

послідовну експортну політику, яка б враховувала китайський торговельний вектор як стратегічно важливий для України.

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DEVELOPMENT OF RENEWABLE ENERGY SOURCES AS A FACTOR OF ENHANCING ENERGY SECURITY IN UKRAINE

Energy ensuring is one of the factors that guarantees the development of the country's economy and the social life. Problems of the environmental pollution make most developed countries to formulate their energy strategies aimed at the use of renewable energy (RES), which is inexhaustible and *environmentally friendly*.

Ukraine can increase the total final energy use from renewable sources to 2030 as has one of the largest energy potential for development in South-Eastern Europe, where 73% of the renewable energy potential will come from thermal energy, 20% from electricity and 7% from transport [6].

According to IRENA, in 2030 about 57 million Gcal of thermal energy can be produced from RES, a significant part of which is biomass (32.7 million Gcal). The fulfillment of this forecast will save about 7 billion cubic meters of natural gas annually [6].

The urgent need to solve the energy problem of the economy promotes the improvement of the institutional environment both at the state and at the regional level. The Energy Strategy "Security, Energy Efficiency, Competitiveness" of Ukraine for the period up to 2035 was approved by the Government On August 18, 2017, this is the basic document for ensuring energy security and sustainable development of the energy sector by 2035 [3]. The Energy Strategy of Ukraine was developed in the context of the Strategy of the Sustainable Development "Ukraine 2020", approved by the Decree of the President of Ukraine on January 12, 2015, No. 5 and provides energy reform and implementation of energy efficiency programs within the defined vector of further development [2].

Such factors as energy intensity reducing, diversification of sources and routes of energy supply and domestic production increasing will promote economic, energy and environmental security. This will lead to the energy balance optimization and will create a solid foundation for the country's sustainable energy future [2].

It is well-known that alternative energy sources include inexhaustible sources of energy that constantly exist or occasionally appear in the natural environment (sun energy, wind, geothermal, aerothermal, hydrothermal, energy of waves and tides, hydropower, biomass energy, organic waste gas, biogas).

Ukraine has a significant bioenergy potential based on the use of biomass biofuels and is one of the strategic directions of development of renewable energy sector.

The annual technically feasible energy potential of solid biomass, which exist practically in all regions of Ukraine, is equivalent to 18 million tons, and its use makes it possible to save about 22 billion cubic meters of natural gas per year. The largest potential of solid biomass is concentrated in the Poltava, Dnipropetrovsk, Vinnitsa and Kirovograd oblasts and exceeds 1.0 million tons of energy per year [7].

Ukraine has the necessary conditions for the production of liquid biofuels, it concerns land resources, plant potential, and its own available production facilities. The annual technically achievable energy potential of liquid biofuels in Ukraine is equivalent to 1 million tons of oil equivalent. Its use makes it possible to save about 1.2 billion cubic meters of natural gas per year. The largest potential of liquid biofuels is concentrated in the Vinnitsa and Poltava regions, where its amounts are more than 90 thousand tons of fuel oil per year.

Ukraine has good potential for the production of fuel ethanol, which is already established in the four distilleries (Gaysinskiy, Zarubynskyy, Ivashkivskyy distilleries, Khorostkiv sugar-refineries MPD). It is planned to attract 8 more distilleries to the production of fuel bioethanol in the next three years. The use of liquid biofuels will help to reduce emissions of greenhouse gases, will have a positive impact on oil impact reducing and will allow our country to fulfill

its obligations regarding implementation of EU Directives 2009/28 / EC of biofuel introduction, which requires up to 2020 to increase the share of ethanol in motor fuel to 10% [7].

Annual theoretical potential of biogas production in Ukraine is 3.2 billion cubic meters. Production of energy from biogas is not harmful to the environment, as it does not cause additional emission of greenhouse gas CO₂ and reduces the amount of organic waste. An effective way to supplement and replace traditional fuel and energy resources is the production and use of biogas which is produced as a result of the application of the methane fermentation technologies for livestock biomass and consists 60-70% of methane. Another source of biogas is waste garbage on landfills, but while in Ukraine there is a problem where to put rubbish, in EU countries government thinks where to take it.

In recent years, wind energy is increasingly used to produce electricity. Wind power capacity of Ukraine exceeded 500 MW in 2017 (including Crimea and Donbas uncontrollable territories - 594.07 MW). By the number of installed capacities the leading position has Zaporizhzhya Region. The wind power stations capacity have increased in Kherson, Mykolaiv and Lviv regions and in the Ivano-Frankivsk region was installed the first wind turbine [7].

At the end of 2017 UES (United Energy System) electricity for Ukraine "green" tariff supplied 273.83 MW of wind power capacity. Last year wind power stations put 970.496 million kWh of electricity in the network. This is enough to provide electricity to more than 207 thousand Ukrainian households (with an average consumption of 400 kWh / month).

2017 was marked by the release of the wind turbine in Kramatorsk with the capacity of 3.2 MW, were installed 22 wind turbines with the capacity of 2 MW and 76 wind turbines with the capacity of 2.5 MW each. It is planned to install the first wind turbine with the capacity of 3.5 MW in 2018 and with a capacity of 4 MW in 2019. It is also planned to expand existing capacities and produce wind turbines with the capacity of 4.5 MW. In 2017 were put into operation four wind farms: in Kherson (Novotroitskaya WES, the total capacity of which will be 69 MW), in the Mykolaiv region (the Black Sea wind farm with a total capacity of 20.8 MW), in Lviv (WES "Old Sambir-2", total capacity of 20.7 MW) and Ivano-Frankivsk regions (the Shevchenkove-1 wind power station, which will have a total capacity of 6.4 MW).

Ukraine has sufficient factors to solve the problems of small hydropower development, such as scientific and technical potential, and considerable experience in designing and developing hydro turbine equipment designs. Ukrainian enterprises have the necessary production capacity to equip small hydroelectric plants with domestic equipment. In 2016 in Ukraine there were over 100 small hydropower stations with a total installed capacity about 80 MW, which produced more than 250 million kWh. Significant savings in fuel and energy resources can be achieved using the hydropotential of Ukrainian small rivers. Moreover the development of small hydropower will contribute to the decentralization of the overall energy system, what will solve a number of problems in the supply of remote and hard-to-reach areas of the countryside. Micro, mini and small hydropower stations can become a powerful basis of energy supply for all regions of Western Ukraine, and for some areas of the Zakarpattia and Chernivtsi regions it can become a source of complete energy supply.

The total capacity of RES in Ukraine as at 01.07.2017 was 1244.2 MW. By type of generation, most part of all are Solar Electro Stations which represents 52% (649 MW), on the second place are Wind Power Stations - 35% (438 MW), then Hydro Electro Stations (except large ones) - 8% (93 MW), biomass - 3% (39 MW), and the smallest from biogas - 2% (26 MW). Almost 60% of all RES capacities in Ukraine are concentrated only in four regions such as Odesa, Zaporozhe, Mykolaiv and Vinnitsa [4].

118.1 (93%) from 126.5 MW capacities introduced in 1.06.2017 were solar power stations, the largest total capacity of which (54%) is concentrated in the Kherson, Vinnitsa and Ivano-Frankivsk regions [4].

As a conclusion, the analysis of the energy problem in Ukraine makes it possible to confirm that there are favorable factors for the development of renewable energy. First of all Ukraine has powerful potential to replace 68.6 million tons of oil equivalent, which is about 50% of the total energy consumption in Ukraine. Also should be mentioned "green" tariff, which is linked to the euro and is guaranteed by the government till 2030 and guaranteed purchase of electricity by SE "Energorynok" till 2030. And the last one is the attractiveness of investment attracting in new capacity building. So, the development of renewable energy sources is considered to be an important factor of raising the level of energy security in Ukraine.

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