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The development of renewable energy in Ukraine in the context of ensuring public employment

ABSTRACT: The article examines the trends in the development of renewable energy in Ukraine in accordance with the long-term strategy of the energy sector of the state in the context of the transformation of employment in the energy sector of the country. It is emphasized that investments in renewable energy technologies create more jobs compared to traditional electricity generation technologies. It is defined that in Ukraine there is a significant untapped potential for energy efficiency, which requires accelerating the pace of modernization and development of renewable energy sources and raises the issue of labor supply to the industry. It was emphasized that there are a number of opportunities for the development of the energy sector of Ukraine related to the development of renewable energy sources. It is underlined that the formation of territorial-industrial clusters in Ukraine for the production of equipment for solar and wind energy with a closed production cycle forms long-term prerequisites for socio-economic stability in the country and stimulates employment. It is

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substantiated that an important reserve for increasing employment in Ukraine is to ensure the energy efficiency of buildings. At the same time, it was noted that in the field of renewable energy and energy efficiency in Ukraine there is a significant shortage of qualified technicians and specialists in the field of innovative technologies, which confirms the importance of studying the problem of labor support in the industry. It is determined that today the solution of the issue of labor supply of the industry takes place mainly at the level of enterprises that invest in the development of their own staff.

KEYWORDS: renewable energy, energy efficiency, electricity, solar energy, wind energy, employment, labor supply

Introduction

The development of the energy sector of Ukraine's economy is influenced by a number of factors, both positive and negative. On the one hand, the trends in the development of the energy sector are negatively affected by the situation in Eastern Ukraine and the state of the labor market; on the other hand, the development of the industry is stimulated by such factors as the long-term government strategy for the development of the energy sector, the active attraction of investment. In particular, there are a number of opportunities for the development of Ukraine's energy sector related to the development of renewable energy sources.

In 2017, Ukraine adopted the Energy Strategy until 2035 (MEPR 2017), the priority areas of which are the development of renewable energy, energy efficiency and energy saving. In 2020, the country approved the Concept for the implementation of state policy in the field of energy efficiency of buildings in terms of increasing the number of nearly zero-energy buildings (RADA 2020). Ukraine also joined the International Renewable Energy Agency (IRENA) (IRENA), which provides the country with access to the Abu Dhabi Development Fund and the IRENA database, as well as a platform for cooperation with leading countries in the field of renewable energy.

1. General trends in the development of renewable energy

In modern conditions in the world economy, attention is growing to the issue of energy efficiency, which leads to a change in electricity generation technologies in favor of renewable energy sources and leads to the transformation of employment in the energy sector. Today in the world the share of electricity produced from renewable sources in total energy consumption is 26%, by 2030 this indicator is expected to increase to 55% (GIZ 2020).

Renewable energy production is growing extremely fast. According to experts, by 2040, alternative energy sources will meet more than 40% of world demand (Kyiinfo 2020). At the same time, employment in renewable energy is constantly increasing (Fig. 1) (in 2018, about 11 million people worked in this industry), and investment in renewable energy technologies, compared to traditional technologies for electricity production, create more jobs per 1 USD investments (employment in the energy sector consists of permanent jobs for employees at electricity generation facilities and subcontractors – direct employment; jobs of personnel employed in the supply chains of the industry – indirect employment; jobs created as a result of the formation of the purchasing power of the above categories of employees – induced employment) (GIZ 2020).

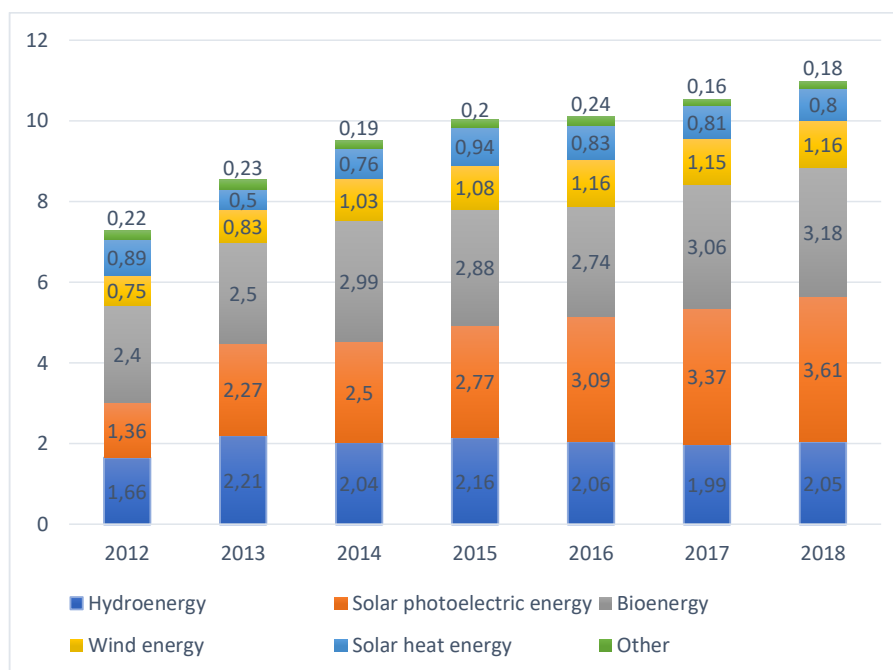


Fig. 1. The structure of employment by renewable energy sector in the world in 2018 [thousand people]
 Source: IRENA 2019

Rys. 1. Struktura zatrudnienia w różnych działach energetyki odnawialnej na świecie w 2018 roku [tys. osób]

Thus, according to the University of California, Berkeley, each job in the field of solar energy (per 1 MW of input capacity) creates from 1.8 to 2.8 jobs in other sectors of the economy, in the field of wind energy – 1.59 jobs (Aldieri et al. 2020).

According to the International Energy Agency (IEA) 2020 report (IEA 2020), Ukraine has significant untapped potential for energy efficiency (IEA U 2020). Today, the country's energy sector, which is mainly focused on the use of fossil fuels, including natural gas and coal (Table 1)

(MEPR 2017), needs to accelerate the pace of modernization and the development of renewable energy sources, which also highlights the problem of providing the industry with labor resources capable of promoting a green transition.

TABLE 1. Structure of the total volume of primary energy supply in Ukraine [%]

TABELA 1. Struktura dostaw energii pierwotnej na Ukrainie [%]

Source of primary energy supply	2015	2020*	2025*	2030*	2035*
Coal	30.4	22.0	16.1	14.3	12.5
Natural gas	28.9	29.3	31	30.8	30.2
Oil products	11.6	11.5	9.2	8.2	7.3
Nuclear energy	25.5	29.3	32.2	29.7	25.0
Biomass, biofuel and energy from waste	2.3	4.9	6.9	8.8	11.5
Wind and solar	0.1	1.2	2.4	5.5	10.4
Hydroenergy	0.5	1.2	1.1	1.1	1.0
Heat energy	0.6	0.6	1.1	1.6	2.1
<i>The total supply of primary energy</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>
Fossil resources	96	92	88	83	75
Renewable resources	4	8	12	17	25

* forecast.

Source: MPE 2017.

Thus, according to the National Renewable Energy Action Plan, the total capacity of renewable energy sources in 2030 is expected to reach 12.6% (excluding large hydropower capacities). According to forecasts, the capacity of solar energy will be increased to 2300 MW, wind – to 2280 MW and bioenergy – to 950 MW (EAP 2018).

According to the State Agency on Energy Efficiency and Energy Saving, in 2019, EUR 3.7 billion were invested in the development of renewable energy sources in Ukraine, which allowed to put 4.5 GW of new capacity into operation and almost triple the production of electricity from renewable energy sources to a total of 6.8 GW (5.5% of total electricity production in the country) (SAEE 2020).

Given that at the beginning of 2020, 4925 MW of capacity was installed in Ukraine at solar power plants and 1170 MW – at wind farms, induced employment in the country can be estimated at 8,865–13,790 people and 1860 people, respectively. In general, the induced effects of employment in these types of energy are estimated at 10.7–15.7 thousand jobs. In general, during 2014–2019, solar and wind energy of Ukraine provided employment for almost 25 thousand workers, and taking the stage of production of equipment – 45 thousand workers into account (GIZ 2020).

At the same time, the renewable energy sector is the most diversified energy sector of the state in terms of investment structure (Fig. 2) (30% of investments are foreign investors,

30% – large business, 30% – small and medium business, 10% – households) and in terms of the structure of electricity producers (800 stations and about 25 thousand households) (GIZ 2020). The total need for investment in this area in the country by 2030 is estimated at EUR 4 billion annually. According to the Concept of Green Energy Transition (MEPR 2020), bringing the share of renewable energy sources in the structure of electricity production to 70% by 2050 will allow Ukraine to completely abandon the most environmentally harmful coal generation.

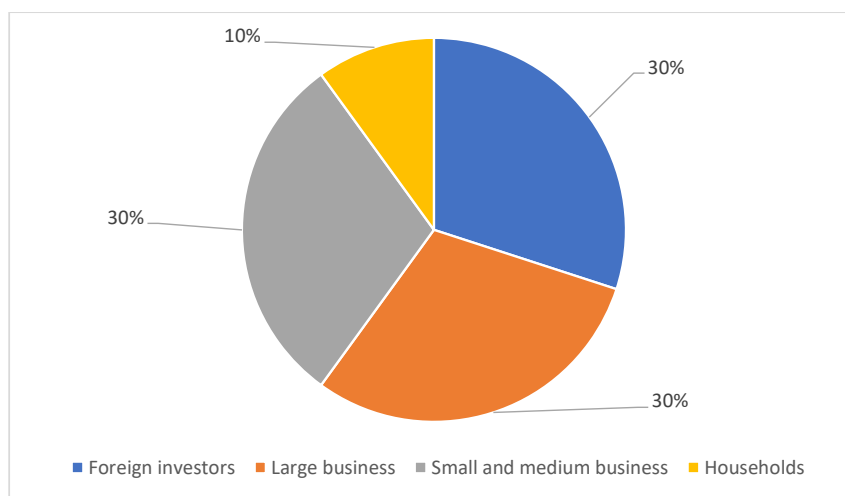


Fig. 2. The structure of investments in the production of electricity from renewable sources in Ukraine in 2019
 Source: GIZ 2020

Rys. 2. Struktura inwestycji w produkcję energii elektrycznej ze źródeł odnawialnych na Ukrainie w 2019 roku

The green energy transition is also designed to significantly stimulate the development of high-tech production in Ukraine, leading to increased demand for goods and services related to “clean” technologies. This will have a direct impact on economic growth, job creation and increasing incomes of Ukrainian citizens (MEPR 2020).

2. Employment in solar energy in Ukraine

In 2014–2019, 40,791 people were employed in the field of solar energy in Ukraine, and without taking into account the stage of equipment production, 21,955 people were employed in solar energy (53.82% of the total number of employees). In general, the employment of workers in the construction and operation of solar power plants in Ukraine is as follows by stages (without

decommissioning): project planning – 1.95% of employees, equipment production – 46.18%, transportation – 3.19%, installation and grid connection – 36.21%, maintenance and technical management – 12.47% (Fig. 3).

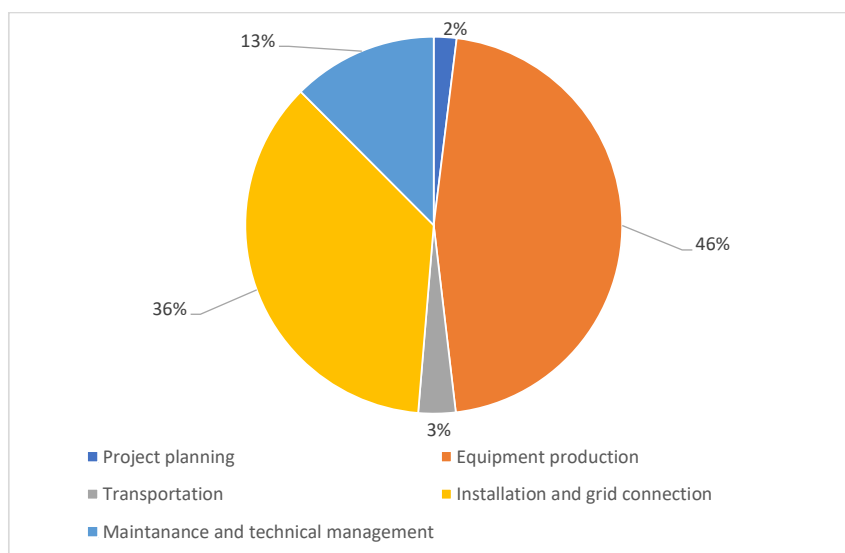


Fig. 3. The structure of employment of workers in the construction and operation of solar power plants in Ukraine
Source: GIZ 2020

Rys. 3. Struktura zatrudnienia pracowników przy budowie i eksploatacji elektrowni słonecznych na Ukrainie

By occupational groups, the distribution of employment is as follows: construction workers and technical staff – 38.6%, industrial workers and technicians – 30.31%, equipment maintenance and technical management workers – 12.47% of employees (EAP 2018) (Table 2). This structure of employment is dictated by the active stage of production of solar panels and the construction of power plants in Ukraine.

Thus, in 2019, KNESS PV started operating in Vinnytsia – the first large-scale industrial production of panels for solar power plants in Ukraine, which allowed to produce in the country 100% of components for the solar energy industry (Kness 2019). Production capacity is 200 MW, another 200 MW will be added at the start of the second stage of production. In total, since the launch of the plant 12 industrial photovoltaic plants with a total capacity of 70.66 MW using solar modules manufactured by KNESS PV have been built in Ukraine.

TABLE 2. Employment of workers in the construction and operation of solar power plants in Ukraine, by professional groups and stages in 2014–2019 [persons]

TABELA 2. Zatrudnienie pracowników przy budowie i eksploatacji elektrowni słonecznych na Ukrainie według grup zawodowych i etapów w latach 2014–2019 [osoby]

Professional groups	Project planning	Equipment production	Transportation	Installation and grid connection	Maintenance and technical management	Decommissioning
Experts in legal, energy regulation, real estate and taxation, standardization	309	696	0	0	43	0
Financial analysts	199	0	0	0	0	0
Electrical, mechanical and energy engineers	144	0	0	143	740	86
Logistics experts	94	0	0	0	0	0
Environmental experts	34	0	0	113	0	69
Occupational safety experts	15	696	0	300	980	64
Industrial workers and technicians	0	11,972	0	0	390	0
Industrial engineers, telecommunications and electricity engineers	0	1943	0	0	0	0
Chemical engineers	0	289	0	0	0	0
Marketing and sales staff	0	866	0	0	0	0
Truck drivers and crane operators	0	0	899	0	0	278
Loaders	0	0	300	0	0	0
Administrative staff	0	919	39	0	67	0
Shipping agents	0	0	39	0	0	0
Geotechnical experts	0	761	13	0	0	32
Quality control experts	0	696	13	38	0	0
Construction workers and technical staff	0	0	0	13,315	2,431	1,407
Civil engineers and construction foremen	0	0	0	863	0	0
Operators	0	0	0	0	413	0
Management	0	0	0	0	21	0
<i>Total</i>	<i>795</i>	<i>18,837</i>	<i>1303</i>	<i>14,770</i>	<i>5,086</i>	<i>1,935</i>

Source: GIZ 2020.

3. Employment in wind energy in Ukraine

In 2014–2019, 4219 people were employed in the field of wind energy in Ukraine (excluding the decommissioning stage). The structure of employment of workers in the construction and operation of wind power plants in Ukraine is as follows by stages: project planning – 4.34% of employees, equipment production – 31.83%, transportation – 1.47%, installation and connection to the grid – 57.88%, maintenance and technical management – 4.48%, decommissioning – 14.13% (Fig. 4). As no wind power plant was dismantled in Ukraine during this period, the employment of employees in this type of activity can be considered as a general additional potential for future periods (2531 employees).

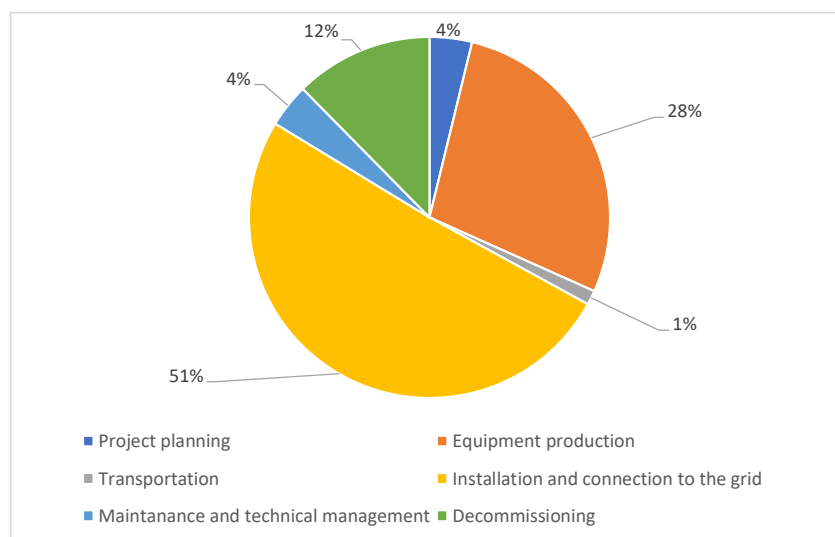


Fig. 4. The structure of employment of workers in the construction and operation of wind power plants in Ukraine
Source: GIZ 2020

Rys. 4. Struktura zatrudnienia pracowników przy budowie i eksploatacji elektrowni wiatrowych na Ukrainie

By occupational groups, the distribution of employment is as follows: construction workers and technical staff – 45.27%, industrial workers – 20.88%; maintenance and technical management of onshore wind power plants – 4.48% (Table 3) (EAP 2018). Excluding the production of equipment, 2876 people (68.24%) out of the total number of employees were employed in the wind energy of Ukraine. As in the situation with solar energy, the structure of employment is determined by the production capacity and installation of wind turbines in the country.

Thus, in 2012 in Kramatorsk, on the basis of Kramatorsk Heavy Machine Tool Plant and Energomashspetsstal Plant, for the first time in the post-Soviet space Fuhrlander FL2500 esta-

TABLE 3. Employment of workers in the construction and operation of onshore wind farms in Ukraine, by professional groups and stages in 2014–2019 [persons]

TABELA 3. Zatrudnienie pracowników przy budowie i eksploatacji lądowych farm wiatrowych na Ukrainie w podziale na grupy zawodowe i etapy w latach 2014–2019 [osoby]

Professional groups	Project planning	Equipment production	Transportation	Installation and grid connection	Maintenance and technical management	Decommissioning	Total
Experts in legal, energy regulation, real estate and taxation, standardization	72	1	4	0	6	0	83
Financial analysts	52	0	0	0	0	0	52
Logistics experts	25	75	4	17	0	3	124
Electrical, mechanical and energy engineers	21	0	0	27	0	30	78
Environmental experts	6	0	0	51	6	24	87
Occupational safety experts	4	76	0	108	11	22	221
Geotechnical experts	4	0	0	0	0	0	4
Marketing and sales staff	0	74	0	0	0	0	74
Industrial workers	0	881	0	0	0	0	881
Industrial engineers	0	71	0	0	0	0	71
Telecommunication engineers and computer engineers	0	1	0	0	26	0	27
Truck drivers and crane operators	0	0	44	212	0	127	383
Loaders	0	0	2	0	0	0	2
Administrative staff	0	61	9	0	9	0	79
Quality control experts	0	75	0	7	0	0	82
Construction workers and technical staff	0	0	0	1,884	26	390	2,300
Civil engineers and construction foremen	0	0	0	136	0	0	136
Operators	0	0	0	0	78	0	78
Management	0	27	0	0	3	0	30
Total	183	1,343	62	2,442	189	596	4,792

Source: GIZ 2020.

blished the production of multi-megawatt class wind turbines (Bilozerova 2012). The volume of investments amounted to EUR 3 million, the number of highly qualified jobs created – 150 and 100, respectively (Efimov 2018). In fact, a territorial-industrial cluster for the production of equipment for wind energy with a closed production cycle was formed.

Given that the installation of one wind farm brings to the region up to EUR 4 million, significantly revives the activities of related industries (launch of one turbine creates hundreds of jobs

in engineering, construction, transport, maintenance of aircraft), and its estimated operation life is 25 years (Efimov 2018), wind energy not only increases the country's energy independence, but also creates long-term preconditions for socio-economic stability: the effect on employment is determined by the amount of income from investment and operation (a small wind farm creates about 50 jobs).

4. Employment in the field of energy efficiency in Ukraine

An important reserve for increasing employment in Ukraine is to ensure the energy efficiency of buildings. At the beginning of 2020, Ukraine approved the concept for the implementation of state policy in the field of energy efficiency of buildings in terms of increasing the number of nearly zero-energy buildings and approved the relevant National Action Plan until 2025 (RADA 2020).

The total employment potential in this area is estimated at 465 thousand jobs in all sectors of the economy for workers employed in energy modernization of buildings and 1135 jobs for energy auditors. The United States, invested USD 1 billion in energy efficiency projects, created 15 to 20 thousand direct, indirect and induced jobs in the economy (FEAO 2017).

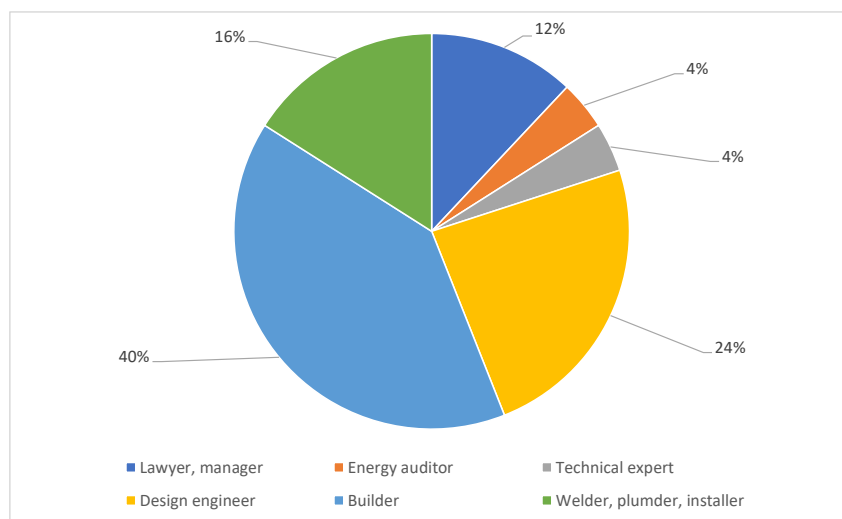


Fig. 5. Structure of potential employment of workers on performance of works on thermal insulation of buildings in Ukraine

Source: GIZ 2020

Rys. 5. Struktura potencjalnego zatrudnienia pracowników przy wykonywaniu prac przy ocieplaniu budynków na Ukrainie

The total estimated employment potential and performance of works on thermal insulation of residential buildings in Ukraine (carried out on the basis of the methodology of the International Renewable Energy Agency IRENA (IRENA 2017)) is 794,672 jobs: lawyer, manager – 95,361 people; energy auditor – 31,787 people, technical expert – 31,787 people, design engineer – 190,721 people, builder – 317,869 people, welder, plumber, installer – 127,148 people (GIZ 2020).

The professions of a builder (40%) and a design engineer (24%) have the greatest employment potential when performing thermal insulation works on buildings in Ukraine (Fig. 5).

5. Staffing of the renewable energy sector in Ukraine

The development of renewable energy in Ukraine involves the creation of jobs with a high level of skills of employees. At the same time, according to the results of the survey of 37 companies in the sector on staffing (25 companies representing renewable energy, 7 – energy efficiency, 5 – operating in both sectors), conducted by the European-Ukrainian Energy Association (GIZ 2020), 89.2% of companies noted a shortage of qualified personnel, with 67.6% of respondents considering it as very significant (Fig. 6). Thus, among equipment companies, 75% experience a very significant shortage of qualified technicians and specialists in the field of innovative technologies.

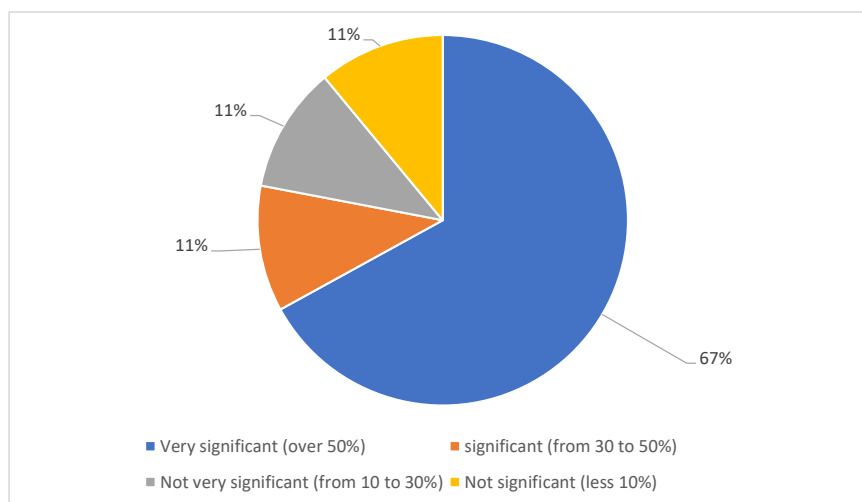


Fig. 6. Distribution of companies operating in the field of renewable energy and energy efficiency in Ukraine, according to the degree of shortage of qualified personnel

Source: GIZ 2020

Rys. 6. Rozkład firm działających w zakresie energii odnawialnej i efektywności energetycznej na Ukrainie według stopnia niedoboru wykwalifikowanej kadry

Importantly, the vast majority of respondents (89.2%) reported an increase in the number of skilled workers in the field of renewable energy and energy efficiency over the last five years. At the same time, since the same share of respondents invest their own funds in the development and training of existing staff, we can conclude that the issues of labor support in the industry are solved exclusively at the enterprise level.

Conclusions

The development of the energy sector of Ukraine's economy is in line with the long-term strategy of the state's energy sector, which determines the directions of development of the renewable energy sector and determines the transformation of employment in the industry. Ukraine has a significant untapped potential for energy efficiency, which requires accelerating the pace of modernization and development of renewable energy sources and highlights the problem of providing the industry with labor resources capable of promoting a green energy transition.

The formation in Ukraine of territorial-industrial clusters for the production of equipment for solar and wind energy with a closed production cycle forms long-term prerequisites for socio-economic stability in the country and stimulates employment. At the same time, there is a significant shortage of qualified workers in the field of renewable energy and energy efficiency in Ukraine. Today, the solution of the issue of labor support of the industry is mainly at the level of enterprises that invest in the development of their own staff.

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Rozwój energetyki odnawialnej na Ukrainie w kontekście zapewnienia zatrudnienia

Streszczenie

Artykuł analizuje trendy rozwoju energetyki odnawialnej na Ukrainie zgodnie z długoterminową strategią sektora energetycznego państwa w kontekście transformacji zatrudnienia w sektorze energetycznym kraju. Podkreśla się, że inwestycje w technologie energii odnawialnej tworzą więcej miejsc pracy w porównaniu z tradycyjnymi technologiami wytwarzania energii elektrycznej. Na Ukrainie istnieje znaczny, niewykorzystany potencjał efektywności energetycznej, co wymaga przyspieszenia tempa modernizacji i rozwoju odnawialnych źródeł energii. To powoduje, że pojawia się kwestia możliwości zapewnienia dostępności pracowników w przemyśle. Podkreśla się, że możliwości rozwoju sektora energetycznego Ukrainy są związane z rozwojem odnawialnych źródeł energii. Powstanie na Ukrainie klastrów terytorialno-przemysłowych do produkcji urządzeń do energetyki słonecznej i wiatrowej o zamkniętym cyklu produkcyjnym stanowi długoterminową przesłankę stabilności społeczno-gospodarczej kraju i stymuluje zatrudnienie.

Wskazano, że ważnym elementem zwiększenia zatrudnienia jest zapewnienie efektywności energetycznej budynków. Jednocześnie zauważono, że w obszarze energetyki odnawialnej i efektywności energetycznej na Ukrainie występuje znaczny niedobór wykwalifikowanych techników i specjalistów z zakresu innowacyjnych technologii, co potwierdza istotność badań związanych z problematyką wsparcia rynku pracy w przemyśle.

Oceniono, że dziś rozwiązanie problemu podaży pracy w przemyśle następuje głównie na poziomie przedsiębiorstw inwestujących w rozwój własnej kadry.

SŁOWA KLUCZOWE: energia odnawialna, efektywność energetyczna, elektryczność, energia słoneczna, energia wiatrowa, zatrudnienie, podaż pracy