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## EFFECTIVE USE OF ALTERNATIVE AND RENEWABLE ENERGY SOURCES

### Summary

The article explains the indicators of alternative and renewable energy types, how to eliminate the possible threat to the country's energy supply, how to ensure the export of electricity produced in the traditional way by allowing the diversification of existing energy resources, and how to accelerate the country's integration into the international energy security system. Here, information on scientific research and practical work conducted in developed countries to overcome problems that cannot be solved with other renewable energy sources based on the use of hydrogen is explained. At the same time, the feasibility of using energy, the study and assessment of its superiority over other renewable alternative energy sources, and the analysis of research works in the field of energy production are given.

**Keywords:** Alternative energy sources, alternative and renewable solar, wind energy, geothermal energy, biomass, water flow energy.

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### Intradaction

As we know, the reality of the possibility of depletion of natural resources (oil, gas, coal, etc.) and the increase of their prices in 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.

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

In general, the classification of alternative and renewable energy sources that can be used internationally is given in Figure 1.



Figure 1. Alternative and renewable energy sources

As you can see from the picture, those sources used in the world include: solar, water,

bio, wind, geo-thermal, bio-gas, fuel cells, tidal energy, small hydropower plants.

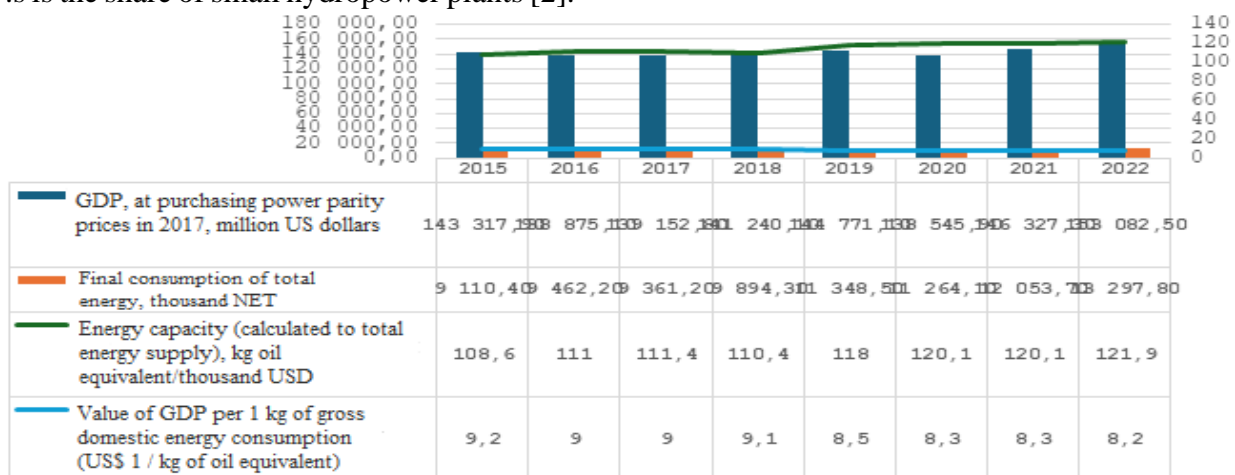
In addition to using some types of these energy sources in Azerbaijan, in order to expand the activities in this direction, to increase the efficiency of the use of energy resources by bringing alternative and renewable energy sources into operation in our country, on October 21, 2004, the President of the country, Mr. The State Program on the use of energy sources" was approved, and in 2009, the State Agency for Alternative and Renewable Energy Sources (ABOEMDA) was established under the Ministry of Industry and Energy in Azerbaijan, and the Decree No. 182 of the President of the Republic of Azerbaijan dated November 10, 2009 [ 1], the statute of that Agency was approved.

Not every country is lucky enough to use renewable alternative energy sources. Azerbaijan has a favorable geographical position and climatic conditions from this point of view. Having 300 sunny and 270 windy days in Azerbaijan means that wind and solar energy have great prospects. Also, the country has opportunities to use the energy of thermal waters. There are also ample opportunities for the exploitation of hydropower resources.

As a result of research conducted in this direction, the full hydropower potential of rivers in the Republic of Azerbaijan is 40 billion. kWh, and the technically favorable potential is 16 billion. It was determined to be 5 billion kilowatts. kW.s is the share of small hydropower plants [2].

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 12 kW/m<sup>2</sup>, 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 caused by the wind with a speed of 5 m/s is 0.075 2 kW/m<sup>2</sup>, this value can change from 102 kW/m<sup>2</sup> to 252 kW/m<sup>2</sup> during a storm or hurricane [4].

According to the obtained data, more than 1 billion m<sup>3</sup> 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 transformation of Azerbaijan into a "green energy" country has already begun. Today, our country is implementing large-scale projects related to the production and export of "green energy" based on the technical potential of renewable energy of 135 GW on land and 157 GW at sea:



**Graph 1. Electricity consumption in the Republic of Azerbaijan, its share in GDP, AQP and energy capacity.**

Source: compiled by the author based on the data of (2).



As can be seen from the graph, the final consumption of total energy has developed with increasing dynamics over 2015-2022 and conditioned the increase of GDP with the priority of purchasing power. In 2016-2018, the share of GDM in 1 kg of total domestic energy consumption increased to 9.1%, and in 2019-2022, it developed with decreasing dynamics and became 8.2% in 2022. The main place in energy consumption is the consumption of renewable energy sources.

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.

The natural climatic conditions of Azerbaijan should be considered acceptable for more successful implementation of water, wind and solar energy measures in this country. At the same time, opportunities for wide application of bioenergy and types of fuel elements in our republic have not been exhausted.

Along with the production of wind and solar energy in Azerbaijan, there are ample opportunities to increase the number of small hydropower plants.

Currently, in many countries of the world, various concessions are applied for the stimulation of alternative energy production and the development of this field. The following can be attributed to them:

- Increasing investments in alternative energy production;
- Application of temporary tax concessions to entrepreneurs and legal entities engaged in alternative energy production;
- Exemption from customs duties of equipment, equipment and technologies brought to the country to create an alternative and renewable energy system;
- Involvement of alternative energy sources in the production of electricity and thermal energy by using the natural potentials of our country.

In our opinion, the implementation of the mentioned concessions and measures in Azerbaijan can have a positive effect on the future

development of electronic energy, along with the studied area.

Wide application of alternative and renewable energy types in our country should be based on a long-term special State Program.

Currently, the alternative energy facilities built in our country are purchased from foreign countries at high prices. This affects the price of the energy to be produced and the repayment period of the expenses. In order to get rid of those costs and reduce dependence on foreign countries, organizing the production of wind power plants, solar batteries, and biogas transmitters in the territory of our republic will create an opportunity to achieve high economic efficiency, as well as to export the equipment to be produced.

As a contribution to initiatives to mitigate the effects of global climate change, Azerbaijan has set a goal of maintaining a 35% reduction in greenhouse gas emissions by 2030 compared to the base year (1990).

In November 2021, at the COP26 Conference held in Glasgow, our country accepted a new commitment to reduce emissions by 40% by 2050 and to create a "net zero emission" zone in the territories freed from occupation. In order to achieve these goals, the Ministry of Energy has set the main goal of increasing the share of renewable energy investment in the total energy balance of the country to 30% by 2030. For this purpose, a total of 1500 MW of new generating capacity is planned to be created at the expense of BOEM, 440 MW by 2023, 460 MW by 2023-2025, and 600 MW by 2026-2030.

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.

### **Result**

As a result of the research, it can be concluded that 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 and 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 positively affect the increase in the volume of trade by increasing its competitiveness.

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## ALTERNATİV VƏ BƏRPA OLUNAN ENERJİ MƏNBƏLƏRİNDƏN SƏMƏRƏLİ İSTİFADƏ

### Xülasə

Məqalədə alternativ və bərpa olunan enerji növlərinin göstəriciləri, ölkənin enerji ilə təminatında yarana biləcək təhlükəsini aradan qaldırması, mövcud enerji resurslarının diversifikasiya olunmasına imkan verməklə ənənəvi üsulla istehsal edilən elektrik enerjisinin ixracına təminatın yaranması və ölkənin beynəlxalq enerji təhlükəsizliyi sistemində inteqrasiyasının sürətləndirilməsi məsələsi izah edilir. Burada hidrogendən istifadəyə əsaslanan digər bərpa olunan enerji mənbələri ilə həlli mümkün olmayan problemlərin aradan qaldırılması üçün inkişaf etmiş ölkələrdə aparılan elmi tədqiqatlar və praktiki işlər haqqında məlumatlar izah edilir. Eyni zamanda, enerjidən istifadənin məqsədəuyğunluğu, onun digər bərpa olunan alternativ enerji mənbələrindən üstünlüyünün öyrənilməsi və qiymətləndirilməsi, enerjisinin istehsalı sahəsində aparılan tədqiqat işlərinin təhlili verilmişdir.

**Açar sözlər:** Alternativ enerji mənbələri, alternativ və bərpa olunan günəş, külək enerjisi, geotermal enerji, biokütlə, su axınlarının enerjisi.

## ЭФФЕКТИВНОЕ ИСПОЛЬЗОВАНИЕ АЛЬТЕРНАТИВНЫХ И ВОЗОБНОВЛЯЕМЫХ ИСТОЧНИКОВ ЭНЕРГИИ

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### Резюме

В статье объясняются показатели альтернативных и возобновляемых видов энергии, как устранить возможную угрозу энергоснабжению страны, как обеспечить экспорт электроэнергии, произведенной традиционным способом, позволяя диверсифицировать существующие энергоресурсы, и как ускорить интеграция страны в международную систему энергетической безопасности. Здесь поясняется информация о научных исследованиях и практических работах, проводимых в развитых странах для преодоления проблем, которые не



могут быть решены с помощью других возобновляемых источников энергии, основанных на использовании водорода. При этом даются возможности использования энергии, изучение и оценка ее превосходства над другими возобновляемыми альтернативными источниками энергии, а также анализ научно-исследовательских работ в области производства энергии.

**Ключевые слова:** Альтернативные источники энергии, альтернативная и возобновляемая солнечная энергия, энергия ветра, геотермальная энергия, биомасса, энергия водных потоков.

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