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ALTERNATIVE ENERGY IS THE WAY TO UKRAINE'S ENERGY INDEPENDENCE

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Modern energy and environmental problems are related to the depletion of oil, gas and environmental pollution. Therefore, in recent years, countries with developed economies have been developing and implementing alternative energy. Unlike depleted resources, alternative energy does not depend on the intensity of their use. Timely reorientation of Ukraine to alternative energy will be able to significantly improve the state of its fuel and energy sector and make it energy independent of other countries. Energy production can be divided into traditional and alternative. Traditional energy sources include oil, gas and coal. Their main disadvantage is the impossibility of their recovery. This is an important factor that encourages the search for other ways to produce energy. Due to some of the richest deposits will be depleted and this factor stimulates the search for new ways of energy production. Some elements of «green» investment have appeared and spread in Ukraine. They arose not because of a specific political and well-thought-out strategy, but as a response to pressing problems in economic development as a result of international commitments. Alternative energy must solve two main problems. These problems include energy efficiency and environmental safety, which are particularly pronounced in eastern Ukraine. The work of many industrial enterprises of Ukraine is quite energy-intensive and requires innovative energy-saving technologies. This situation is caused by the inefficient structure of production. This situation can be remedied by improving the local and national economy. This will help accelerate the development of alternative energy sources and create conditions for compliance with the norms of sustainable development and high international environmental principles of economic activity. In the electricity market of Ukraine, alternative types of alternative energy are gradually becoming more and more popular. Although they will not soon be able to reach the level of traditional sources. Green investments should also contribute to this. In recent years, Ukraine, following the example of Europe, is actively implementing and investing in alternative energy. This applies to different types of renewable energy sources: sun, wind, tides, hot springs and others. All this was caused by the depletion of oil and gas fields in Ukraine. Also negative are the consequences of their processing on the environment.

Keywords: alternative energy supply, new energy supply, innovation, energy, energy neutrality, green investment, biodiesel.

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Formulation of the problem

In modern conditions, the issues related to the depletion of oil and gas fields and environmental pollution during their processing are acute.

Therefore, in recent years, countries with developed economies have begun to use alternative energy sources.

This approach allows Ukraine to limit the use of oil, gas and coal in the industrial enterprises of

our country, and in the future to use more environmentally friendly natural resources in the national economy.

Analysis and research of publications

The most significant contribution to the study of the essence of alternative energy sources was made by scientists: K. Markevich, V. Sidenko, O. Veklych, Y. Pidvysotsky, A. Frolov, S. Chekunova and others. The aim of the article is to study different types of

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alternative energy sources, including biofuels. The purpose of the publication is also the innovative use of energy sources and the impact on the environment.

The purpose of the article

The purpose of the article is to investigate different types of alternative energy sources (in particular, biodiesel), their innovative using, and their influence on the ecology.

Presentation of the main material

Ukraine is the second largest country in Europe. The country also occupies a huge area, which is home to a large number of mineral deposits (oil, natural gas, coal and lignite, manganese and others). Despite all the technologies used to conserve resources, they tend to be depleted.

Energy production can be divided into traditional and alternative types. Traditional minerals include oil, gas and coal. Their main disadvantages are that they are not renewable. This is becoming an important factor in turning to other ways of energy production. After some time, even rich deposits will be depleted and this will be an incentive to find new ways to produce energy in the world.

In 2019, gas production in Ukraine decreased by 3.4% to 20.3 billion cubic meters. The most depleted are Zapadno-Khrestyschenske (90%) and Shebelinske (89%) deposits. Slightly more reserves remained in Yablunivsky (79%), Efremovsky (82%) and Melekhivsky (82%) deposits [1].

The state of the oil industry in Ukraine is not very good. Oil production remains relatively low at almost 35%. This means that innovative forms of energy production should be developed and implemented to simplify energy production and improve the ecological situation in Ukraine. Consider the consequences that accompany oil and gas production:

- natural unforeseen exits to the earth's surface;
- emergency emissions during transportation;
- soil contamination with heavy metals due to natural gas production;
- harmful emissions into the atmosphere;
- non-methane light organic compounds, methane, nitrogen, carbon, sulfur compounds;
- physical and chemical oil pollution of the soil layer during earthworks.

Modern conditions of electricity production in Ukraine lag far behind the countries with developed economies and are much more expensive and much more harmful to the environment.

Electricity production in Ukraine is based on the combustion of coal, fuel oil, natural gas, peat, the use of nuclear energy, and a small share of energy from renewable sources (hydropower, wind, solar, biofuels). Electricity production in Ukraine is carried out at the expense of nuclear (52%), thermal (37%), hydroelectric and other energy sources (11%). The

supply of Ukrainian enterprises with their own coal is estimated at 92%, oil – at 18%, natural gas – at 22%. Nuclear fuel is almost entirely imported. Ukraine ranks eighth in the world in terms of electricity production at nuclear power plants (after the United States, France, Japan, Russia, Korea, Great Britain and Germany). There are four NPPs in Ukraine, which operate 15 power units with a total capacity of 13.8 million kW. The share of own resources in the fuel and energy balance of Ukraine is almost 50% [6].

Alternative energy sources are natural phenomena that are converted into thermal or electrical energy by conversion in special installations. These include:

- solar electromagnetic radiation;
- kinetic energy of air masses (wind);
- kinetic energy of water flow (river);
- energy of sea tides;
- thermal energy of hot springs.

Alternative energy also includes obtaining heat in the process of burning renewable fuel – biogas, bioethanol, fuel pellets, etc. [2].

Alternative energy must solve two main problems that exist not only in Ukraine but all over the world. These include: energy efficiency and environmental safety. In Eastern Ukraine, the work of local enterprises is energy-intensive and requires innovative energy-saving technologies. The reason for this is the inefficient structure of production and outdated technology. This situation can be remedied by improving the economy in the direction of accelerating the development of alternative energy sources. It is necessary to create conditions for compliance with the norms of sustainable development and high international environmental principles of economic activity.

In the electricity market, the percentage of use of alternative energy sources is gradually increasing. Alternative energy will not soon be able to reach the desired level (Table 1). It shows that the share of energy supply from renewable sources in Ukraine continues to develop every year and compared to 2014 increased by 2%. The data are given for 2014–2018 without taking into account the temporarily occupied territory of the Autonomous Republic of Crimea and part of the temporarily occupied territories in Donetsk and Luhansk regions [3].

Such results are not rapid. However, they continue to increase and indicate environmental restrictions on Ukraine's use of oil, gas and coal for industrial purposes. Green investments should also contribute to this. Some elements of green investment have appeared and spread in Ukraine. They arose in response to pressing problems in economic development, as well as as a result of international commitments. It is worth paying attention to the

Table 1

Energy consumption based on renewable sources for 2014–2018

Indicator	Unit	2014	2015	2016	2017	2018
General supply of primary energy	thousand tons of oil equivalent (toe)	105683	90090	94383	89462	93165
Of it						
Hydropower	thousand tons of oil equivalent (toe)	729	464	660	769	897
In % to the amount	%	0.7 %	0.5 %	0.7 %	0.9 %	1.0 %
biofuel energy and waste	thousand tons of oil equivalent (toe)	1934	2102	2832	2989	3195
In % to the amount	%	1.8 %	2.3 %	3.0 %	3.3 %	3.4 %
Wind and solar energy	thousand tons of oil equivalent (toe)	134	134	124	149	197
In % to the amount	%	0.1 %	0.1 %	0.1 %	0.2 %	0.2 %
Total energy from renewable sources						
Total energy supply from renewable sources	thousand tons of oil equivalent (toe)	2797	2700	3616	3907	4289
The share of energy supply from renewable sources	%	2.6 %	3.0 %	3.8 %	4.4 %	4.6 %

«green» bonds. Investments in «green» bonds are interesting for Ukrainian and foreign investors. There are some problems with the obstacle to the formation of this market. One of them is macroeconomic imbalances. They are characterized by insufficient savings and a growing current account deficit. Another problem is the underestimation of the importance of technological progress. This causes a technological lag behind developed countries. An important problem is the low level of coordination of actions of various public administration bodies. Solving it requires a high level of coordination and coordination when disseminating new tools or platforms for green business. There are other factors that are no less important. In Ukraine, «green» investment is attracting more and more attention from politicians, scientists and society. Ukraine does not have a sufficient level of coordination of state bodies to pursue such a policy. Efforts in this area are ineffective and do not help the gradual development of green assets in Ukraine. The introduction of «green» financing is a priority for economic development. Specific actions remain under discussion or are not being implemented too quickly.

Investment incentives are becoming quite popular in Ukraine. They are designed to help reduce the use of traditional energy through the development of renewable energy sources. The following customs and tax incentives were adopted:

Items 14, 16 part 1 of Article 282 of the Customs Code of Ukraine and items 197.16 of Article 197 of the Tax Code of Ukraine

Indefinite exemption from import duty and VAT on goods is provided for goods imported into the customs territory of Ukraine (provided that identical goods with similar quality indicators are not produced in Ukraine):

– equipment running on renewable energy sources, energy-saving equipment and materials,

means of measuring, controlling and managing the consumption of fuel and energy resources, equipment and materials for the production of alternative fuels or for the production of energy from renewable energy sources;

– materials, equipment and components used for production: equipment running on renewable energy sources; materials, raw materials, equipment and components that will be used in the production of energy from renewable sources; energy-saving equipment and materials, products, the operation of which provides savings and rational use of fuel and energy resources, etc.

Item 213.2.8 of article 213 of the Tax code of Ukraine

Indefinite exemption from excise tax on the sale of cogeneration plants produced in Ukraine and/or from renewable energy sources.

One of the tools to stimulate the development of renewable energy in Ukraine was the establishment of a «green» tariff for electricity produced from alternative sources (feed-in tariff). Therefore, since 2009 there has been an intensification of construction of wind farms, power plants, small hydropower plants and other stations on alternative energy sources. Ukraine has failed to achieve renewable electricity generation in accordance with state strategic documents. On April 25, 2019, the Law “On Amendments to Certain Laws of Ukraine Concerning Ensuring Competitive Conditions for Electricity Production from Alternative Energy Sources” was adopted. According to this document, it is necessary to make the transition from the model of «green» tariffs to the model of stimulating clean energy through auctions. This model is perceived positively by experts. However, there are some reservations about the distribution of annual support quotas and the difficulty of foreign investors entering the RES market. The unresolved issue is the lack of maneuverability and storage capacity [4, p. 204].

Some companies in Ukraine use alternative energy sources. In Ukraine, the total annual technically achievable energy potential of alternative energy sources is about 63 million tons. The share of energy extracted from alternative sources is about 3%. According to the Ukrainian energy strategy, by 2030 the share of alternative energy in the country's overall energy balance will be increased to 20%. The main areas of renewable energy in Ukraine are: wind energy, solar energy, bioenergy, hydropower, geothermal energy [5].

The world organization IRENA (International Renewable Energy Agency) confirms that Ukraine has sufficient potential to increase by 10 times the use of alternative energy sources. Thermal energy plays a leading role in this. The use of biomass can provide energy to the enterprise and central heating of buildings.

Bioenergy is a branch of alternative energy. In this area, energy is produced from biomass. Biomass is a reproductive substance of organic origin. It includes agricultural, forestry and household waste. Thus, bioenergy is the production of thermal or electrical energy from biological waste.

A biomass thermal power plant is the simultaneous production of both types of energy from biofuels. The main direction of a biomass thermal power plant is the production of thermal energy (an alternative to a gas thermal power plant). The choice in favor of a biomass thermal power plant will reduce carbon dioxide emissions and waste levels in the regions. It will also help increase the country's energy independence as a whole.

In 2018, the first bio-thermal power plant in Ukraine started operating in Kamyanets-Podilsky. It can produce both heat and electricity. Its capacity is more than 45 MW.

“The construction of this bio-thermal power plant lasted three years and cost 9.1 million euros. These funds were attracted by the community as a loan from the World Bank at 0.5%.” This was stated in an interview with the chief engineer of the institution Vasyl Tarasyuk.

The raw materials for the operation of the station are agricultural and forestry waste (straw, corn, peat and wood chips). This project should pay off in seven or eight years. Already the station replaces

about 30% of gas. This allowed to save up to 1 million cubic meters of gas (about 8 million hryvnias) during the last heating season.

The new thermal power plant can heat about 200 houses, several kindergartens and schools. This is about 65% of the city's infrastructure.

The city of Kamyanets-Podilsky also has 14 boiler houses. They are equipped with solid fuel boilers. The city is able to fully provide itself with energy and heat houses.

Other cities of Ukraine are also gradually switching to alternative energy [7]:

- the city of Slavutych for the second year in a row more than a third of its own needs in heat provides thanks to a biofuel boiler room. This boiler house did not allow the city to freeze after the gas supply was cut off;

- the city of Zhytomyr, by 2021 plans to convert 95% of the city's heating system to biofuels. More than 10% of boiler houses in Ukraine already use biomass.

Table 2 summarizes the data presented.

The information is provided in accordance with the national action plan for renewable energy until 2020 and the energy strategy of Ukraine until 2035 [8, Art. 25]. Forecasts for the development of alternative energy in the heat supply sector are quite positive. This leads to a reduction in carbon dioxide emissions, an increase in electricity generation and the number of jobs.

Conclusions

In recent years, Ukraine has begun to actively implement and invest in alternative energy. These investments are made in renewable energy sources. All this was caused by the depletion of oil and gas fields in Ukraine. Also negatively affects the environment pollution in the process of processing hydrocarbons. Biofuels can be considered one of the most promising ways to gain Ukraine's energy independence. Ukraine has raw materials for the development of bioenergy. These include sunflower, soybeans, corn, wheat, canola, stanza and others.

The gradual replacement of traditional energy sources with alternative ones will bring energy to Ukraine. In addition, it will help reduce the cost of purchasing and transporting oil and gas and improve the environmental situation in the country.

Table 2

Forecast of development of renewable energy sources in the heat supply sector of Ukraine (2017–2035)

Year	MW of heat	MW electr.	Substitution natural gas, billion m ³	The share of renewable energy sources	Reduction CO ₂ , Mt CO ₂ /year	Investment, million euros	Number of jobs
2017	5000	45	3.6	7.60%	6.8	1000	13000
2020	7000	250	4.4	12.30%	8.6	1800	22000
2025	11250	800	6.6	22%	12.9	3800	42000
2030	16200	1260	8.9	30%	17.5	5700	64000
2035	24000	1780	12.2	40%	24	8000	97000

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АЛЬТЕРНАТИВНА ЕНЕРГЕТИКА – ШЛЯХ ДО ЕНЕРГЕТИЧНОЇ НЕЗАЛЕЖНОСТІ УКРАЇНИ

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В сучасному світі доволі гостро постає енергетична та екологічна проблема, що пов'язана із виснаженням родовищ нафти та газу, а також із забрудненням довкілля під час їх перероблення. Саме тому в останні роки країни з розвинутою економікою почали використовувати джерела альтернативної енергії. Також своєчасна переорієнтація України на альтернативну енергію зможе не тільки суттєво покращити стан її паливно-енергетичної галузі, а й зробити її енергонезалежною від інших країн. Варто звернути увагу на те, що на сьогодні видобуток енергії можна поділити на традиційний і альтернативний. Отже, до традиційних можна віднести нафту, газ і вугілля, однак їх основний недолік полягає в тому, що їх неможливо відновити. Саме це стає першим чинником, що спонукає здійснювати пошук інших способів видобутку енергії, адже прийде час, коли навіть найбагатіші родовища виснажаться і цей фактор стимулює до пошуку нових способів видобутку енергії та з кожним роком все більше і більше потребує уваги. Наразі в Україні з'явилися та розповсюдились деякі елементи “зеленого” інвестування. Однак вони виникли не через спеціальну політичну та продуману стратегію, а у відповідь на нагальні проблеми в економічному розвитку, а також внаслідок прийнятих міжнародних зобов'язань. Альтернативна енергетика має вирішити дві основні проблеми, що існують не тільки в Україні, а й у всьому світі. До них відносяться: енергоефективність і екологічна безпека, які особливо яскраво виражені на Сході України. Адже робота багатьох промислових підприємств України є доволі енергозатратною та потребує інноваційних енергозберігаючих технологій, що викликано неефективною структурою виробництва. Цю ситуацію можна виправити удосконаливши місцеву та національну економіку, що допоможе пришвидшити розвиток альтернативних видів енергії та створить умови, в яких стане можливим дотримання норм стабільного розвитку та високих міжнародних екологічних принципів господарської діяльності. Наразі на ринку електроенергії України поступово починають займати все більший відсоток альтернативні види енергії, хоча вони ще не скоро зможуть досягти рівня традиційних джерел. Хоч такі результати не можна назвати стрімкими, проте вони продовжують збільшуватись і дають надію на те, що в майбутньому наша країна обмежить використання нафти, газу та вугілля і буде використовувати більш екологічні ресурси. Цьому також мають посприяти “зелені” інвестиції. За останні роки Україна, беручи приклад з Європи, почала активно впроваджувати та інвестувати в альтернативну енергетику. Це стосується різних видів відновлюваних джерел енергії: сонця, вітру, припливів і відливів, гарячих джерел та інших. Все це було викликано виснаженням родовищ нафти та газу в Україні, а також їх негативним впливом на навколишнє середовище, що виникає в процесі їх перероблення.

Ключові слова: альтернативні джерела енергії, відновлювані джерела енергії, інновації, енергетика, енергонезалежність, “зелені” інвестиції, біопаливо.

АЛЬТЕРНАТИВНАЯ ЭНЕРГЕТИКА – ПУТЬ К ЭНЕРГЕТИЧЕСКОЙ НЕЗАВИСИМОСТИ УКРАИНЫ

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В современном мире остро стоит энергетическая и экологическая проблема, связанная с истощением месторождений нефти и газа, а также с загрязнением окружающей среды во время их переработки. Именно поэтому в последние годы в странах с развитой экономикой начали использовать источники альтернативной энергии. Своевременная переориентация Украины на альтернативную энергию сможет не только существенно улучшить состояние ее топливно-энергетической отрасли, но и сделать ее энергонезависимой от других стран. Стоит обратить внимание на то, что сегодня добычу энергии можно разделить на традиционную и альтернативную. К традиционным полезным ископаемым можно отнести нефть, газ и уголь. Однако их основной недостаток заключается в том, что их невозможно восстановить. Именно это становится первым фактором, побуждающим осуществлять поиск других способов добычи энергии. Придет время, когда даже самые богатые месторождения истощатся и этот фактор стимулирует к поиску новых способов добычи энергии. Сейчас в Украине появились и распространились некоторые элементы «зеленого» инвестирования. Однако они возникли не через специальную политическую и продуманную стратегию, а в ответ на насущные проблемы в экономическом развитии и в результате принятых международных обязательств. Альтернативная энергетика должна решить две основные проблемы, существующие не только в Украине, но и во всем мире. К ним относятся: энергоэффективность и экологическая безопасность, особенно ярко выражены на Востоке Украины. Работа многих промышленных предприятий Украины является довольно энергозатратной и требует инновационных энергосберегающих технологий. Такое положение дел вызвано неэффективной структурой производства. Эту ситуацию можно исправить усовершенствовав местную и национальную экономику, что поможет ускорить развитие альтернативных видов энергии и создаст условия, в которых станет возможным соблюдение норм устойчивого развития и высоких международных экологических принципов хозяйственной деятельности. Сейчас на рынке электроэнергии Украины постепенно занимают все больший процент альтернативные виды энергии, хотя они еще не скоро смогут достичь уровня традиционных источников. Такие результаты дают надежду на то, что в будущем наша страна ограничит использование нефти, газа и угля и будет использовать более экологичные ресурсы. Этому также должны поспособствовать «зеленые» инвестиции. За последние годы Украина, беря пример с Европы, начала активно внедрять и инвестировать в альтернативную энергетику. Это касается различных видов возобновляемых источников энергии: солнца, ветра, приливов и отливов, горячих источников и других. Все это было вызвано истощением месторождений нефти и газа в Украине, а также их негативным воздействием на окружающую среду, возникающее в процессе их переработки.

Ключевые слова: альтернативные источники энергии, возобновляемые источники энергии, инновации, энергетика, энергонезависимость, «зеленые» инвестиции, биотопливо.

ALTERNATIVE ENERGY IS THE WAY TO UKRAINE'S ENERGY INDEPENDENCE

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Modern energy and environmental problems are related to the depletion of oil, gas and environmental pollution. Therefore, in recent years, countries with developed economies have been developing and implementing alternative energy. Unlike depleted resources, alternative energy does not depend on the intensity of their use. Timely reorientation of Ukraine to alternative energy will be able to significantly improve the state of its fuel and energy sector and make it energy independent of other countries. Energy production can be divided into traditional and alternative. Traditional energy sources include oil, gas and coal. Their main disadvantage is the impossibility of their recovery. This is an important factor that encourages the search for other ways to produce energy. Due to some of the richest deposits will be depleted and this factor stimulates the search for new ways of energy production. Some elements of «green» investment have appeared and spread in Ukraine. They arose not because of a specific political and well-thought-out strategy, but as a response to pressing problems in economic development as a result of international commitments. Alternative energy must solve two main problems. These problems include energy efficiency and environmental safety, which are particularly pronounced in eastern Ukraine. The work of many industrial enterprises of Ukraine is quite energy-intensive and requires innovative energy-saving technologies. This situation is caused by the inefficient structure of production. This situation can be remedied by improving the local and national economy. This will help accelerate the development of alternative energy sources and create conditions for compliance with the norms of sustainable development and high international environmental principles of economic activity. In the electricity market of Ukraine, alternative types of alternative energy are gradually becoming more and more popular. Although they will not soon be able to reach the level of traditional sources. Green investments should also contribute to this. In recent years, Ukraine, following the example of Europe, is actively implementing and investing in alternative energy. This applies to different types of renewable energy sources: sun, wind, tides, hot springs and others. All this was caused by the depletion of oil and gas fields in Ukraine. Also negative are the consequences of their processing on the environment.

Keywords: alternative energy supply, new energy supply, innovation, energy, energy neutrality, green investment, biodiesel.

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