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QARABAG VƏ İŞĞALDAN AZAD OLUNMUŞ ƏRAZİLƏRDƏ ALTERNATİV VƏ BƏRPA OLUNAN ENERJİ MƏNBƏLƏRİNDƏN SƏMƏRƏLİ İSTİFADƏNİN İQTİSADİ POTENSİALI

Xülasə

Məqalədə alternativ və bərpa olunan enerji mənbələrindən istifadə məsələləri geniş şərh edilmişdir. Burada Qarabag və işğaldan azad olunmuş ərazilərdə alternativ və bərpa olunan enerji mənbələrinin iqtisadi potensialı təhlil edilərək qiymətləndirilmişdir. Tədqiqat nəticəsində müəyyən edilmişdir ki, Qarabag və işğaldan azad olunmuş ərazilərdə mövcud olan çaysuları potensial enerji mənbəyi yaratma qabiliyyətinə malik olduğundan, bu ərazilərdə bərpa olunan elektrik enerjisi istehsalında mühüm rol oynayacaqdır. Bütün bunlar gələcəkdə ölkənin enerji potensialının artırılmasında və bu sahənin rəqabətqabiliyyətliliyini yüksəldilməsi məqsədilə ölkə daxilində və regionda iri miqyaslı infrastruktur layihələrinin həyata keçirilməsini şərtləndirəcəıkdir.

Açar sözlər: Alternativ enerji mənbələri, elektrik enerjisi istehsalı, bərpa olunan enerji,hidroenerji, günəş enerjisi, külək enerjisi.

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Introduction.

The main goal of Azerbaijan's energy policy is to use its energy potential for efficient use of its natural resources and sustainable economic growth, to improve the living standards of the country's population, and to help strengthen its foreign economic position.

This strategy determines the goals and objectives, priorities and criteria of the long-term development of the country's energy sector for the coming period, as well as the energy policy mechanisms at different stages of implementation, ensuring the achievement of the set goals.

The widespread use of alternative and renewable energy types helps to eliminate the potential threat to the country's energy supply, allows the diversification of existing energy resources, ensures the export of electricity produced in the traditional way, and at the same time accelerates the country's integration into the international energy security system. The reality of the possibility of depletion of natural resources (oil, gas, coal, etc.) and the increase of their prices on the world market has become the main goal of the countries of the world to reduce the use of traditional energy and meet the demand through environmentally friendly alternative energy sources.

Main part. Currently, there is significant development in the field of alternative and renewable solar, wind energy, geothermal energy, biomass, water flow energy, use of other renewable energy sources and application of new technologies.

One of the most important issues during the implementation of the energy strategy is the compliance of the country's energy sector with the real development process. This strategy envisages development until 2030 in accordance with the country's new challenges and development priorities, which are directed to 5 main directions approved by the Decree of the head of the country on national priorities for socio-economic development dated February 2, 2021.

In recent years, the natural disasters that have occurred in the world and the increasing tension, the emergence of new conflicts and the threat of worsening of the existing global problems have

arisen [2]. Within the framework of the international mechanism that ensures energy security, it is only possible to go beyond the trade and financial energy relations of individual countries and create a stable energy supply system for all countries.

Increasing the efficiency of the use of alternative energy sources, the production of electricity and its efficient use are of great importance for the country's economy. Azerbaijan is one of the countries with high potential for renewable energy sources. Thus, the technical potential of renewable energy sources of the country is 135 GW on land and 157 GW on sea.

The total power generation capacity of Azerbaijan is 7,977 MW in 2022, the capacity of renewable energy power plants, including large hydropower plants, is 1,165 MW, which is 14.6% of the total capacity. These can be seen more clearly from the graph below.

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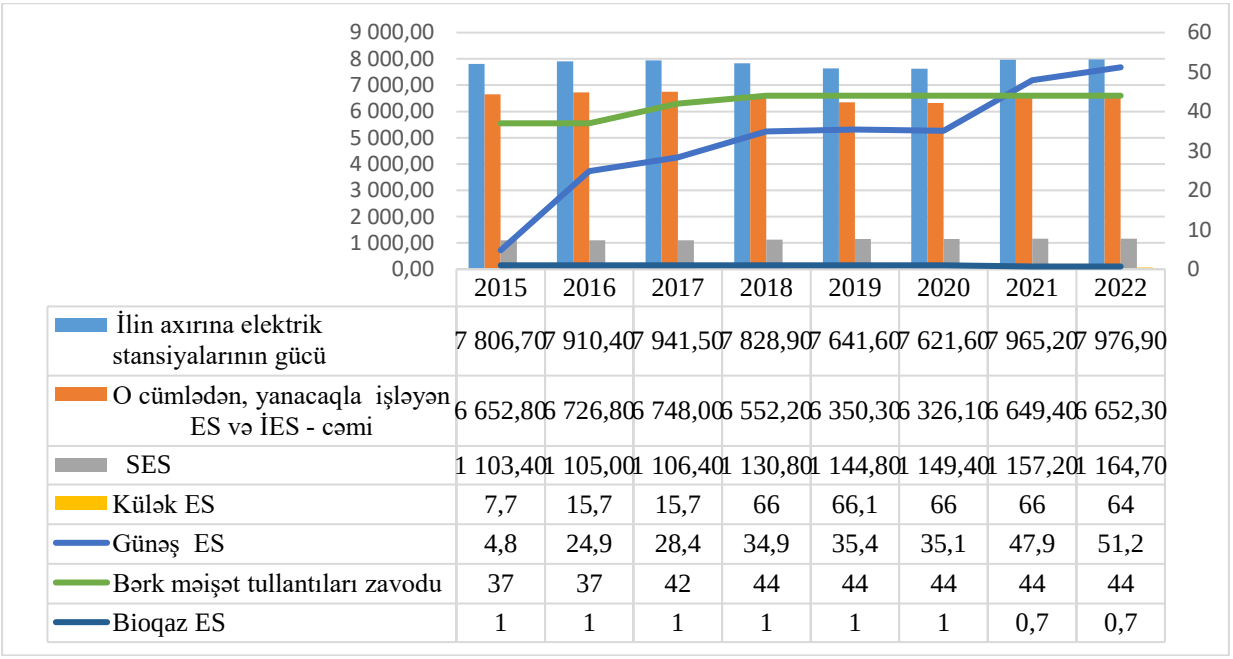


	2015	2016	2017	2018	2019	2020	2021	2022
İlin axırına elektrik stansiyalarının gücü	7 806,70	7 910,40	7 941,50	7 828,90	7 641,60	7 621,60	7 965,20	7 976,90
O cümlədən, yanacaqla işləyən ES və İES - cəmi	6 652,80	6 726,80	6 748,00	6 552,20	6 350,30	6 326,10	6 649,40	6 652,30
SES	1 103,40	1 105,00	1 106,40	1 130,80	1 144,80	1 149,40	1 157,20	1 164,70
Külək ES	7,7	15,7	15,7	66	66,1	66	66	64
Günəş ES	4,8	24,9	28,4	34,9	35,4	35,1	47,9	51,2
Bərk məişət tullantıları zavodu	37	37	42	44	44	44	44	44
Bioqaz ES	1	1	1	1	1	1	0,7	0,7

Chart 1.1. Capacity of power plants in the Republic of Azerbaijan, MW
Source. (8) was compiled on the basis of data.

As can be seen from the graph, the capacity of power plants by the end of the year developed with increasing dynamics for 2015-2017, but it developed with decreasing dynamics for 2018-2020. In 2021-2022, it is possible to observe dynamics of increase in the power of power plants again. Growth dynamics can also be observed in solar and wind energy. This increase is the result of the application of modern technologies.

Since wind energy is generated as a result of the activity of solar energy on Earth, it is also considered a renewable energy type. The amount of wind energy is more than 100 times the total kinetic energy of all rivers on Earth. If the maximum value of the density of solar energy on the earth's surface is around 1 2 kW/m2, the value of the density of wind energy on the earth's surface perpendicular to the direction of the wind varies in a very large interval.

So, if the energy density created by the wind with a speed of 5 m/s is 0.075 2 kW/m2, this value can be changed from 10 2 kW/m2 to 25 2 kW/m2 during a storm or hurricane [5].

HPP 1164.5 MW (30 stations, 20 small hydropower stations), wind energy capacity 64 MW (8 stations, 2 hybrid), bioenergy capacity 37.7 MW (2 stations, 1 hybrid), solar energy capacity 51.2 MW (12 stations, 2 hybrid). Wind - 2.81 MW, solar - 3.8 MW and bioenergy - 0.7 MW devices were installed in 2 hybrid power

plants (Gobustan and Julfa). Solar power plants with a total capacity of 39 MW are operated in the Nakhchivan Autonomous Republic. The installed capacity of renewable energy sources, excluding large hydropower plants, was 201.4 MW in 2022, making up 2.5% of the total electricity production capacity.

Based on the conducted research, we can note that in 2022, renewable energy sources (excluding hydropower) accounted for 14.4% of the total electricity production. Hydropower production accounted for 14.9% of the total production, which means an increase of 1.1%. Solar energy 4.5%; wind energy 7.2%; other renewable sources accounted for 2.7% of the total electricity production.

The production of electricity in the country in 2022 amounted to 28.9 billion kWh. In this period, the production of electricity in HPPs was 1595.7 mln. kWh, and 349.5 million for other sources (KES, GES and BMTYZ). kWh was 83.3 million in wind power plants during the year. 60.9 million kWh in Solar Power Stations. kWh, 205.3 million at the Solid Household Waste Incineration Plant. kWh of electricity was produced.

The electricity produced from renewable energy sources made up approximately 7% of the total production. Based on the data of the State Statistics Committee, we can say that the production of electricity in the country in January-December 2023 was 27 billion 561.5 million kWh, which is 1% more than the previous year, and the production of commodity electricity was 26 billion It was 0.7% more, making 636.1 million kWh. According to the obtained data, more than 1 billion m3 of gas will be saved at the expense of 1800 MW wind and solar power plants, which are planned to be put into operation by the end of 2026. In 2030, another 5 GW of "green" production capacities will be put into use, and at the initial stage, 4 GW of these volumes will be exported to Europe via the Black Sea, and 1 GW will be exported to Turkey and Europe via Nakhchivan.

The economic potential of renewable energy sources is estimated at 27 GW, including 3000 MW of wind energy, 23000 MW of solar energy, 380 MW of bioenergy potential, and 520 MW of mountain river potential. In addition to renewable energy sources, efficient use of alternative energy sources is of great importance. Studies show that the use of river water energy available in Karabagh and liberated territories can play a key role in this direction.

Let's consider the mechanism of using the energy of existing river waters in Karabagh and liberated territories.

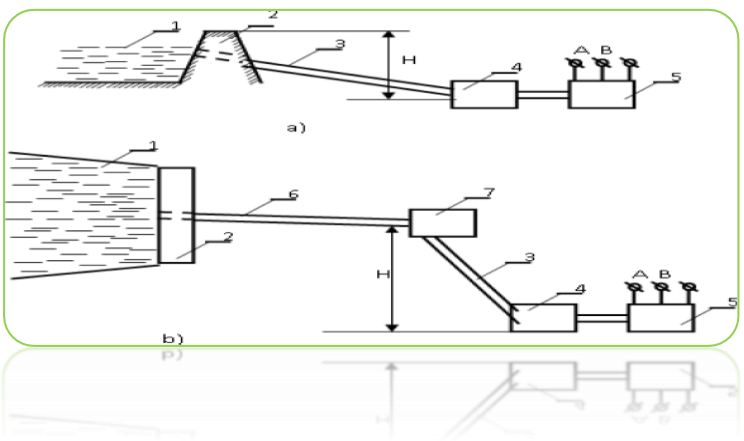
Flow kinetic energy should:

$$Wkin = \frac{mV2}{2} \qquad (1)$$

When the water of the rivers is cut off, the water of the river turns into a lake. At this time, the flowing water converts its kinetic energy into potential energy. In this case, the source of potential energy is created:

$$Wpot = mgH \qquad (2)$$

here:
m – amount of water,
kg; g-free fall acceleration, m/sec2



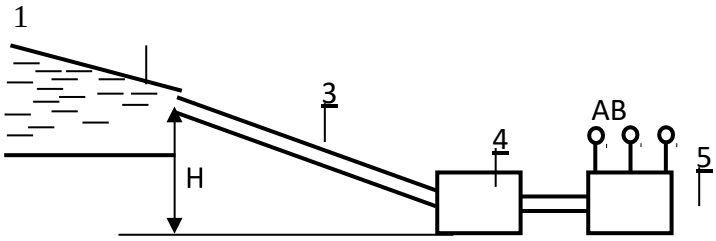
Scheme 1. The scheme of a medium-power HPP with a dam:

1-lake water, 2-dam, 3-pressure pipe, 4-turbine, 5-generator, 6-transmission pipe, 7-pressure regulator.

H is the height difference between the bottom and the level of the water. In other words, it is the height of the lake.

As a result of the research, it can be concluded that their power is usually less than 5 MW. HPPs on rivers are built both with and without dams. In HPPs with dams, the dam prevents the flow of the river. Running water creates a lake. That is, it creates a potential energy source. At this time, the kinetic energy in the turbine shaft is converted into mechanical energy. Due to that energy, the shaft of the generator is rotated on one shaft with the turbine. As a result, electricity is produced. This process is performed according to the following schemes. As a result of stopping the flow rate of the river in hydroelectric power stations with dams, the flowing water forms a lake and becomes a potential source of energy. It is from this point of view that the potential energy of the water is converted into kinetic energy and that energy is transferred to the shaft of the turbine. At this time, the kinetic energy is converted into mechanical energy in the turbine shaft.

HPPs installed on rivers HPPs without dams are built in the fast-flowing part of the river. At this time, water is collected and its kinetic energy is transferred to the shaft of a turbine through a pressure pipe. The shaft of the generator is rotated and electricity is produced.



Scheme of a small powerful HPP without a dam

Already today, Azerbaijan is known for its rich energy resources. At the same time, the use of renewable energy sources in the country has always been in the center of attention.

The price of industrial production in the economy of Karabakh determined the increase of retail trade turnover in the region. These can be seen more clearly from the graph below

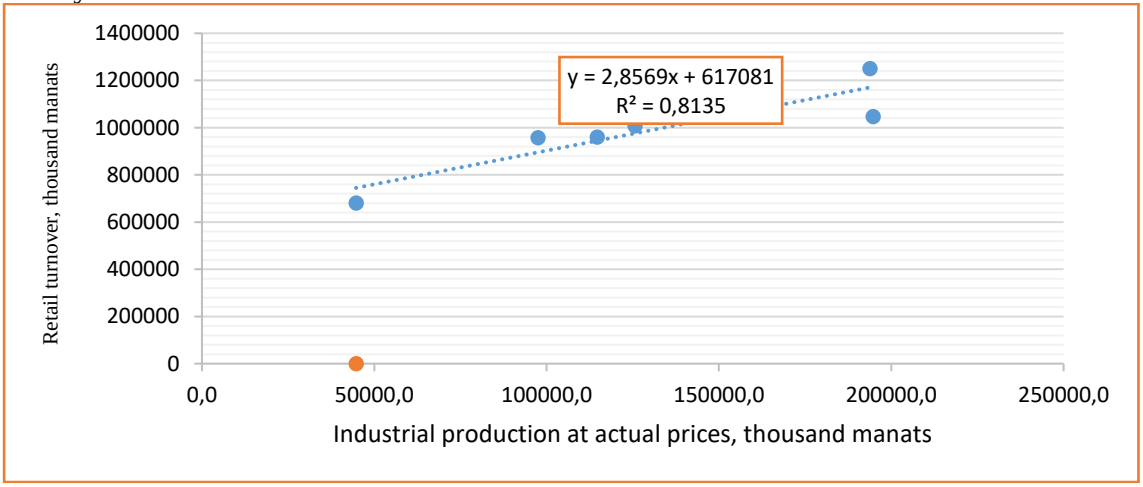


Chart 1.2. Dependence between the price of industrial production and retail trade turnover in Karabakh economic region

Source. compiled by the author based on the data of (8).

As can be seen from the graph, there is a high correlation dependence expressed by the linear regression equation y = 2.8569x + 617081 between the price of industrial production and retail trade turnover in Karabakh economic region (R^2 = 0.8135).

If we calculate the coefficient of elasticity according to the coefficient of the free variable in the relationship equation and the average values of the cause factor and the result factor for the studied periods, we will get the following result [4].

$$E_1 = \frac{\alpha_1 \times \bar{x}}{\bar{Y}} = \frac{2{,}8569 \times 128512{,}2}{984229{,}2} = 0{,}37303$$

According to the elasticity coefficient, a 1% increase in the price of industrial production in the Karabakh economic region results in a 0.37% increase in GDP.

In addition, a number of works are being carried out on the evaluation of the possible potential for electricity production from renewable energy sources and the steps to be taken and measures to be implemented in order to use this potential. 8 areas have been selected in the direction of identification and prioritization of areas with the potential of renewable energy sources.

Appropriate measures are already being taken regarding the implementation of pilot projects in the 3 selected areas. Compared to wind energy, it is planned to implement projects in the regions in the next years to use the potential of solar energy available in the entire territory of the country, to use land unsuitable for agriculture, and to distribute electricity generation capacities on renewable energy sources. Work is being continued in the direction of investing in selected and prioritized renewable energy sources in areas with high potential through an auction.

Based on the analysis, it was estimated at 35 GW in the shallow water basins of the Caspian Sea and 122 GW in the deep water basins. Effective use of this existing potential will create new jobs, as well as opportunities that add value to the country's economy. In addition, on August 2, 2022, a decision was made to allocate a loan package from International Financial Institutions in the amount of 114.2 million US dollars for the 230 MW Garadagh Project to be built in Azerbaijan by the "Masdar" company. With this, EBRD - 21.4 million US dollars, ADFD - 50 million US dollars, JICA - 21.4 million US dollars and ADB - 21.4 million US dollars will be allocated[9].

According to experts, depending on the geographical position of the place, the seasons of the year, the change of received energy and the position of the Sun in the sky, the position of the solar panels changes around both the 1st and the 2nd horizontal axes placed perpendicular to it, ensuring that the rays always fall at right angles to the surface of the panels during the day. is obtained at the expense of.

As mentioned, the position of the Sun in the sky varies depending on the seasons of the year and the hours of the day in each area, regardless of its geographical position, except for the areas around the equator. It is from this point of view that the energy of the Sun's rays falling on any area changes in different seasons. In order to obtain maximum energy from the rays falling on the solar panels, the rays must always fall on the surface of the panels at an angle of 900.

As a result of the analysis, it can be concluded that it is necessary to change the position of the solar panels in one direction or another depending on the position of the Sun in the sky and ensure that the rays always fall on the surface of the panels at an angle of 900.

The device works as follows. In order to obtain maximum energy from the Sun in any area, the unit's solar panel block (1) is positioned and activated according to the position of the Sun in the sky. The parameters of the electric energy received from the conversion of solar rays are constantly measured through the block (5) and the value of the maximum energy corresponding to the noon time is stored in the memory block (12). The sun is recorded by the block (11) that measures the power of the energy, the energy storage of the car is done with maximum values, the difference signals obtained by the car transmit proportional signals to the inputs of the blocks (6) and (7). The sun is recorded by the block (11) that measures the power of the energy, the energy storage of the car is done with maximum values, the difference signals obtained by the car transmit proportional signals to the inputs of the blocks (6) and (7).

The need to change the position of the solar panels around the 2nd horizontal axis means ensuring that their surface is directed at right

angles to the sun's rays in different seasons and places.

Thus, maximum efficiency in energy conversion is achieved due to light rays constantly falling on the surface of the panels at a right angle during the day.

Such an approach makes it possible to achieve high efficiency in the work of energy converters, taking into account both the geographical location, seasonal changes, and the hours of the day.

In particular, it should be noted that Zangilan, Jabrayil, Gubadli and Fuzuli are very suitable for implementing solar energy projects in the territories freed from occupation. Thus, the solar energy observed in these areas is the second most favorable region in the country after the solar energy observed in Nakhchivan MR.

Based on the preliminary studies, comparative analysis of topography, climatic conditions, proximity to the grid, energy production potential, transport infrastructure and other technical factors, the area of Jabrayil and Zangilan regions was considered suitable for solar energy projects. Thus, it can be concluded that the adaptation of the country's energy economy to world standards and the application of international standards will help to determine the economic-ecological and social efficiency of the energy sector and will create the basis for the correct formation of the country's energy strategy.

The result

At a time when the demand for the use of alternative and renewable energy sources is increasing, it is important to evaluate the high potential of these sources in Karabakh and the territories freed from occupation and to use them effectively. will play an important role in the formation of the product price. Thus, as a result of the reduction of overhead costs due to these sources, the price of the product will have a positive effect on the increase in the volume of trade turnover by increasing its competitiveness.

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ЭКОНОМИЧЕСКИЙ ПОТЕНЦИАЛ ЭФФЕКТИВНОГО ИСПОЛЬЗОВАНИЯ АЛЬТЕРНАТИВНЫХ И ВОЗОБНОВЛЯЕМЫХ ИСТОЧНИКОВ ЭНЕРГИИ В КАРАБАХЕ И НА ОСВОБОЖДЕННЫХ ТЕРРИТОРИЯХ

Резюме

В статье широко освещены вопросы использования альтернативных и возобновляемых источников энергии. Здесь был проанализирован и оценен экономический потенциал альтернативных и возобновляемых источников энергии в Карабахе и на освобожденных территориях. В результате исследований было установлено, что воды рек в Карабахе и на освобожденных территориях обладают способностью создавать потенциальный источник энергии, поэтому они будут играть важную роль в производстве возобновляемой электроэнергии на этих территориях.

Все это будет определять реализацию масштабных инфраструктур-ных проектов внутри страны и в регионе в целях увеличения энергетического потенциала страны и повышения конкурентоспособности этой отрасли в будущем.

Ключевые слова: Альтернативные источники энергии, производство электроэнергии, возобновляемые источники энергии, гидроэнергетика, солнечная энергия, энергия ветра.

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ECONOMIC POTENTIAL FOR THE EFFECTIVE USE OF ALTERNATIVE AND RENEWABLE ENERGY SOURCES IN KARABAKH AND THE LIBERATED TERRITORIES

Summary

The article widely covers the use of alternative and renewable energy sources. Here, the economic potential of alternative and renewable energy sources in Karabakh and the liberated territories was analyzed and assessed.

As a result of research, it was found that river waters in Karabakh and the liberated territories have the ability to create a potential source of energy, so they will play an important role in the production of renewable electricity in these territories.

All this will determine the implementation of large-scale infrastructure projects within the country and in the region in order to increase the country’s energy potential and increase the competitiveness of this industry in the future.Economic potential for the effective use of alternative and renewable energy sources in Karabakh and the liberated territories

Keywords: Alternative energy sources, electricity generation, renewable energy sources, hydropower, solar energy, wind energy.