

PROBLEMS AND WAYS OF SOLUTION IN THE DEVELOPMENT OF RENEWABLE ENERGY SOURCES IN THE REPUBLIC OF KAZAKHSTAN



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The article considers the existing problems in the electric power industry of the Republic of Kazakhstan at the present stage. The analysis revealed environmental and economic problems. The reasons for need to develop the branch of green energy for the country are specified. The production of renewable energy sources in recent years in Kazakhstan and in the world was analyzed. The ways of solving problems in the further development of alternative energy were revealed.

Keywords: *proceeded in the sources of electric power, power engineering specialist, energy-savings, energy efficiency, national power system, fixed tariff.*

The development of renewable energy sources in the Republic of Kazakhstan are caused by the economic and environmental problems influencing the sustainability of energy. The first of them were determined by the exhaustion of fuel resources. Environmental problems were formed due to the impact of energy on the environment.

Technological activity of people in the twentieth century led to the filling of the atmosphere with "greenhouse" gases of fossil fuels combustion in production and household purposes. Accumulation of a large amount of carbon dioxide in the atmosphere leads to increase in air temperature on the planet and its average annual indicators, this is the greenhouse effect. Emissions of these substances exceeded the capacity of natural processes to neutralize them. Combustion of fuel leads to production of carbon dioxide. Depending on the type of fuel, each ton produces from 1.47 to 2.5 tons of carbon dioxide [1]. As a result of the poor environment on the Thermal Power Stations there are clusters in the lower atmosphere of aerosol chemically harmful particles and organic dust, called "photochemical fog", and in weak winds over the cities hangs smog.

In Astana there are two operating Thermal Power Station with gross emissions of pollutants into the atmosphere ~ 10 thousand tons per year (2016). Only one Thermal Power Station in the capital releases ~ 5,400 thousand tons of pollutants per year into the atmosphere. Twenty enterprises of the Northern and Central regions of the Unified energy system of Kazakhstan annually emit more than ~ 110 thousand tons of pollutants into the atmosphere [2]. The conducted studies at the Thermal Power Station in Astana showed an excess of emissions of pollutants according to technical regulations for emissions into the environment [3].

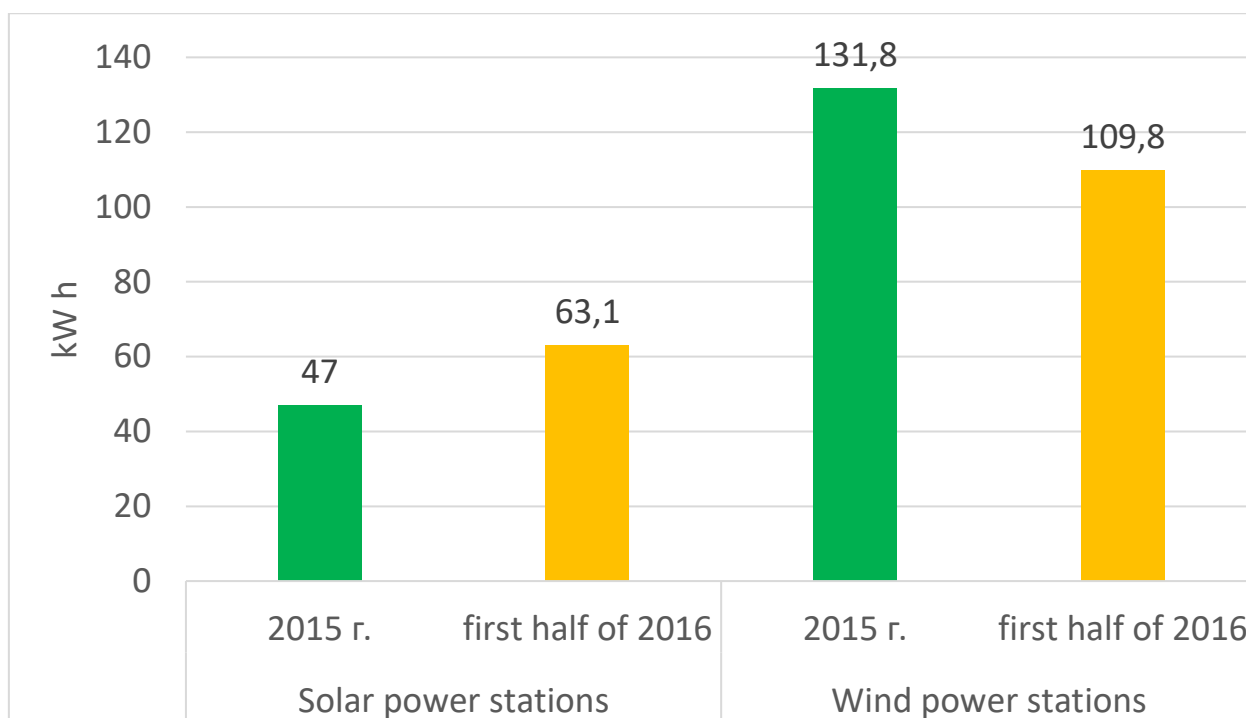
The consumption of fossil fuels in the country continues to grow and this can lead to catastrophic changes in the climate [4]. Kazakhstan changed its energy strategy, defining the need for a new energy model. However, the lack of resources and the degree of adaptability of the relevant technologies have a hindering effect on the development of alternative energy sources. At development and deployment of RES large initial investments are necessary, and then it is difficult to determine the additional financial and economic impact from the use of renewable energy.

The problem with prime cost of received energy for the next 15 years was solved, according to the law, a fixed tariff was set in the country: for electric power of wind power stations was set at KZT 22.68 per 1 kW / h; for solar power station -

34.61 KZT / kW / h; for small hydroelectric power stations - 16.71 KZT per 1 kW / h; and 1 kWh of electricity from biogas plants - 32.23 KZT. Furthermore, in order to support the domestic producer, a fixed tariff for electricity generated by solar power station using photovoltaic modules based on Kazakhstan silicon at the amount of 70 tenge/ kWh at the capacity of power production up to 37 MW. The established preferential tariffs will be valid for 15 years. Taking into account inflation, annual indexation of tariffs will be carried out. The fixed tariff scheme includes investment and operating costs, as well as the cost of connecting to the network. And for this period, the purchase of all renewable energy sources is guaranteed. But for investors there is a currency risk as sub-laws concerning this question are still not adopted. Accordingly, only after their adoption, Kazakhstan will ensure the financial attractiveness of RES projects [5].

Kazakhstan has a rich potential of renewable energy resources, such as hydro, wind and solar energy, which is estimated to exceed 1 trillion kW / h per year. In the structure of energy consumption by type of energy carrier in the Republic of Kazakhstan for 2005-2015 the share of RES is 0.02%. According to the data of the Ministry of Energy of the Republic of Kazakhstan, the potential of solar energy by calculations is about 2,5 billion kW/h. per year, and the number of the sundial per year is estimated at 2 200–3 000 of 8 760. The wind potential reaches 1,820 billion kW / h. in a year. The thermal potential of geothermal waters is 4.3 GW.

Power production by solar and wind power stations for 2015 and 1 half-year 2016 was presented in figure 1. The increase in electricity produced in the 1st half of 2016 due to alternative sources in solar power stations exceeds the annual output of 2015. Production of electricity due to wind decreased during the same period.

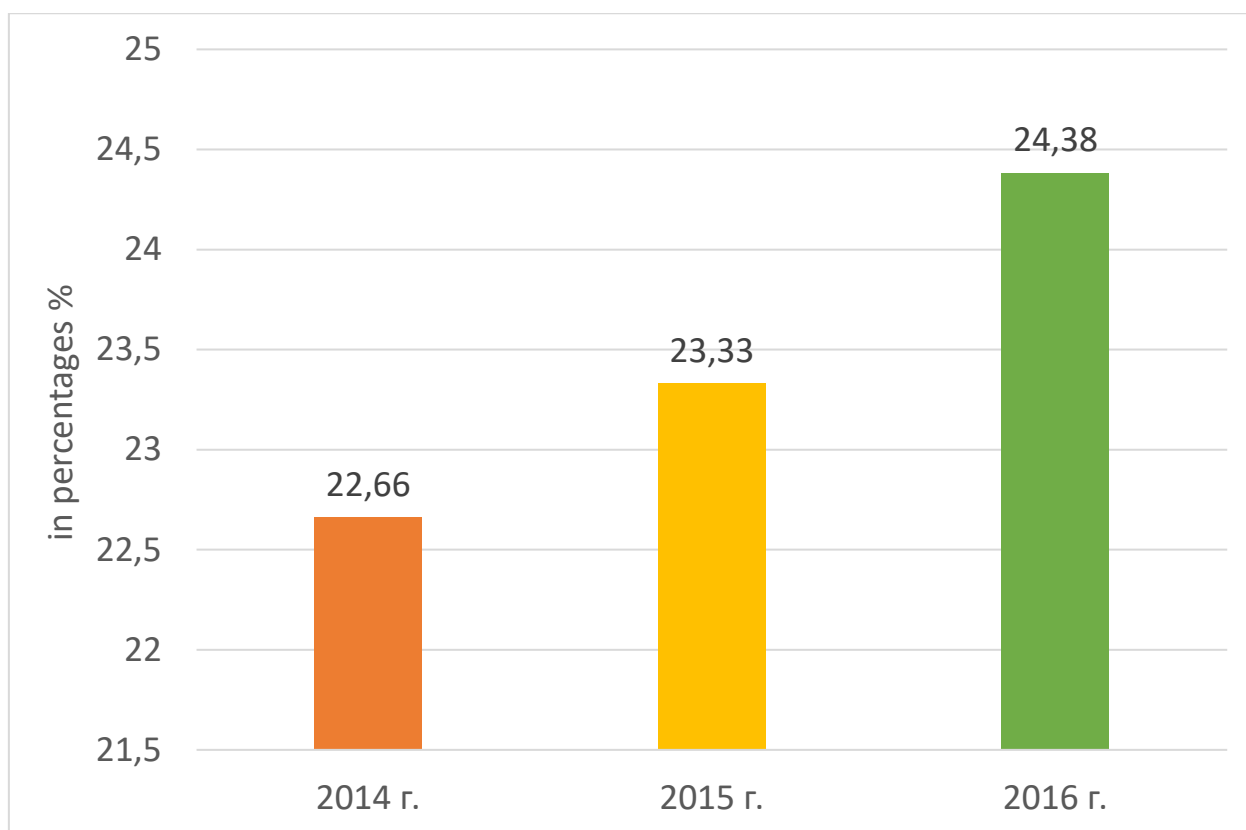


Источник: [www.rfcaratings.kz, АО «Рейтинговое Агентство РФЦА», Энергетика РК 2016 г.]

Figure 1 Power production by solar and wind power stations for 2015 and 1 half of 2016, in million kW / h.

The Republic is an energy power, possessing 4% of world reserves of fuel and energy resources [6]. In the Strategic Development Plan of the Republic of Kazakhstan until 2020, the share of alternative sources (solar and wind) in electricity generation should increase by no less than 3%. But according to the independent information and consulting company Enerdata, for the period 2014-2016 the share of RES production decreased by 2.9%, compared to the whole world, this figure is improving annually, for the period from 2014-2016 was 3%.

In total, 24.67 TW of electricity, including public production and industrial producers, were produced worldwide in 2016. 24.38% of these were obtained through renewable energy sources. The indicator is improving every year. If in 2014 the share of renewable energy was 22.66%, then in 2015 - 23.33% (Fig. 2).

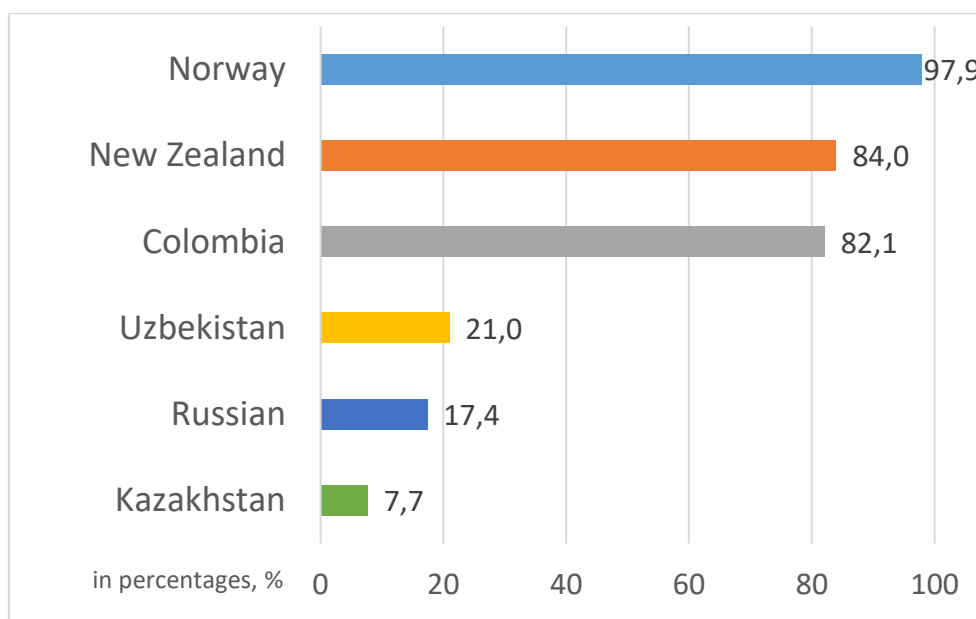


Источник: [независимая информационно-консалтинговая компания Enerdata]

Figure 2, electricity generation RES for 2014-2016 years in the world, in %.

According to the independent information and consulting company Enerdata, the largest amount of energy from renewable sources was received in Norway from 97.87% of 150 TW produced in a year, whereas in Kazakhstan, out of 104 TW of total electricity produced, only 7.65% is in RES. Moreover, compared to previous years, their share is decreasing: in 2014 – 7.88%, in 2015 – 7.83%, in 2016 – 7.65%. Wherein, about 0.02% is generated from the energy of the sun and wind. Even not the richest Colombia from 82 TW of generated electricity of 82,04% turns out from RES (fig. 3).

Kazakhstan's electricity needs are estimated at 105 billion kW / h [7]. The installed capacity of RES facilities in Kazakhstan in 2015 amounted to 82.2 million kW/h, 7.2% - WPS of them, 91.4% - small hydro power stations, 1.4% - SES [8].



Источник: [независимая информационно-консалтинговая компания Enerdata]

Figure 3 Power generation of renewable energy for 2016 year for selected countries (in the world), in %.

In Kazakhstan there are 50 wind, solar and hydroelectric power stations with a capacity of 300 MW, which generate 930 million kW / h of electricity per year. All the above-mentioned projects are implemented within the framework of the Concept of transition the Republic of Kazakhstan to a "green" economy [9]. The use of renewable energy largely depends on the created prerequisites, in particular legislation for the development of green energy in the republic, and the shortcomings which can create serious obstacles. In the above-mentioned Concept on the transition Kazakhstan to a green economy and the Strategic Development Plan of the Republic of Kazakhstan until 2020 (Presidential Decree No. 922 of February 1, 2010), the state program on forced industrial-innovative development of Kazakhstan for 2010-2014 (Decree of the President of the Republic of Kazakhstan dated March 19, 2010 №958) set unattainable targets for the share of alternative energy sources in the total energy consumption. On the one hand, we attract investors on the other hand, the adopted legislation, for example, a moratorium on the lease of land by foreigners, creates difficulties, because land suitable for the construction of RES facilities

should be bought or leased by the owner, so that they can be transferred to the category of energy lands. Most of the land in Kazakhstan has an agricultural purpose. Besides at allocation of the land plots of the investor, he should include in the Plan for placing facilities for the use of RES and then approved by the Ministry of Energy. At the same time, the limits of the RES connected power in a certain part of the electrical network that has restrictions on the capacity of electrical connections are established. The important place among economic problems is the loss of electricity in the backbone networks.

In the conditions of dissociation in management and remoteness of objects distribution of the electric power in regions, areas and the cities of Kazakhstan is carried out on networks of 0, 4-110 kW. Great number of owners of electrical grid assets realize at the same time control. The transmission of electricity via 220-500 kW backbone networks is carried out by the operator of the National electric network – JSC "KEGOC". High rates of losses of electric energy in the NEG of Kazakhstan in comparison with the developed countries are caused by the following reasons:

- 1) the difference in the length of the network between the main centers of consumption and generation (Kazakhstan is characterized by long networks (500-1500 km)).
- 2) Differences in climatic conditions (sharply continental climate of Kazakhstan adversely affects the losses in electrical networks with voltage of 220 kW and above).

Electricity losses in networks of NEG account for 5.3% of total supply to the grid (with world figures to 2.4%), in networks of wreck from 5 to 20.4% (with global indicators to 7.1%).

These problems are compounded by the absence of a unified technical policy in the development of regional electric grid companies and the openness of the structure of their owners. To increase the technical and commercial losses added disinterest of REC owners in the renewal of fixed assets.

The lack of centralized power supply to about 70 settlements with a population of more than 16 thousand people is a sick issue of the energy system of Kazakhstan. Taking into account the enormous extent of rural power lines, about 360 thousand km, as well as their contents increase the cost of electricity produced by traditional sources.

The problems of energy saving and energy efficiency in the economy of the Republic of Kazakhstan are acute. The specific tasks of saving, rational use of energy resources in the links of energy production and energy consumption prescribed and performed in the law on energy efficiency could be the solution of this issue. To this should be added the transition to energy-saving technologies and the introduction of an automated energy control and metering system (AMR) will be good reserve of energy efficiency.

The main reasons for the need to develop RES in the Republic of Kazakhstan are: ensuring energy and environmental safety; preservation of the environment; conquest of the world markets of renewable energy sources; preservation of own energy resources for future

Thus, the analysis of development of renewable sources of the electric power in Kazakhstan showed the imminent need of solutions of the revealed problems.

The first way is investment. Attraction of investments of international financial institutions and creation of the Central Asian hub of "green" technologies will provide a financial basis for the development of RES in Kazakhstan. For the Republic, the development of a green economy is very important, since this issue will help to ensure the country's competitiveness. Surely, at the same time that investment privileges and preferences are respected for the construction and operation of facilities for the use of RES.

The second way is legislative, which is currently under discussion due to contradictions in the legislation of Kazakhstan. Complex improvement of a number of normative legal acts taking into account technological and other specifics of objects on use of RES will give a certain order in the sphere of their power supply.

There will be a successful integration of alternative sources into a single electric power, heat and electricity and heat energy market.

Thus, elimination of the above-stated problems will provide in the offered ways to the Republic of Kazakhstan numerous economic and ecological advantages. RES can reduce dependence on imported energy resources, create additional opportunities for some industries and agriculture, and reduce emissions of greenhouse gases and other harmful substances. There is no need for long-distance transportation of fuel due to them. In this regard, in most developed countries there has been a recent trend to increase the proportion of their use. The existing mechanism for supporting industrialized countries by the state indicates the introduction of alternative energy sources and replacement of carbon media.

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