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**ALTERNATIVE ENERGY SOURCES DEVELOPMENT AS AN
INSTRUMENT OF THE ENERGY SECURITY OF UKRAINE**

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This report studied the problem of using the alternative energy sources in the national economy, define the most promising areas of alternative energy development in Ukraine and establish its potential and for national energy security.

Key words: alternative energy, energy security, biogas, solar energy, wind energy, energy industry, energy deficiency.

At the beginning of the XXI century widely traced the increasing the role of energy in economic development. The main reason of this is stable industrial production growing and rising the world population, which provokes the consumption of energy resources. According to the Global model of human development “World 3”, designed at Massachusetts Institute of Technology, there is a continuous, steady growth in world consumption of energy resources by an average of 1-2% annually, which in absolute terms is about 200 million tons of fuel. Moreover, according to this model, the part of third countries the process is constantly increasing and in 2020 reached 70% of total consumption.

According to this model in the near future expected a decreasing in production of raw energy. In particular, the most probable scenario of global oil reserves will be exhausted in the next 39 years, natural gas - in 37 years. Moreover, the term resource depletion was calculated on the assumption that in during decades explored resources will be increased in 5 times than current data by opening new fields [1]. It can be assumed that the future price of energy will be increased in appliance with reduction of production.

The world market increasing of energy resources price is detrimental the Ukraine economy. It is reflected in increasing the price of imported natural gas, and rising in price of gasoline and diesel fuel in the domestic market. Both of these

factors provoke the increasing of costs of nearly all groups of domestic products, reducing their competitiveness and accessibility for consumers.

Overcoming the energy dependence of our country and establishing a database of its energy security is the priority sector of the domestic economy. Ukraine industry agriculture are in unfavorable economic situation, which need to find out the exit and requires innovative improvements according to saving technologies, modern types of energy, using the alternative and renewable energy sources (ARES). Considering the risk of reduction in energy supply of the world market in the long term. The last direction got the special actuality.

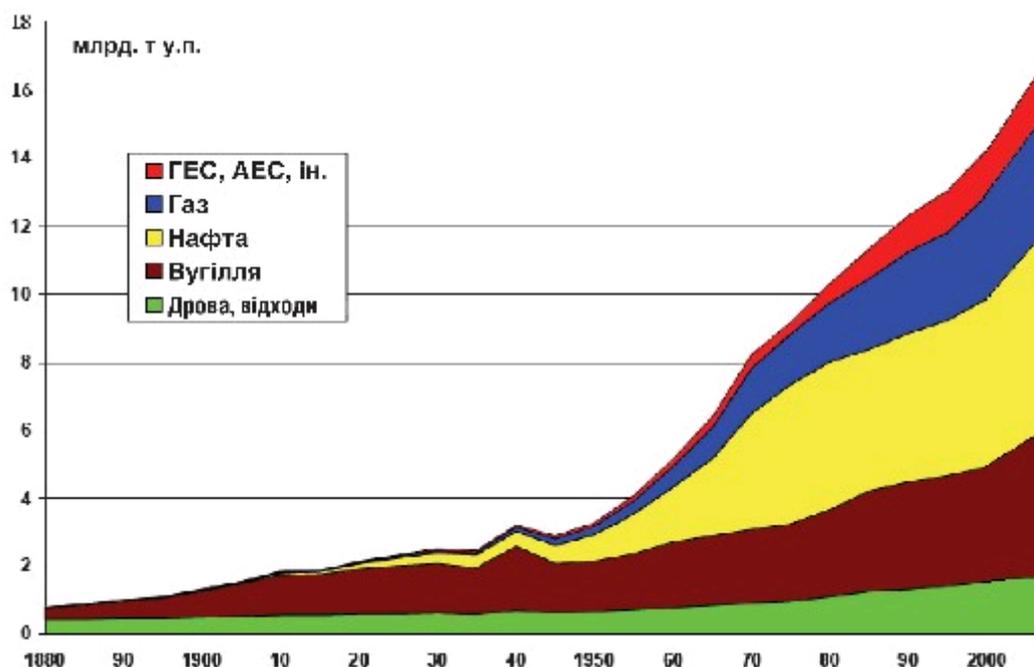


Figure. 1. The dynamics of world energy consumption XX-XXI century [1].

The problem of using alternative energy sources extensively shown in domestic and foreign scientific literature. So Meadows [1] works describes the problem of planning the use of natural resources to maintain ecological balance and preserve conditions for further growth. In particular, the author expresses the idea of necessity for a rapid transition from traditional to alternative energy sources to prevent its deficits.

In E. Buzovskoho, V. Skripnichenko, M. Luchnyk [2] researched the practical aspects of planning, organizing, operating and managing innovative development

through the use of alternative energy sources and energy efficient technologies. These authors emphasize the exceptional role of energy resources in the world economy.

In B. Fradkins [3] works researched the high potential of alternative energy sources, including geothermal, over the traditional. Also provides specific recommendations of priority use of different energy sources in different geographical areas.

In the works of B. Danylyshyn [4] reveals the essence of the concept of “energy security” and deals with the problems of security in our country. In the works of T. Ryauzovoi [5] and G. Zabarnnyi [6] also described the practical problems of using different types of alternative energy sources in Ukraine according to geographic and other characteristics of each region. However, the role of alternative energy sources in the energy security of our country is the question that requires research.

For this purpose, we had to identify the most promising areas of alternative energy development in Ukraine and establish its potential and importance for energy security of Ukraine.

In 2003 a group of Ukrainian experts developed the strategy of alternative, renewable and off-balance energy sources as part of the draft Energy Strategy of Ukraine till 2030. According to the project the share of renewable energy sources (RES) in total primary energy consumption in 2030 should reach 17.5% or 35 million tons of fuel. Of these, 7.03 million tons of fuel or 20.06% of the total alternative energy sources accounted for geothermal energy (Table 1).

Table 1

Using renewable energy in Ukraine 2001-2030 years [2]

Indicator	Production of electricity and heat for years							
	2001		2001		2001		2001	
	Total million tons of standard fuel	%	Total million tons of standard fuel	%	Total million tons of standard fuel	%	Total million tons of standard fuel	%
1	2	3	4	5	6	7	8	9
Solar energy	0,002	0,04	0,11	1,18	0,9	3,96	2,68	7,7

including:								
- electricity	-	-	0,01	0,11	0,2	0,88	0,72	2,1
- thermal energy	0,002	0,4	0,1	1,07	0,7	3,08	1,96	5,6
Wind energy	0,01	0,2	0,6	6,41	4,3	18,94	8,9	25,4
Geothermal energy	0,004	0,07	1,0	10,68	5,1	22,47	7,03	20,06
Hydropower	4,53	81,82	4,95	52,88	6,1	26,87	7,19	20,54
including:								
- small	0,17	3,07	0,15	1,6	0,5	2,2	0,67	1,91
- large	4,36	78,75	4,8	51,28	5,6	24,67	6,52	18,63
Biomass energy	0,99	17,87	2,7	28,85	6,3	27,76	9,2	26,3
Total	5,54	100	9,36	100	22,7	100	35	100

Policy analysis of using the alternative and renewable energy sources show that the most promising indicators of potential output of electricity and thermal energy is biomass. That is why this type of energy, mainly produced from agriculture wastes - one of the most developed sectors of the domestic economy.

Analysis of foreign experience proved the high efficiency of this type of energy. Back in 1995, the EU countries the share of biomass accounted for 60% of energy consumption derived from renewable sources (6% of total primary energy consumption). So in some countries, the share of biomass in total energy consumption is much higher than the average European figures: in the U.S. - 3.2%, Denmark - 8%, Austria - 12%, in Sweden - 18%, Finland - 23%. According to the program of ARES in the EU by 2010, the share of biomass in total ARES will be 74%, which is equivalent to 9% of total energy consumption.

Ukraine has great potential of production of bioethanol (based on alcohol and corn) and biodiesel (raw material - rape). The average harvest of rapeseed is 603 thousand tons of crop area - 821 hectares). In addition, the cost of ethanol is constantly decreasing because alcohol is cheaper production [7].

Analyzing global experience determined that for implementation ethanol production in Ukraine is necessary to intense potential raw material culture for processing into bioethanol. After that production start be the effective alternative crop for this is beets, that can directly process the sugar factories in 25% concentrated

syrup from further processing into alcohol-factories. To produce 1 ton of 25% nd syrup to recycle 2 tons of sugar beet roots. In a production conditions, can get 166.5 liters of bioethanol. Cost of raw materials to produce 1 liter of ethanol at the current price of sugar beets 220 UAH/t. (Excluding VAT) will be 2.34 UAH /Liter. [8]. Such the price of biodiesel will be much lower than the price of gasoline, which in 2012 ranged at 11 UAH/Liter. Thus, even this minimal substitution of traditional petroleum fuel will reduce fuel price, reduce transport services costs and the revival the economic activity of enterprises.

The problem of natural gas expensiveness, that is mainly used public utilities, can be solved by using other alternative energy sources such as wind and solar. Ideas of using solar and wind energy had been developed earlier than other types of alternative energy, as humanity has accumulated considerable experience of its application. The capacity of wind turbines increased tenfold by technology development and start to be competitive with other energy types. Its main drawback is season and weather dependence, but modern means of energy storage are given to partially solve this problem.

Nowadays the most promising kinds of solar energy in Ukraine are:

1. direct conversion into low-potential heat without prior concentration flux of solar radiation (for hot water facilities, public utilities and heating process, agriculture necessity);
2. direct conversion into electrical energy by means of direct current solar cells.

Pilot projects, that had been implemented during the recent years, showed that the annual heat energy in Ukraine is 500 - 600 kWh h/m². Considering the potential of solar collectors using in progressive countries that means 1 m² per person, annual efficiency of solar installations for Ukraine and hot water supply and heating can be 28 kWh h/m² heat. Realization of this potential give the possibility to save 3.4 million tons per year.

Talking about solar radiation as base of energy production, the technically permissible potential of solar energy roofs housing Ukraine today is 26 - 37

TWh/year, which in monetary terms is (at present the cost of 1 kWh = 0.05 euro) : 1.3 - 1.8 billion euro per year [9].

Wind power is absolute effective. In our country, it is possible to build wind farms on the Black sea and the sea of Azov coasts, steppes and mountains in Crimea and the Carpathians. In time of high fuel prices, turbines are competitive in price policy and able to participate in satisfaction of energy necessity.

Ukraine has significant wind resources. In winter amount of wind energy resources is the largest. The average wind speed during season is 3,8-4,1 m/s. On the north territories 2,6-3,0 m/s. at Zakarpatiya 3.8 - 4.9 m/s. in central and increase on eastern and southern Ukraine to 6 m/s. In the regions of the Ukrainian Carpathians, on the Black Sea and Sea of Azov average wind speed reaches 7 - 8 m/s.

Power density of wind energy lowest of Zakarpatiya (Uzhhorod, 21 W/m²) and on north (Zhytomyr, 66 W/m²). Quite significant wind potential inherent at the eastern regions (Donetsk, 452 W/m²). Power density of wind energy in the regions of the Ukrainian Carpathians and the Black Sea and Sea of Azov and the largest is 471-597 W/m².

The same distribution has a number of potential generated by wind energy. This index is 800 - 1000 MDzh/m² on the north and central regions with increasing in the east and south to 3500 - 4000 MDzh/m². In the regions of the Ukrainian Carpathians, this index reaches maximum values (Mzh/m²/sezon 4707, p. Pozhezhevskaya) [11].

That is why, wind energy is a universal energy source for the entire territory of our country, and particularly has great potential in some regions such as Crimea, Carpathians, Zakarpatiya, Donetsk Upland, Azov and Black Sea lowlands. In these regions, wind energy is a viable alternative thermal power plants (TPP), that is not only consume costly resources, but also bring damage to the environment and pose a threat to surrounding areas.

In the nowadays economy the importance of alternative energy sources increases according to decreasing reserves of traditional energy resources and increasing costs of its production. There are factors, that determine alternative energy as foreground that traditional:

1. renewable property;
2. environmental safety;
3. relatively uniform accessibility.

Considering this, the increasing of renewable energy sources using will allow to our country to significantly strengthen its energy safety. Using biofuels as a substitute for traditional petroleum products, according to the authors, will enable to reduce Ukraine's dependence on oil prices on international fuel market. At the same time, the construction of new wind and solar generators will significantly reduce the burden on TES and reduce consumption of natural gas and coal.

Implementation of these measures to enhance energy security requires the creation of targeted government programs in this direction, and improve the legislation in order to create more favorable conditions for development of alternative energy sources. Taking to attentive, the now we have got the constant progress and power plants with alternative energy sources, with implementation of mentioned measures, Ukraine has the opportunity to realize significant benefits in the long term.

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