

## SCIENTIFIC BASIS OF ALTERNATIVE ENERGY RESOURCES AND THEIR USE

O.A. Ibragimov

Doctor of Philosophy in Geography (PhD) Director of the State Scientific Production Enterprise  
“Kartography”, Uzbekistan

Jasur Z. Usmanov

Doctor of Philosophy in Agricultural Sciences. (PhD) Head of the Kashkadarya Region  
Department of the Cadastre Agency, Uzbekistan

**ABSTRACT:** This article presents the scientific basis of using alternative energy sources, especially wind generators and solar panels. At the same time, the share of energy extraction from alternative energy resources, the total energy supply and its growth pattern were analyzed. In addition, it was analyzed how much share of the growth picture corresponds to developed countries.

**KEYWORDS:** Alternative energy, Renewables Global Status Report, Global, regional and local, resource, Local grid, Electric power, solar, wind, biowaste, geothermal water.

### INTRODUCTION

It is known that in the future it is necessary to use energy sources to ensure environmental, economic, energy security and development of the energy sector in our country. Of course, the use of renewable and alternative energy resources through the protection of ecology while preserving natural resources is important for the life of the future generation.

In recent years, large-scale measures have been taken to ensure the saving of electricity in the economic and social spheres of the republic, including one of the main decisions of the government on the development of renewable energy sources and the improvement of energy efficiency in the republic. Decree of the President of the Republic of Uzbekistan dated May 5, 2015 No. PD-2343 “On the program of measures for the introduction of energy-saving technologies and systems” approved by the decision “On the program of measures to further develop renewable energy in 2017-2019, increase energy efficiency in economic sectors and the social sphere”.

Standards for placing energy-saving markings in the production of household appliances have been introduced. Energy-saving lamps and energy-saving technologies are being introduced in

the lighting of streets, residential and social buildings, and the sale of lamps with a voltage of more than 40 W has been stopped in the territory of the republic.

Investment projects for the introduction of modern steam and gas turbine devices are being implemented in the energy sector. In addition, despite the adopted measures, the energy consumption of the country's economy remains at a high level. The degree of diversification of the fuel energy balance due to the involvement of renewable energy sources in industrial production does not correspond to world trends. Natural gas and other types of traditional hydrocarbon fuels dominate the main fuel used in the production of electricity and thermal energy.

Most of the 17 “Sustainable Development Goals” adopted by the United Nations on September 27, 2015 by all its member states in 2015-2030 through the rational use of natural renewable energy sources - to eliminate poverty, end hunger, achieve health and well-being, provide clean water and sanitation, develop cheap and clean energy, create decent jobs and ensure economic growth, industrialization, It is aimed at creating innovations and infrastructure, creating sustainable cities and comfortable living spaces, responsible consumption and production, combating climate change, protecting marine and terrestrial ecosystems, establishing peace, justice and effective governance, and ensuring cooperation. Because environmental degradation and climate change are mainly caused by the use of non-renewable hydrocarbon resources. Energy supply is one of the main indicators of sustainable development of countries.

According to the “Renewables Global Status Report” in 2014, the amount of energy obtained from alternative energy resources was 19.2% compared to the total energy sources. In 2015, this indicator increased by 4.5 times and compared to hydrocarbon fuel equivalent it was 364.9 billion. tons. It is expected that by 2050, its consumption rate will reach 40% worldwide through alternative energy. This serves not to exceed the amount of quotas given to countries aimed at mitigating climate change and to raise the environmental score.

This problem is of great importance for the Republic of Uzbekistan, which is a full member of the international community and has joined the Paris international convention on climate change. Therefore, on May 26, 2017, the decision PD-3012 “On the program of measures to further develop renewable energy in the Republic of Uzbekistan in 2017-2021, increase energy efficiency in economic sectors and the social sphere” was adopted. In it, the issue of implementation of comprehensive measures aimed at ensuring energy saving in the economic sectors and social sphere of the republic is set. On May 21, 2019, the Law of the Republic of Uzbekistan “On the Use of Renewable Energy Sources” was adopted. In the law, one of the main directions of the state policy in the field of the use of renewable energy sources is defined as the establishment of priorities in the field of the use of renewable energy sources, the development and implementation of measures and programs.

To ensure sustainable development at the global, regional and local levels, the world needs an environmentally friendly and affordable source of energy. Solving this problem through entrepreneurship and innovation, changing technologies and supporting local initiatives is the need of the hour.

What should be done and what should be done at a time when natural fuel reserves are decreasing at a rapid rate from year to year on a global scale? In science, in this regard, it usually begins with clarifying the definition or concept of the term and term used in it. Because the same word, term or term is interpreted differently in different literatures, it has become an axiom that does not require proof. In our case, it is appropriate to focus on the concepts of terms, phrases and terms, which are considered keywords (Table 1).

**Table 1**  
**Definition of key terms, terms and phrases related to alternative energy resources**

T/p	Terms, terms and word combinations	Definitions given to them	Literature and sources
1.	<i>Renewable energy resources</i>	Solar, wind energy, earth temperature (geothermal), natural movement of water currents, biomass energy that are naturally renewable in the environment	Article 3 of the Law of Uzbekistan “On the use of renewable energy sources” dated May 21, 2019.
2.	<i>Use of renewable energy resources</i>	Scientific research, experimental design, search, implementation, design, construction and installation works and works related to energy production from renewable energy sources, its transportation, collection, realization and consumption.	
3.	<i>Devices of renewable energy resources</i>	A complex of technological equipment, technological and (or) component equipment for energy production from renewable energy sources, energy reception, transformation, storage and (or) transmission, as well as accounting	
4.	<i>Local network</i>	Electric, heat and (or) gas network operating independently for transportation (transmission) and (or) distribution of electricity, thermal energy or biogas	
5.	<i>Micro and small hydroelectric stations</i>	Damless hydroelectric power plants with an installed capacity of 0.2 MW and up to 30 MW, using the energy of the natural movement of water currents to generate electricity	
6.	<i>Alternative energy</i>	It is a set of promising methods of obtaining, transmitting and using energy (often from renewable sources) that are not traditionally	

		widespread, but are generally of interest due to their profitability and low risk of environmental damage.	
7.	<i>Electric energy</i>	The field of generation, transmission, distribution, sale and consumption of electric energy	Article 3 of the Law of the Republic of Uzbekistan “On Electric Energy” of September 30, 2009
8.	<i>Electricity</i>	A special type of commodity characterized by simultaneous production and consumption	
9.	<i>Energy</i>	Quantitative measurement of the movement of particles that make up any form of matter, in particular, a body or a system of bodies, and the interactions of these particles with each other and with other particles	National encyclopedia of Uzbekistan, 11 volumes. - T.: “OzME DIN”, 2006. - 141 p.
10.	<i>Protection of the surrounding natural environment</i>	A system of activities carried out by the state and society aimed at ensuring the harmony of the relationship between society and nature, based on the preservation of natural resources and their productive, rational use	Uzbek-Russian-English ecological explanatory dictionary.-T.: “Chinor ENK”, 2004.- 38-p.
11.	<i>Environmental protection</i>	A set of measures designed to limit the negative impact of human activity on nature.	Environmental protection // kartaslov.ru
12.	<i>Environmental safety</i>	The degree to which the state of the environment (ecosystems) can meet the vital needs of organisms	Nigmatov A. Environmental law. - T.: “Publisher”, 2012. - p. 34.
13.	<i>Energy resources</i>	Elements of nature that make it possible to obtain electrical energy through various means	H.V. Salimov. Ecology / Russian-Uzbek explanatory dictionary.-T.: “UzME DIN”, 2012.- 462 p.

Later, in the scientific literature, the term “renewable energy resources” is used. But national legislation uses the phrase “renewable energy sources” (Table 1). This is logical, because a natural “resource” (such as the sun, wind, biowaste, geothermal water) becomes a “resource” after being used by human activities. It is logical that the term “alternative” is applied to the currently used energy sources.

By the 21st century, the production of energy, or rather electricity, has become the basis of sustainable development and economic growth. Because the level of electricity consumption is 3-4 times higher than the population growth. This, in turn, requires a further increase in the consumption of hydrocarbon fuels, which are considered the main source of energy and are increasingly depleted. But alternative energy is a promising way of obtaining, transmitting and using energy, which is not as widespread as conventional energy, but which has attracted interest

due to its low risk of environmental damage. Alternatives, on the other hand, aim to reduce carbon dioxide emissions from fossil fuels, which are the main driver of global warming.

Alternative energy resources are natural and social elements that provide pathways and replace traditional energy sources. Alternative energy Any source of energy that is an alternative to fossil fuels. The variety of sources of energy and their alternative causes different approaches from a scientific point of view.

In the rational use of alternative energy resources (in our case, alternative energy resources), it is necessary to approach the issue from the point of view of their environmental safety. Energy sources are mainly divided into two types - non-renewable and renewable. Non-renewable natural resources include hydrocarbons such as coal, oil, and gas. As the need for energy increases, the means of its production are being improved with the help of innovative technologies. But from the point of view of the negative impact on the environment in obtaining electricity, it can be conditionally divided into two:

- Environmentally hazardous and energy vehicles cause a large amount of carbon dioxide to be released into the atmosphere and cause climate warming. They can include large hydro, heat, condensation and hydroaccumulator power plants.
- Electricity produced by means of environmentally safe alternative energy sources, which have little impact on the environment, is considered relatively environmentally safe because it is mainly obtained from renewable energy sources and has a very low negative impact on the environment.

Renewable energy sources – Earth's permanent energy sources (wind, solar, geothermal, sea waves, inland waters, bio-organic waste) are environmentally friendly, have almost no negative impact on the environment, and are the best alternative for transferring natural resources to the next generation.

Although the use of renewable energy sources devices will cost a lot of money initially, they pay for themselves from an environmental point of view. Sulfur, nitrogen, and carbon oxides released into the air due to conventional fuel-based energy are spread over long distances. They mix with rainwater, turn into acid compounds and fall to the ground as part of the rain, having a negative effect on people, vegetation and soil. Due to the increase of such acids in the environment, heavy metals have a negative effect on food and, ultimately, through these products, on the human body. In this case, one harm leads to another harm.

Environmentally friendly renewable energy sources do not damage the environment or disrupt the flow of matter and energy in ecosystems. These sources are usually not able to fully supply large enough population centers and large industrial enterprises. They provide energy to remote villages, neighborhoods and small structures. The use of environmentally friendly renewable energy sources in our country has great prospects and is also effective from an ecological and socio-economic point of view.

One of the most convenient sources of alternative energy for the conditions of Uzbekistan is wind energy. This is a field of energy that specializes in converting the kinetic energy of air masses in the atmosphere into electricity, heat and any other form of energy for use in the national economy. Energy extraction is done using many types of aggregates such as wind generators and mills. Wind energy can be used to produce mechanical or electrical energy in SHPPs. This energy directly depends on the wind speed. A standard wind turbine consists of a three-bladed rotor mounted on a tubular steel shaft. The turning mechanism directs the rotor in the direction of the wind. The rotor drives the reducer and the asynchronous generator. Most wind generators operate with wind speeds greater than 3-4 meters per second and, depending on the type of turbine and wind direction, achieve maximum output with wind speeds of 8-25 meters per second. Usually the maximum operating speed is 25-30 meters per second.

The cost of wind energy does not depend on changes in fuel prices, operating costs are low; does not emit harmful emissions. But for its independent operation, it is characterized by a backup supply source, i.e. wind power capable of generating energy, high initial costs, high noise emission and visual impact.

Turbines with a power of 0.5-3 MW are popular in the market of wind generators. The average capacity of wind generators has now increased to 5 MW. At the moment, the working life of wind generators is 30 years, and its price is 0.93-1 \$/W. Its power varies depending on the area of the wings. For example, 3 MW (V90) turbines produced by the Danish company "Vestas" use blades with a diameter of 90 m, and the height of the tower reaches 115 m.

In large hydropower, energy is obtained by converting the kinetic energy of water flow into mechanical energy, and they are low in production cost, can be quickly turned on and off depending on energy consumption, restoration, construction requires more capital, reservoirs occupy large social areas; climate mitigation; it has positive and negative properties, such as the accumulation of water for irrigation. However, an alternative to it is a mini-hydroelectric power plant, which does not require a small dam and does not require much capital.

Advantages of small HPPs: they are installed at the bottom of the reservoir, as well as with special hinges that allow you to work on it; the capacity of the installed device is equal to 5 Kw and it is possible to increase the energy capacity by installing its pipes as modules; construction does not have a significant negative impact on the environment and is considered environmentally safe.

Solar energy is based on the conversion of electromagnetic solar radiation into electrical or thermal energy. Solar power plants use direct solar energy. Photoelectric cells convert light radiation energy into electrical energy, and according to technological development, solar power stations (SPS) are divided into three generations:

Photoelectric cells in the 1st generation QES are based on the use of mono or polycrystalline silicon. This type of photovoltaic cell accounts for 80% of installed systems worldwide. In the near

future, such photovoltaic cell devices will be among the most popular products in the energy market. The efficiency of these cells is 11-16 percent.

2nd generation. QES is made of a thin film made of amorphous silicon, cadmium-telluride or copper-indium-selenium. The efficiency is 8 percent and is cheaper than the first generation.

3rd generation. The efficiency of QES is 30-60% and they can be installed one above the other. For now, they are not considered a fully formed technology.

QES: requires little funds; does not emit harmful waste; photovoltaic modules can be used for a long time (at least 30 years), it is easy to install and use; provides high-quality electricity in local electricity supply. However, the initial capital expenditure for the construction of the QES is high; dependence on direct solar radiation; it also has disadvantages such as the size of the occupied area.

Geothermal energy includes thermal power plants (GeoIES) that use water as a heat carrier from geothermal sources. GeoHPs are more environmentally friendly than HPPs. GeoIES are built in volcanic regions where water at relatively shallow depths is heated above its boiling point and sometimes erupts in the form of geysers. Access to underground sources is done by drilling wells. Bioenergy is the energy obtained by burning waste biomass, which is obtained as a source of dry trees or their branches, plant rhizomes from the garden, wood bark and shavings, straw used as feed and bedding in livestock farms, organic waste-fertilizer, agricultural crops (grain, cotton, corn, bananas, etc.). They are burned in special BioES furnaces, water is heated in boilers, turned into steam and turns pipes to get electricity. Biomass energy is a promising direction of energy production, production and use of biomass waste [23; pp. 25-28]. Thus, the rational use of alternative energy resources reduces the release of harmful gases into the natural environment and is unrivaled in the production of additional electricity.

## CONCLUSION

To date, the share of obtaining energy from alternative energy resources has made 21% of the total energy supply over the next 5-6 years, and its growth rate has increased 4-5 times. However, its growth indicators correspond mainly to 20 developed countries. It was recommended to widely introduce the use of alternative energy resources that are developing or on the way to development, including in Uzbekistan. The initial task in revealing the geographical, cartographic and geodetic basis of alternative energy resources begins with clarifying the vocabulary, terms and terms used in it. Later, in national legislation and scientific literature, it is logical to use the term “renewable energy sources” instead of “renewable energy resources”, because a natural “resource” (sun, wind, biowaste, geothermal waters) becomes a “resource” after being used in human activities. The word “alternative” refers to the currently used energy. Alternative energy resources are divided into 2 types, 14 sources depending on the restoration, and 2 parts and 14 types depending on the level of environmental safety of the means of energy production.

## REFERENCES

1. Ibragimov O.A, Nigmatov A.N. The subject of modern cartography and its scientific research methodology: problems and solutions. EPRA International Journal of Environmental Economics, Commerce and Educational Management Journal DOI: 10.36713/epra0414|ISI I.F Value: 0.815|SJIF Impact Factor (2020): 7.572.
2. Ibragimov O.A. The mechanism of creation and use of the geographic information system database of alternative energy resources. "BULLETIN" No. 4 (265) of the Karakalpakstan branch of the Academy of Sciences of the Republic of Uzbekistan – "Science" - 2021.
3. Ibragimov O.A., Abdurashidov Z.A. Future prospects of alternative energy resources in the Fergana Valley: use of solar energy (in the case of the Republic of Uzbekistan). Natural resources of Uzbekistan and their use for the purposes of public welfare. Proceedings of the republican scientific-practical conference. UzMU.-T. 2018. B. 13-15.
4. Ibragimov O.A., Safarov E.Yu. Improving the methodology for determining suitable areas for the placement of alternative energy facilities. "Economics and Society" No. 4 (95) - Saratov - 2022. (11.00.00; No. 11).
5. Ibragimov O.A. Technology of development of maps of alternative energy resources based on geoinformation system. Information of the Geographical Society of Uzbekistan, volume 60. - Tashkent, - 2022. p. 300-308.
6. Ibragimov O.A., Khikmatov F.Kh., Magdeev Kh.N., Rakhmanov K.R., Khakimova Z.F., Ziyayev R.R., Erlapasov N.B. Contents of the "Surface Waters" section of the "National Atlas of Uzbekistan". Geographical problems and opportunities of tourism and recreation development in Uzbekistan. Republican scientific and practical conference. - Against, 2021, p. 4-8.
7. Ibragimov O.A., Nigmatov A.N. Modern science of cartography and its scientific research methodology. Information of the Geographical Society of Uzbekistan, volume 58. - Tashkent, - 2020. p. 283-294.
8. Ibragimov O.A., Safarov E.Yu. Developing wind and sunlight distribution maps for installation of opposite energy sources in the conditions of the Republic of Uzbekistan. International Conference. Europe, science and we, Praha, Czech Republic. 2022 p. 20-25.
9. Abdurakhmanov S.N. Boykulov J., Avilova N. Technologies and programs used in creating an electronic card // Journal of Agriculture of Uzbekistan. No. 10, 2017, p. 42.
10. Abdurakhmanov S.N. Inamov A. Improving the methods of creating objects in the geodatabase // "Agroilm" scientific application of the agricultural journal of Uzbekistan. 5(49) - issue Tashkent, 2017, pp. 76-77.
11. Abdurakhmanov S.N. Inamov A. Digitization of state geodetic points and connection of objects to these points // Bulletin of the State Committee "Ergeodezkadastr" of the Republic of Uzbekistan. Number 2. - Tashkent., 2013. - 14 p.
12. Dobbelsteen A., Broersma S., Stremke S. Energy potential mapping for energy-producing neighborhoods. Int. J. Sustain. Build. Technol. Urban Dev. 2011, pp.170–176.
13. Huisman O, Rolf A. de By, "Principles of Geographic Information Systems". The Netherlands-2009. - 453 p.

14. Jeffrey H, Stuart K. Card, James A. Landay, “A toolkit for interactive information visualization”. USA-2006. 2 p., - 267 p.
15. Kang-tsung Chang. Introduction to Geographic Information Systems. Fourth edition. - McGraw Hill Education (India) 2008. - 450 p.
16. Renewables Global Status Report 2016. REN21 Secretariat. UNEP. -Paris: — Renewable Energy Policy Network REN21 Secretariat for the 21st Century, 2016. — 28 p.
17. World Energy Focus. World Energy Council. -London:WEC, 2016.- 8 p.
18. Yasobant S, Vora K, Hughes H, Upadhyay A, “A Newer GIS Technology for Implementation Research in Health” India-2005. 428 p.
19. Zakhidov, R.A., Kremkov, M.V., The wind power potential of Uzbekistan, Appl. Solar Energy, 2015, vol. 51, no. 4, pp. 336–337
20. Zehner, Ozzie (2012). Green Illusions. Lincoln and London: University of Nebraska Press. pp. 1–169, 331–42