

Possibility of Using Alternative Energy Sources in Chechen Republic

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Abstract—The topic of this article is very relevant, since the issue, concerning the level of environmental pollution by harmful emissions arose recently. The purpose of the article is to assess the situation from the point of view of the energy economy in the Chechen Republic. The task is to analyze of various options for the use of non-traditional (alternative) energy sources in the Chechen Republic. The article also provides an overview of proposals that promote the development of alternative energy. This article allows drawing a conclusion about feasibility of using alternative energy sources.

Keywords—wind power; solar energy; renewable energy sources (RES)

I. INTRODUCTION

The depletion of oil, coal and gas can cause a global energy catastrophe. After all, the traditional sources of energy are excised. The wind, sun, the rivers, oceans, the seas have inexhaustible reserves of energy. Biomass and recyclables are available in unlimited quantities [1]. In 2018, it is absolutely clear that alternative energy and energy saving are the only way to the future and hope for the survival of the majority of the population of the planet.

II. THE NEED TO USE ALTERNATIVE ENERGY

Devices that can be used to derive energy from inexhaustible or renewable natural resources reduce reliance on traditional raw materials. The widespread transition to alternative energy can completely eliminate this dependence. The main problem is that these easily accessible energy resources are not renewed. Eventually, mankind will pump out all the oil, burn all the gas and dig up all the coal.

Do not forget about the negative environmental impact of fuel combustion. Combustion products pollute the air. Residents of large cities cause these negative environmental impacts.

The world community has long been aware of the limitations of fossil fuel reserves, and the negative impact of their use on the environment. Leading states have already implemented or are now implementing programs for the gradual transition to clean and renewable energy sources. Efforts on using of alternative energy sources is also being underway in Russia, both at the federal and regional levels [3].

Government of the Russian Federation has issued Order No. 1715-p since November 13, 2009 the energy strategy of Russia for the period up to 2030 has been approved, in which much attention was paid to the need of using renewable energy sources and local fuels. In particular, it notes:

The strategic goals of using renewable energy and local fuels are:

- reduction of the growth rate of the anthropogenic load on the environment and counteraction to climate change, if it is necessary to meet the growing energy consumption;
- rational use and reduction of the growth rate of the consumption of available fossil fuel resources in the context of the inevitable depletion of its reserves;
- preservation of public health and quality of life by slowing the rate of growth of environmental pollution when using fossil fuels, as well as reducing national health spending;
- slow down of the growth rates of expenses for distribution and transportation of electric energy and fuel and losses arising from this;
- involvement of additional fuel and energy resources in the fuel and energy balance;
- increase in the level of energy security and reliability of energy supply by increasing its decentralization level [3].

The Government of the Chechen Republic dated June 23, 2011 has approved the Chechen Republic energy sector development program for the period up to 2030.

The Chechen Republic energy development program for the period until 2030 includes 4 subprograms:

- Subprogram "Power".
- Subprogram "Hydropower".
- Subprogram "The use of alternative and renewable energy sources".
- Subprogram "Use of geothermal waters" [4].

Renewable energy today is the most dynamically developing direction of power and heat. Renewable resources are of particular importance in decentralized power supply systems that are typical of large areas of Russia and other countries.

III. TYPES OF RENEWABLE ENERGY SOURCES

Renewable energy sources (RES) are energy resources of constantly existing natural processes on the planet, as well as energy resources of waste products of biogenesis of plant and animal origin.

Most often, renewable energy sources include the energy of solar radiation, wind, water flows, biomass, thermal energy of the upper layers of the earth's crust and ocean.

RES can be classified by type of energy:

- mechanical energy (wind energy and water flows);
- thermal and radiant energy (the energy of solar radiation and heat of Earth);
- chemical energy (energy contained in biomass).

Using the concept of energy quality - efficiency, which determines the share of energy source, which can be turned into mechanical work, then renewable energy, can be classified as follows: renewable sources of mechanical energy are characterized by high quality and are mainly used for electricity generation. Thus, the quality of hydropower is characterized by a value of 0.6 ... 0.7; wind - 0.3 ... 0.4. Quality of the thermal and radiant renewable energy sources does not exceed 0.3 ... 0.35. The indicator of the quality of solar radiation used for photoelectric conversion is even lower - 0.15 ... 0.3. The energy quality of bio-fuels is also relatively low and, as a rule, does not exceed 0.3.

From these positions, it is customary to single out the gross potential of renewable energy sources, the technical potential of renewable energy sources and the economic one.

Gross capacity is the amount of energy contained in this type of energy resource, subject to its full beneficial use. Technical potential is a part of the gross potential, the conversion of which into useful energy is expedient at an appropriate level of development of technical means. The economic potential of renewable energy is part of the technical potential that is economically feasible to convert into useful energy under specific economic conditions.

TABLE I. RES RESOURCES IN THE WORLD AND RUSSIA

Type of energy mln, t.o.e	Theoretical resources, mln, t.o.e		Technical resources,	
	World	Russia	World	Russia
Energy of sun	$1,3 \cdot 10^8$	$2,3 \cdot 10^6$	$5,3 \cdot 10^4$	$2,3 \cdot 10^3$
Wind energy	$2,0 \cdot 10^5$	$2,6 \cdot 10^4$	$2,2 \cdot 10^4$	$2,0 \cdot 10^3$
Geothermal energy (to a depth of 10 km)	$4,8 \cdot 10^9$	-	$1,7 \cdot 10^5$	$1,0 \cdot 10^2$
Ocean energy	$2,5 \cdot 10^5$	-		
Biomass energy	$9,9 \cdot 10^4$	10^4	$9,5 \cdot 10^3$	53
Hydropower	$5,0 \cdot 10^3$	$3,6 \cdot 10^2$	$1,7 \cdot 10^3$	$1,2 \cdot 10^2$

Let us estimate roughly the potential of renewable energy sources, assuming that with rational use of it, an average of 2 kW per person is required to create comfortable living conditions. With each square meter of the earth's surface, it is possible to obtain using various renewable energy sources, on average, 500 W of power. If we assume that the efficiency of converting this energy into a convenient for consumption form is only 4%, then for a power of 2 kW an area of 100 m² is required. The average population density in cities, taking into account the suburban area of about 500 people per 1 km². To provide them with energy at the rate of 2 kW per person, it is necessary to remove 1000 kW from 1 km², i.e., it is sufficient to occupy only 5% of the area. Thus, RES may will provide a satisfactory standard of living if cost-effective methods for its transformation are found, taking into account the resource potential. The general resources of RES in the world and Russia are given in Table I. However, the contribution of these sources to the global energy balance is currently quite modest [5].

IV. PROSPECTS OF USING ALTERNATIVE ENERGY SOURCES IN THE CHECHEN REPUBLIC

Further, the ecological situation in the Chechen Republic will be considered in a more detail, as well as potential alternative sources of energy and the possibility of their use in the region. Because before proceeding to assess the feasibility of introducing such energy sources, it is necessary to analyze the geo-graphical area of the region, to evaluate the effectiveness of each of the renewable resources, because each region has its own characteristics. This article aims to analyze existing alternative energy sources and to consider the possibility of their use in the Chechnya region. Firstly, it is necessary to analyze the scientific methodology devoted to the problems of the transition of traditional energy to the energy sector, which has a number of advantages, unconventional one. Examples of such benefits are the use of renewable and therefore inexhaustible energy sources and, of course, the least

environmental pollution. Secondly, it is necessary to analyze the feasibility of using these sources in order to generate electricity [6].

Wind is widely available, non-polluting, in the process of generating electricity, the environment, energy a potential source of clean energy. However, during industrialization, wind energy replaced organic fuel (coal, oil) as a cheaper and more reliable source of energy. However, due to oil crises, wind energy technologies used to produce electricity, pump water and power in remote areas have renewed interest, contributing to the revival of wind power. Wind energy is a branch of energy related to the conversion of wind energy into mechanical, thermal and electric. On the globe, the total power of wind energy is estimated at $2,43 \cdot 10^{15}$ MW. According to the "Green Peace", due to wind energy, a person is able to receive 530,000 TWh of energy per year. Solar energy is an area of energy that is associated with the conversion of solar energy into heat and electricity. The amount of energy that flows to the Earth from the Sun is 123 trillion t.o.e per year - this is 3000 times more than the energy obtained from all types of fuel. If we use only 0.0125% of all energy coming from the Sun, then even this is more than enough to satisfy the current energy needs of all countries [7]. Based on scientific analysis, it should be noted the presence of prospects for the development and use of solar energy in the territory of the Chechen Republic. For the Chechen Republic and Grozny, in particular, the movement of the Sun is characteristic, namely that it gains the greatest height and, remaining on it throughout the day, descends only in the evening. Simply put, the movement of the Sun, in a given area, occurs around an object. On the day of the winter solstice (December 22), the length of the day in the city of Grozny is 8 hours 58 minutes, whereas on the day of the summer solstice (June 22) the length of the day is 15 hours and 24 minutes. From the above data, it can be concluded that the duration (average) of sunshine is 4447 h / year. The average number of days "without the Sun" in the Chechen Republic is fifty-seven per year. Of these fifty-seven days, forty-seven are the winter days. Proceeding from this, it follows that the Chechen Republic is suitable for the development of solar energy, since it has large reserves of solar energy and a sufficient duration of solar days. At the moment, solar and combined solar-wind power plants are not in great demand, but the number of consumers is growing every year. The main consumers of such power plants are, first of all, facilities in remote areas where there is no power supply. Also, consumers who finance these activities in order to save on traditional resources in the future, since such systems have a payback period of four to twelve years. Among other things, there are consumers related to the main ones, who, by virtue of their interest in new technologies, create a demand for solar and wind solar power plants [8]. Due to the significant performance of sunshine, as well as the average wind speed in Russia, the Chechen Republic can use these two resources combined. However, significant financial investments are required the interest of both producers and consumers in order to accomplish this. The most common design of wind turbines is a design with three blades, horizontal and vertical axes of rotation. Wind turbines with a vertical axis of rotation have the advantage, i.e. they require small wind speeds to get started. However, such wind generators are not widely spread due to difficulties with the braking mechanism. The energy produced by a wind

installation depends on the diameter of the rotor blades and the wind speed. For example, wind turbines with a capacity of 10 kW per year produce about 16,000 kWh, while about 130,000 kWh can produce wind turbines with a capacity of 600 kW. The horizontal axis of rotation of the engine has a significant part of the wind turbine, about 90%, and only 10% - the vertical axis of rotation [9; 3].

V. CONCLUSION

In conclusion, it should be noted that almost the entire territory of the Chechen Republic is suitable for using all the above-mentioned sources of energy, and especially the energy of Sun, since it has enough unused resources that are necessary for energy production [3].

It must be borne in mind that for the implementation of the foregoing, significant financial investments are required on the part of producers and, accordingly, interest on the part of consumers [9]. The future of renewable energy discussed here depends on a number of factors: energy consumption growth, population growth, fossil fuel prices, public opinion on the development of nuclear energy, environmental issues and many others.

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