyrgyzstan), Technopolis Group (Belgium), Collaborating Center on Sustainable Consumption and Production - CSCP (Germany) with financial support from the European Union SWITCH Asia program (PERETO: In Kyrgyzstan, 2022).

"The commitment to achieving energy efficiency and energy security in Kyrgyzstan at the national policy level is clearly supported by the European Union. It is very important to ensure synergy of all stakeholders, a systematic approach to project implementation and sustainable results. The key point is cooperation with relevant government departments to support the course of national policy towards a green economy," said Karl Frosio, coordinator of the SWITCH Asia program in Kyrgyzstan, in his welcoming speech (PERETO: In Kyrgyzstan, 2022). A sociological study is currently being conducted - a survey of the HoReCa sector and consumers to identify their level of knowledge in the field of environmental protection, energy and resource efficiency, sustainable production and consumption. The results of the study are planned to be widely presented in October this year.

The information collected during the study will be used to develop training courses for representatives of the tourism sector, as well as educational programs, which can then be implemented by the country's universities. Based on the results of the study, it is also planned to develop an electronic guide for consumers on sustainable consumption and environmentally friendly lifestyles, adapted for Kyrgyzstan. There are plans to create an online platform with a library on sustainable production and consumption and energy efficiency, a network of consultation centers throughout the country, develop green certification criteria for the HoReCa sector, green financing tools and much more. "We hope that the project will help expand access of small and medium-sized businesses to green financing, especially in remote regions, and create favorable conditions for the development of appropriate policies at the national level," noted Nurzat Abdyrasulova, president of Unison Group (PERETO: In Kyrgyzstan, 2022).

It is expected that by the end of the project, 300 small and medium-sized tourism enterprises will have been trained, and 50 of them will receive direct support in introducing green technologies. An important component of the project is environmental education of the population - tourists and local residents, and the introduction of environmentally friendly behavior into everyday life. Through an information campaign and digital products developed by the project, it is planned to reach about 300,000 Kyrgyzstanis. The purpose of the introductory seminar was not just to talk about the project, but also to receive feedback from all interested parties. Participants of the event noted the relevance of the project and the compliance of its goals with the needs of the tourism industry of Kyrgyzstan. The event also helped to identify relationships with other initiatives and potential partners (PERETO: In Kyrgyzstan, 2022).

UNWTO Secretary-General Taleb Rifai said: "Tourism, one of the fastest growing economic sectors today, accounts for 10% of global GDP, 7% of global exports and one in ten jobs. However, growth comes hand in hand with responsibility as we strive to ensure a better future, peace and prosperity for our planet and the people who inhabit it. It is estimated that tourism is responsible for 5% of global CO2 emissions. We need to move towards a truly green economy in tourism, where growth does not come with destructive impacts on the environment or culture" (World Conference Tourism and Future Energy – Reducing CO2 Emissions). Tourism accounts for 8% of global carbon emissions. It is estimated that during the summer peak there are 34,000 flights daily. This means that every three seconds an aircraft takes off or enters European airspace. The aviation industry accounts for 3% of greenhouse gas emissions across Europe. This level is expected to increase by as much as 700% by 2050. The consequences can be irreversible, not only in the form of shortages of raw materials, but also in the form of climate change and environmental damage. So what are the consequences of environmental pollution and carbon dioxide emissions? First of all, the strengthening of the greenhouse effect, which is a slight increase in atmospheric temperature. The result is melting glaciers, rising sea levels and extreme weather patterns such as heat waves, droughts and thawing permafrost. CO2 also causes ocean acidification. More and more countries and organizations are taking action to stop these changes. Airlines must monitor their emissions and purchase new ones when they use up their free allowances. The EU predicts that, among other things, thanks to such measures, CO2 emissions from aviation will not exceed 111 megatons per year by 2030 (World Conference Tourism and Future Energy – Reducing CO2

Emissions). Technological advances in aviation benefit it because lighter planes burn 40 percent more up to 60 percent less fuel. Alternative fuels are also being tested to reduce carbon emissions. Moreover, thanks to international regulations, from 2027 each carrier will be responsible for planting trees.

5.4. Strategies for the decarbonization of the tourism industry as components of the formation of energy conservation in society

The World Conference on Tourism and Future Energy aims to stimulate debate among industry leaders, entrepreneurs, financial institutions and policy makers to explore new opportunities and innovative solutions for the future energy of the global tourism sector and promote low-carbon growth (World Conference Tourism and Future Energy – Reducing CO2 Emissions). Based on the results of the meeting dedicated to the energy of the future in the accommodation and hospitality industry, the following conclusions were drawn:

– Ensuring an enabling environment for low-carbon growth: Financial, structural, institutional and regulatory mechanisms must be put in place to achieve full success. There is a need for public policy mechanisms of a strategic nature for the private sector, both at the international, regional and national levels. Such mechanisms must be backed by the commitment of hotel owners and managers;

– Improving the quality of measurements to better manage energy consumption in hotels: Most SMEs in tourism are unaware of their level of sustainability or their status in relation to energy and resource consumption. There is an urgent need to measure energy consumption through mechanisms and methods designed to manage and control energy consumption;

– Application of new technologies in the enterprises of the future: the sharing economy, which relies on the so-called “Internet of Things” (IoT) and blockchain technologies, is rapidly changing the approaches that will be applied to tourism entrepreneurship in the future. Smart, connected devices are quickly becoming competitive factors in business;

– Supporting consumer engagement: Repeatedly mentioned throughout the sessions, consumer engagement leading to long-term changes in consumer behavior is essential to achieving sustainability goals. Such ideas tend to gain momentum through the use of digital and other new technologies that promote democratic thinking and culture and create an environment that supports it, while also combining financial sustainability with social, environmental and economic impact.

Based on the results of the meeting on low-carbon models of sustainable tourism, the following conclusions were drawn:

The key role of government support: this approach is a prerequisite for efficient use of resources, environmental protection and combating climate change in many countries. Support may cover policies, roadmaps, media awareness campaigns, clean energy and green tourism, and capacity-building initiatives to raise public awareness;

Learning from positive experiences and applying best practices: Experiences in retrofitting existing infrastructures, such as the pilot hotels presented in the Near Zero Energy Hotels (neZEH)

project, should be encouraged and disseminated. Experience from the thriving airline industry suggests that growth can be balanced with commitments to curb climate change;

Empowering stakeholders through collaboration: Sustainability management is one of the most effective approaches to reducing carbon emissions in the industry. All participants must measure and track their carbon footprint and actions to address the negative impacts of that footprint, and establish ongoing long-term management of their sustainability activities against mandatory emission reduction targets;

Spread the word about the benefits of sustainable tourism: Many organizations and government agencies position themselves as champions of sustainability, but few of them practice what they call for. Sustainable development not only helps reduce transaction costs and improve energy efficiency, but also meets consumer needs and increases customer loyalty.

A low-carbon tourism sector focused on both growth and sustainability requires the full, consistent participation of accommodation clusters, air and ground transport. A huge role in solving these issues is given to innovations in the field of energy use and its sources, in particular renewable energy sources. The World Tourism Organization (UNWTO) is putting this concept into practice through projects such as the Near Zero Energy Hotels (neZEH) initiative, which will be launched tomorrow. As the Secretary-General of the United Nations has stated, “Access to energy helps children learn in the evenings, farmers produce more crops, and hospitals provide better care.” In addition, it provides 24-hour train service, allows hotels to host thousands of tourists every year and, of course, airplanes to take us to new, unfamiliar countries so that we can learn more about the wonderful world in which we live.

With hotels being the second largest consumer of energy in the industry, it is critical that lodging businesses reduce their emissions and use renewable energy. There is a compelling economic case for reducing emissions from the hotel industry: moving to low-carbon models will provide cost-effective operations while promoting competitiveness. There are energy-efficient technologies that facilitate such transformations, and improved best practices for hotel design and operation. However, to be fully successful, the market must provide an enabling environment for low-carbon growth, including financial, structural, institutional and regulatory frameworks. At the same time, small and medium-sized hotels, which make up 90% of the hospitality sector in Europe, must have adequate and easily accessible information on low-carbon operating models, as well as access to independent technical advice and financial support. Awareness-raising activities involving consumer participation and the use of digital technologies will bring about the necessary changes in people's behavior and attitudes towards this issue.

“The tourism sector faces an urgent challenge and significant opportunity to become a leader in reducing CO2 emissions and an active participant in the less carbon-intensive economy of the mid-twenty-first century. This requires strategic policy frameworks supported by national governments and international organizations, effective systems for measuring and reporting emissions, and schemes to enable tourism companies to achieve emissions reduction targets.” - Eugenio Yunis Executive Vice President, Federation of Tourism Enterprises, Chile (World Conference Tourism and Future Energy – Reducing CO2 Emissions). Addressing the challenges and solutions facing the hospitality industry related to climate change, Mr. Younis emphasized the

need for government strategic policy frameworks targeted at the private sector, including management commitments, measurement of energy consumption and emissions, action plans for equipment upgrades and employee training. He recommended encouraging green consumption among hotel guests and engaging consumers more broadly, including through involvement in environmental projects outside the hospitality industry.

The extreme weather events currently underway have and will continue to impact our way of life, our economy and the well-being of our communities. Climate change will become a central issue affecting tourism development and management, as well as the movement of tourists. Paradoxically, tourism has a significant climate impact through greenhouse gas (GHG) emissions, which are projected to increase significantly by 2035 due to significant growth in international tourism and changes in travel frequency and distance traveled . Based on the UNWTO's business-as-usual growth forecast to 2035, CO2 emissions generated by tourism will increase by approximately 135% between 2005 and 2035. Accommodation sector emissions are expected to increase globally by 3.2% per year. Whatever this increase, it is clear that a significant reduction in negative impacts is in the interests of the tourism industry itself. Achieving ambitious targets to reduce carbon emissions and reposition the tourism sector to become part of a less carbon-intensive economy is estimated to account for 4.0 - 4.1% of the total global tourism economy in 2050. This means that Meeting the 50% emissions reduction target would entail a cost of about US$11 per trip, based on the projected 6.6 billion international and domestic arrivals by 2030. If these costs are divided just between the 1.8 billion international arrivals projected by the World Tourism Organization (UNWTO), they would amount to about US$38 per trip. On a user-pays basis, these costs are quite comparable to many existing tourism taxes and fees. But we are talking not only about costs, but also about how to position this issue. The tourism sector's perceived lack of action to reduce its carbon intensity poses reputational risks, especially as investment and consumer attitudes towards carbon-intensive sectors and companies increase (World Tourism Organization UNWTO, 2023).

The accommodation sector must adhere to three principles: a clear, transparent and far-reaching strategic commitment from hotel management at the highest level to change attitudes towards the environment; reliable and detailed measurements of energy consumption and carbon emissions in all areas and departments of hotels; long and short term plans for each hotel with goals and measures to achieve them. There are a wealth of proven, reliable tools and techniques available to help reduce GHG emissions. These tools and methods only need to be adapted to the specifics of the industry. The focus is always on a wide variety of technical measures, such as switching to renewable energy sources and biofuels, upgrading or replacing existing equipment for lighting, heating, cooking, air conditioning, etc., improving the thermal insulation of buildings to reduce cold and warm air, etc. At the same time, the understanding is deepening that in order to achieve the set goals, non-technical measures are no less important. This includes better training employees to take energy efficiency into account on a daily basis, promoting environmental education programs for hotel guests, increasing guest awareness of green initiatives, and involving local communities in environmental projects (World Tourism Organization UNWTO, 2023).

"Energy audits were fundamental to helping participating hotels make the right decisions about their next steps. According to the results obtained, 16 pilot hotels were able to dramatically reduce primary energy consumption for accommodation-related functions - by an average of 63%. In order for a hotel to be fully sustainable, the focus must be on behavioral change and commitment among employees, management and guests." - Prof. Theocharis Tsoutsos, Technical University of Crete, neZEH project coordinator, Greece. Presenting the findings of the EU-funded project "Nearly Zero Energy Hotels (neZEH)" (2013–2016), Prof. Tsoutsos highlighted the challenges the hospitality sector faces in achieving Near Zero Energy Building (nZEB) status. Although hotels should set an example of environmental awareness and efficient use of energy, there is a lack of reliable data on this type of building. The project showed that by applying a structured approach, energy consumption levels can be radically reduced while simultaneously increasing the share of renewable energy sources. However, as the speaker emphasized, achieving full nZEB status requires not only technical solutions, but also changes in behavior, which are achieved through the participation of employees, managers and hotel guests. The basic premise is that hotels and other buildings of a certain size that are frequently visited by large numbers of people should set an example of environmental and energy efficiency. This is demonstrated by the European Union's Energy Performance of Buildings Directive (EPBD), which requires that priority be given to achieving Near Zero Energy Building (nZEB) status. Hotels constitute a special category and there is currently no reliable data available for such buildings. The problem is compounded by the fact that there is a wide range of different categories of hotels depending on location (coastal, mountain, urban, rural hotels) or depending on functional features (resorts, spas, mini-hotels). It has become clear that almost all hotel owners need technical assistance to begin work on refurbishment plans and assess the sustainability of the investment required (World Conference Tourism and Future Energy – Reducing CO2 Emissions).

Therefore, to help hotels take the first step, the energy audit measured 16 hotels in seven European countries (Greece, Croatia, France, Romania, Italy, Spain and Sweden) and analyzed the results. The energy audit was a fundamental factor in helping the participating hotels make the right decisions about their next steps. According to the results obtained, 16 pilot hotels were able to dramatically reduce primary energy consumption for accommodation-related functions - by an average of 63%. At the same time, the share of renewable energy used for location-related functions could be increased from 18% to 46% on average. In addition, the analysis showed that non-accommodation functions, such as a gym, spa, kitchen, etc., account for a larger share of consumption than the actual accommodation functions. Primary energy consumption for these functions can be reduced by an average of 53%. "The answer to the question of how to achieve sustainability goals is simple, but many hotel owners and managers do not understand it. Measure your energy consumption, analyze where you can improve, invest the necessary funds to save in the future and benefit from new technologies and renewable energy." - Alvaro Carrillo de Albornoz President/CEO, ITH, Spain (World Conference Tourism and Future Energy – Reducing CO2 Emissions).

Sustainability is not a trend of the future, but a reality of today. It is worrying that many tourism businesses do not understand or know what their sustainability status is. A strong advocate

for measuring hotel energy consumption, Mr. Carrillo de Albornoz presented ITH's five-point strategy and online tool for hotel sustainability self-diagnosis. In addition, he emphasized the need for adequate financing mechanisms for small and medium-sized hospitality businesses, which often do not have the profitability required by more traditional financial institutions such as energy service companies (ESCs), which typically focus on large businesses with high energy consumption. Be that as it may, the situation is very clear: in most cases, tourism companies are unaware of their status in terms of sustainability and energy consumption. They only realize their situation when they attempt to become certified as a sustainable hotel. Therefore, ITH starts from the starting point and proposes a basic strategy for achieving progress in this area, consisting of five points :

measuring energy and water consumption and recycling waste;

analysis of the results aimed at clarifying whether these latter can be optimized;

– identifying appropriate measures to be taken to achieve savings;

– whenever possible, introduction of renewable energy sources;

– inclusion of appropriate measures in sustainability policies and dissemination of information about such measures.

However, even following such a strategy, we will quickly face the next major obstacle - finding adequate financing mechanisms. According to a common misconception, such mechanisms can be offered by energy service companies (ESCs). The problem - and not only in Spain - arises when small and medium-sized hotel enterprises turn to such services. Firstly, small and medium-sized hotels are often not profitable enough for energy companies, which prefer to focus on large companies with high consumption levels that require large-scale investments. Secondly, the ESC business model is based not only on financial and technical aspects, but also on trust. Given the significant duration of ESC contracts, there is a risk that small and medium-sized hotels associated with such a contract may lose their solvency even before the end of the contract (World Conference Tourism and Future Energy – Reducing CO2 Emissions). Thus, there is an urgent need for adequate financing mechanisms for small and medium-sized hotels. To help the Spanish tourism sector move forward, ITH, together with the Ministry of Tourism, has developed a web platform that allows hotel management to conduct self-diagnosis to determine the current sustainability status of their hotels. In addition, the website provides an energy efficiency assessment tool and provides customized advisory services on various energy saving solutions, along with information on estimated investment volumes, potential savings and payback periods. These easy-to-use tools will help hotel owners and management get on the path to renewal and provide confidence that they are making the right decisions about energy and their business operations.

A fundamental solution to the problem of energy saving in the tourism sector is not possible without the creation in the country and implementation at each level of a pragmatic and effective motivational mechanism for energy saving. The incentive mechanism for energy saving should establish a direct connection between electricity suppliers and consumers.

The main measures to ensure a reduction in energy consumption in the hotel business, in our opinion, should be:

1) quality control of the design of hotel complexes, including control of compliance with heat protection and energy saving standards;

2) quality control of construction and installation work in terms of energy efficiency and energy saving standards for engineering equipment and systems;

3) careful selection of equipment that meets a rational combination of safety, comfort and energy costs;

4) automation of engineering systems aimed at reducing unjustified costs;

5) optimization of costs for paying for housing and communal services and energy resources.

Summarizing what has been said, it is worth noting that the main task the introduction of energy-saving and energy-efficient technologies at tourism enterprises is to reduce the cost of tourism services in order to increase the price attractiveness of the services provided by tourism enterprises and increase the profits of tourism enterprises from the sale of tourism services.

A competent, pragmatic policy in the field of energy-saving technologies will help preventively eliminate a number of problems that burden the material and technical base of tourism enterprises.

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CONCLUSIONS

The transformation of the energy sector of Ukraine is an integral component of the integral strategy of the socio-economic modernisation of Ukraine, which is based on dynamic economic growth, rational and effective use of national resource potential, and integration of Ukraine into the European economic space. The key result of the transformation strategies should be the transformation of the country's fuel and energy complex from a problematic sector that requires constant state support to a modern, efficient, competitive industry of the national economy, capable of sustainable development for the long term in the conditions of regional integration and competition on the European and global energy markets. Accordingly, the processes and measures that form the target trajectory of the development of the energy sector must ensure the consistency of the main priorities with the broader goals of society and consider the development of the energy sector as a component of the sustainable socio-economic development of the country as a whole.

In particular:

- the transition of the energy sector of Ukraine to the market principles of functioning and competition, which will stimulate the improvement of the efficiency of the economic activity of the subjects of the energy sector and the efficiency of the use of energy resources by economic subjects and society in general;
- elimination of Ukraine's critical dependence on supplies of energy resources from monopolistic sources, increasing the level of energy security by diversifying the routes and sources of energy supply of the national economy;
- integration of the energy sector of Ukraine into the EU energy markets and the European energy security system;
- ensuring the competitiveness of the national energy sector on the European energy market by creating favourable conditions for attracting investments and technical modernisation of energy sector facilities;
- full-scale integration of the energy sector of Ukraine into the European energy market with free movement of energy resources, investments and technologies, which will ensure proactive renewal of the energy industry and increase the level of self-sufficiency in extracted energy resources;
- technological renewal of the energy sector.

Ukraine needs to correct deformations of the real sector in the direction of reducing the share of resource- and energy-intensive types of activities, promoting the reduction of energy and environmental intensity of production through the introduction of modern technologies, rationalisation of resource use, optimisation of the territorial location of production, etc. Sectors with lower energy intensity and use technological processes characterised by high energy efficiency should become drivers of growth in the industry.

Transformation of the energy sector: digitalisation, social responsibility and green marketing:

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