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DEVELOPMENT OF RENEWABLE ENERGY SOURCES IN THE NORTHERN BLACK SEA COAST

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ABSTRACT

The objective of the study was to analyse the policy and economy of renewable energy sources development in the Northern Black Sea Coast of Ukraine. Presently the share of the renewable energy resources in the power balance of Ukraine is rather small, namely 0.3% of the general development of the electric power. Nevertheless, Ukraine has huge potential with this regard. The accepted power strategy of Ukraine till 2020 has to play an important role. The potential of renewable energy sources in Ukraine makes 113 million tons of equivalent fuel whereas taking into consideration the modern level of production, traditional energy sources can provide Ukraine with 68 million tons of equivalent fuel with fuel and energy resources. The required theoretical level of the research included the use of analysis, comparison and synthesis. The analysis of the alternative energy development, which aims at experience and forecast of possible ways of development has given the opportunity to obtain the result of the research within vertical (historical) and horizontal (functional) scopes. In the southern regions of the country the investment projects aiming at the creation of power plants, working with sun and wind energy are actively carried out. The Northern Black Sea Coast of Ukraine is the most suitable region for development of this branch of alternative power engineering.

Introduction

The excessive growth of energy consumption in the country was presented in «The Energy Strategy of Ukraine through 2030», so now the significant budget funds are invested in building the energy capacity. According to the strategy, the level of energy efficiency in 2030 Ukraine will reach Poland nowadays. The alternative energy sources are the priority in many countries, both developed and still developing. It is based on the need for energy safety in the European Union and it was decided that the renewable energy will have made up 20% by 2020. The development of the renewable energy sources is one of the priority directions promoting the achievement of the energy safety by Ukraine. Ukraine has its own

technology, their manufacturers and integrators of the modern energy systems, but we have to develop the alternative sources that faced the administrative barriers and monopoly providers of the traditional energy sources (Shevtsov, 2004; Sinchuk et al., 2013).

The objective and the scope of the study. Policy and economy of the development of renewable energy sources in the Northern Black Sea Coast are discussed in this article.

The research methods include the analysis of the alternative energy development, comparison of the potential of renewable energy sources and the synthesis of the results of research into vertical (historical) and horizontal (functional) scopes.

Main part. According to the Institute of Renewable Energy National Academy of Sciences, the total potential of renewable energy amounts to 113 million tons of equivalent fuel and it can provide Ukraine with fuel and energy resources completely (Esypov, 2011; Khmara, 2010). Figure 1 shows the potential of the renewable energy sources (tons of equivalent fuel). Modern mining energy of equivalent fuel is 68 million tons. Thus the potential of renewable sources of energy can ensure Ukraine's fuel and energy resources completely (Kordon, 2010; Perga, 2009).

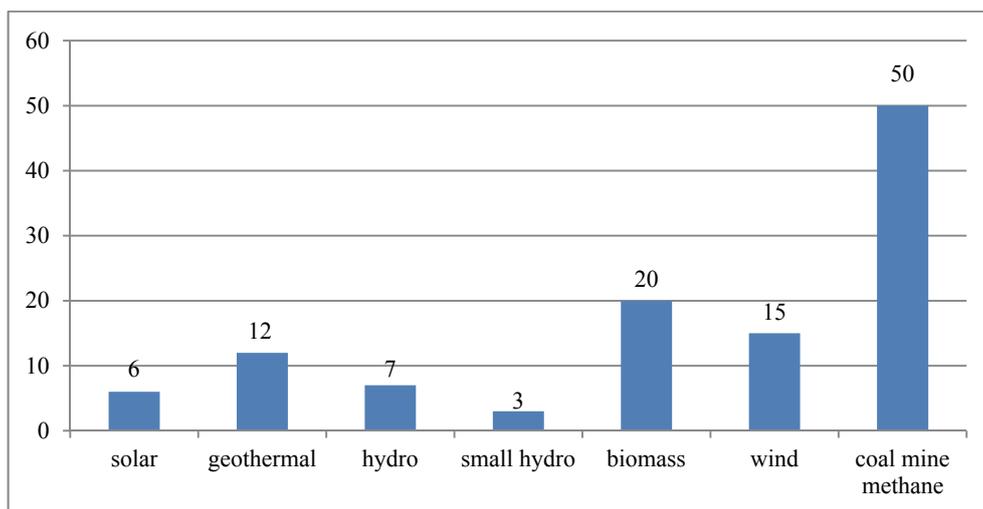


Figure 1. The potential of the renewable energy sources (tons of equivalent fuel)

Now this branch is most intensively developed in the Crimea. Today three available on the peninsula of solar power stations have got 187.5 MW of the electric power. Also six Crimean wind power plants make generally 70 MW of electricity. In energy balance of the Crimea the share of alternative energy makes about 20%. According to the Ministry of Ecology and Natural resources, functioning of alternative power plants in the Crimea reduces emissions of carbon dioxide in the atmosphere by 250 thousand tons per year (Taranenko, 2011; Gnatush, 2013).

It has taken away the land plots with a total area of 3.196 thousand hectares for placement of objects of alternative power engineering in the Kherson region. The development and coordination of project's documents with regard to allocation of the alternative power

engineering objects proceeds by area of 100 more hectares of lands. For the «solar» potential the Kherson region occupies one of the first positions. The quantity of sunny days in a year reaches 240, or 65%. Average solar insolation in this area is $1.25 \text{ MWh}\cdot\text{m}^{-2}$ a year. The flat relief of this territory promotes the development of the solar power (Gnatush, 2013).

Mykolaiv district has excellent starting conditions for the development of the alternative energy. The number of sunny days in the Ochakov area is about 300 cloudless days per year. Around 10% of the total wind potential of Ukraine is focused on the territory. The development of the alternative renewable energy sources is the priority of the Program of Economic and Social Development of Mykolaiv region in the future years. The construction of renewable energy will not only gain extra energy generating capacity for the region's needs, but also attract the significant investment in the local economy, create hundreds of new jobs, develop the infrastructure and favor implementation of the important social projects.

In 2013 in the Mykolaiv district the renewable energy sources has brought 400 MW of energy, and this year the level is in one GW, i.e. one million kilowatts that is equal to the power of one block of a nuclear power plant. According to the State plans it is expected that 10% of all obtained energy will be undertaken from renewable sources by 2015. In 2020 this figure will be 20%, in 2030 – 30%, and in 2050 – more than 50%.

In the Mykolaiv district the wind park «Ochakov» (Figure 2) with 500 megawatts works and the Tiligulsky hydroelectric power station is planned to be built. This project is investment attractive. In the present conditions the payback of the solar stations makes up 5 years, and the wind ones – 7. In 2013 in the Mykolaiv district the first solar plant of 29.3 MW power was opened. The power plant consists of 121,176 polycrystalline solar modules installed in 4 rows, and 27 inverter stations. It is planned to establish the similar 6 environmentally friendly power plants in 6 regions of the territory.



Figure 2. The wind park «Ochakov» in the Mykolaiv district of Ukraine

The most promising areas in Mykolaiv region for the development of wind power is the Ochakov and Berezan wild fields with the total area of 4,000 hectares. With the aim of harnessing the wind energy potential of the Mykolaiv region «Ochakov Windy Park Power» implements the investment project for the construction of the wind station, which answers to the trend of «New energy» Ukraine national projects.

During 2013 the wind installations Ltd. «Ochakov Windy Park Power» 117.8 million kWh energy was produced. In addition, «Ochakov Windy Park Power» has been designing the construction of three wind farms. The planned design capacity of the Ochakov's wind power plant is 300 MW (120 wind installations). The total amount of investment for the construction of the Ochakov's wind power plant is expected to be 6 billion USD. Putting into operation the Ochakov's wind power plant at full capacity will be able to save the equivalent of 30% power of 1 nuclear reactor of the nuclear power plant.

The share of the installed capacity of wind turbines wind of Mykolaiv district from 01.01.2014 is 10% of the total operating power of the wind of Ukraine. Implementation of these projects of construction of wind power plants in Mykolaiv district will increase the installed capacity of the wind power to 1,000 MW and attract investments in this territory of 20 billion USD. The main problem of the wind energy development in Mykolaiv district is the lack of the electrical networks for attaching the wind plants to the united energy system of Ukraine. The cost of the construction of the electric networks voltage 35 kV and 150 for joining the wind plants is estimated at 600 million USD.

The investment projects of building solar power plants are supported in Mykolaiv oblast. At this time, the projects for the construction of solar power plants are planned to be carried out in the seventh regions. The implementation of the projects for construction of solar power plants will take place with the help of investors. The project «Voskhod Solar» is carried out outside the settlements within the territory of Berezan district of Mykolaiv district. From 01.01.2014 Ltd. «Voskhod Solar» construction of the solar power capacity of 52.9 MW was completed. Currently the works with connecting power to the joint power system are being carried out. The cost of the attracted investment is valued at 1.3 billion USD. The project «Pluton Solar» will be performed within the Kazankivsky district of Mykolaiv region. The installed capacity of the specified plant is 10 MW, the estimated cost of the attracted investments is about 28 million euro. The project «Neptune Solar» was built within the Voznesensky district of Mykolaiv oblast (Figure 3). The installed capacity of the specified plant is 29.8 MW, the cost of the attracted investments is 775 million USD. Within the period of May-December 2013 24.9 million kWh of electricity was produced by the solar power plant.

It is a definite environmental policy of the district to replace fossil fuels with alternative types of energy based on the biological materials. Therefore, the area of winter rape up to 65,000 hectares was increased. There are about 50 businesses which are able to provide the biological raw materials for processing it into energy. On the basis of JSC «Zeleny Gay», which is located in the Voznesensky district, the line of processing branches after trimming was established. Moreover, biomass for the production of biogas that is burned in the co-generating setup type Cento T120S (capacity 125 kW, thermal – 160 kW) is provided. Biogas installation can metabolize 10 tons of green material per day, capacity of 2,000 m³ of biogas per day. The heat from the cooling of the generator can be uses for heating greenhouses covering 15 acres. The expected savings in transitioning into natural gas is about 500, 000 m³ per year.



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Figure 3. Project «Neptune Solar» in the Voznesensky region of Mykolaiv district

Odessa district is the leader among regions of Ukraine in construction of the solar power stations. Four solar energy stations with the power capacity of 184 MW are already put into the operation. While in Odessa district there are no successful projects of the wind use for the electricity development. But in some of the southern areas the measuring towers are installed which measure the wind speed. Furthermore, there are perspectives for installation of the wind-driven generations in the next five years.

Conclusion

The Northern Black Sea coast of Ukraine is the most favorable in Ukraine for the development of the renewable energy, especially wind and solar power plants. Therefore, there are all the investment projects for the development of the alternative energy.

The environmental public policy and economy in the district aims at the investments in the wind energy industry to reduce the dependence from hydropower, as well as investing in the solar panels for the population and buildings in the city also to reduce the dependence from the grid. For the realization of the energy strategy the Ukrainian authorities should resolve two tasks. Firstly, they should improve the administrative conditions for creation of new energy companies and allow individual users to provide energy to a common network. Secondly, to support the production of energy from alternative sources which have great potential.

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ROZWÓJ ODNAWIALNYCH ŹRÓDEŁ ENERGII NA PÓLNOCNYM WYBRZEŻU MORZA CZARNEGO

Streszczenie. Celem pracy jest przedstawienie polityki i gospodarki na rzecz rozwoju odnawialnych źródeł energii na północnym wybrzeżu Morza Czarnego na Ukrainie. Obecnie udział odnawialnych źródeł energii w bilansie energii Ukrainy jest niewielki i stanowi tylko 0,3% ogólnego potencjału energetyki konwencjonalnej. Niemniej jednak Ukraina posiada ogromny potencjał w odnawialnych źródłach energii. Przyjęta strategia udziału OZE w bilansie energetycznym Ukrainy do 2020 roku ma do odegrania ważną rolę. Potencjał odnawialnych źródeł energii na Ukrainie oceniany jest na poziomie 113 mln ton paliwa umownego, natomiast biorąc pod uwagę nowoczesny poziom produkcji, źródła tradycyjne są w stanie dostarczyć Ukrainie 68 mln ton paliwa umownego w postaci zasobów paliw i energii. W celu spełnienia wymagań związanych z poziomem teoretycznym badań zastosowano metodę analizy, porównania i syntezy. Analiza rozwoju alternatywnych źródeł energii, której celem było doświadczenie i prognoza możliwych sposobów rozwoju umożliwiła uzyskania wyniku badania w zakresie pionowym (historycznym) i poziomym (funkcjonalnym). W południowych regionach kraju projekty inwestycyjne ukierunkowane na budowę elektrowni, pracę z energią słoneczną i wiatrową są aktywnie realizowane. Północne wybrzeże Morza Czarnego na Ukrainie jest najbardziej odpowiednim obszarem dla rozwoju tej gałęzi energetyki alternatywnej.

Słowa kluczowe: polityka z odnawialnych źródeł energii, bezpieczeństwo energetyczne