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COMPARATIVE ASSESSMENT OF RENEWABLE ENERGY IN KAZAKHSTAN AND THE PEOPLE'S REPUBLIC OF CHINA

A.E.Zholdasbek
Al-Farabi Kazakh National University, Almaty, Kazakshtan
e-mail: aknura.zholdasbek@gmail.com

Abstract. The article examines the experience of China and Kazakhstan in the implementation of renewable (green) energy for sustainable development, the main problems and ways to solve them. In the modern world, energy is the basis for the development of basic industries that determine the progress of social production. The purpose of searching for alternative energy sources is the need to get it from the energy of renewable or almost inexhaustible natural resources. At the present stage of development, green energy depends on the interconnected development of such areas as renewable energy sources, energy saving, resource saving and waste management. The energy potential of Kazakhstan is compared with the People's Republic of China. The significant potential of Kazakhstan in energy saving has been underestimated to the present time, the focus in the current policy has been made on the development of power capacities. The development of energy technologies is very important for the future of all mankind. Availability of energy available for consumption has always been necessary to meet human needs, increase the duration and improve the conditions of his life. Based on the results of the analytical review, recommendations were developed to achieve the set goals for the introduction of alternative energy in the sustainable development of Kazakhstan.

Keywords: renewable energy sources, green energy, sustainable development.

Introduction. Sustainable development of a country is development that meets the needs of the present generation and does not compromise the ability of future generations to meet their needs. The transition to sustainable development is an urgent necessity for the Republic of Kazakhstan. In November 2011, the Republic of Kazakhstan submitted a National Proposal for inclusion in the agenda of the UN Conference on Sustainable Development RIO+20, discussion of the Global Energy and Environmental Strategy for Sustainable Development in the XXI century. The rationale for this strategy and recommenddations for its practical implementation are set out in the monograph of the first president of the Republic of Kazakhstan N. A. Nazarbayev. [1] The main goal of the strategy is to achieve an optimal level of satisfaction by the middle of the XXI century the needs of all countries of the world in energy and other natural resources, including through the active use of renewable energy sources (RES).

"Green" energy is energy resources, the use of which does not harm the environment, and which, therefore, are environmentally friendly sources of energy. At the present stage, "green" energy depends on the interrelated development of the following areas: renewable energy sources (RES), energy conservation, resource conservation and waste management.

Renewable energy sources - energy from sources that, by human standards, are inexhaustible. The main principle of using renewable energy is to extract it from the constantly occurring processes in the environment. The environment processes and services for technical applications. "Green" and renewable energy are often considered as identical concepts. [2] Renewable, "green" energy is obtained from natural resources, such as: sunlight, water flows, wind, tides and geothermal heat that are replenished naturally.

Kazakhstan is one of the world leaders in the diversity and quantity of natural resources of mineral origin. Since some of the most important resources for the country's economy are oil, gas and coal, regulation in these sectors of the economy is very advanced, the government has historically paid less attention to the development of alternative energy sources. For example, most power plants in Kazakhstan currently run on natural gas, coal, and petroleum products.

However, the recent global financial crisis and the awareness of the need to reduce reliance on energy resources and the impact on the environment prompted the country's leadership to actively focus on creating favorable conditions for the use of renewable energy sources. [3]

On March 19, 2010, the President of the Republic of Kazakhstan approved State program on accelerated industrial and innovative development in the Republic of Kazakhstan for 2010-2014. Further, in August 2014, it was approved State program Industrial and innovative development of the Republic of Kazakhstan for 2015-2019 both programs confirm the significant potential of renewable energy sources such as water, wind and solar energy in Kazakhstan in the short and long term. [4] In particular, according to experts ' calculations, the wind energy potential in Kazakhstan is estimated at 1 trillion kilowatt-hours per year and the country has the

first place in the world in terms of the potential volume of wind energy per capita. Moreover, despite the geographical location of Kazakhstan, the resources of solar energy in the country, they are stable and suitable due to favorable climatic conditions. Studies show that the potential of solar energy in the southern regions of the country is 2500-3000 hours of sunshine per year

Nevertheless, the number of renewable energy projects will grow and by 2020, 34 renewable energy facilities will be put into operation in the republic, which includes wind power plants (WPP), hydroelectric power plants (HPP) and solar power plants (SPP). The total capacity of the new power plants will be 1362.34 megawatts. Most of the energy will be generated by 13 wind farms - 1081 megawatts. A 100-megawatt wind farm will be built in Sarysu district. In 2015, wind farms will start operating in Karaganda and Kostanay regions. The wind farm will be built in the town of Fort Shevchenko in Mangystau region. 17 hydroelectric power stations will produce 205.45 megawatts. The main hydroelectric potential is concentrated in the Almaty region. By 2020, it is planned to build 11 hydroelectric power stations there. Hydroelectric power stations will be built in East Kazakhstan, Dzhambul and South Kazakhstan regions. In addition, it is planned to build 4 solar power plants with a total capacity of 76 megawatts. The projected capacities will be an unprecedented indicator for the republic, but they are very modest in terms of compared to other countries that have long been working with projects of a different order. For example, only for 2012 China brought it out 13 gigawatts of new generation capacity based on wind farms. [5]

Republic Transition Concept Kazakhstan's Transition Concept to a green Economy, which sets out the goals, objectives, basic principles and general approaches to the transition to a green economy, stipulates that the development of alternative energy engineering in Kazakhstan should occur through the construction of wind and solar power plants, so that the share of such power plants is equal to that of other countries. Total electricity production reached 3% in 2020 and 10% in 2030. [6]

Despite the fact that the republic's economy is highly provided with traditional fuels, building a new energy model based on renewable energy sources is extremely important for the country for the following reasons.

The first is the critical need to reduce emissions of greenhouse gases and other pollutants, the main producer of which is the fuel and energy complex of the Republic of Kazakhstan, which mainly works by burning fossil fuels: coal, oil and gas.

The second is the growing energy deficit, which can become a deterrent to the development of the republic's economy. It is also worth noting that the indicator of specific energy consumption per unit of GDP in Kazakhstan is 1.9, which is several times higher than in developed countries-members of the Organization for European Economic Cooperation (OECD). The high energy intensity of the economy has negative consequences, such as a decrease in the competitiveness of manufactured goods and significant environmental pollution [7]

Our country occupies a leading position in the world in terms of greenhouse gas emissions to GDP. Being a party to the UN Framework Convention on Climate Change (since 1995) and having ratified the Kyoto Protocol to this Convention in 2009, Kazakhstan has committed itself to reducing greenhouse gas emissions. [8] Introduction of renewable energy sources to Kazakhstan's energy mix is one of the most effective ways to reduce the harmful impact of the energy sector on the environment and diversify generating capacities. Despite the huge usage opportunities the share of this sector in the total volume of electricity generated in Kazakhstan is still small: 12.5% including traditional large hydroelectric power plants, while only 0.5% of them are non-traditional types of renewable energy. For comparison, in Denmark and Iceland, the RES utilization rate (excluding large hydroelectric power plants) is 29%, Portugal and China-18%, Spain-42.2%, the United States-10%, Russia-1.5%, and in the global structure of electricity production, RES occupy about 19-20%

Currently, the development of alternative energy in Kazakhstan is most promising in the following areas: [10]

- Hydroelectric power industry. The capacity of the existing hydroelectric power plants is 2,068 MW with an annual electricity generation of 8.32 billion cubic meters. kWh. The theoretical hydro potential is about 170 billion cubic meters, at the same time, 27-30 billion kWh can be produced economically efficiently. The predominant part of hydroelectric resources is located in the Eastern and South-Eastern regions of the republic. Especially relevant for the energy-deficient Southern region are small hydroelectric power plants (less than 35 MW), which have a low production cost and exert a small burden on the environment. The most promising ones for the hydroelectric power sector. The main rivers of the region are: Ili, Charyn, Chilik, Karatal, Koksu, Tentek, Khorgos, Tekes, Talgar, Bolshaya and Malaya Almatinki, Usek, Aksu, Lepsy, Yrgayty. According to experts, small hydroelectric power plants installed there will be able to generate about 8 billion cubic meters of electricity. kWh per year and are able to fully meet the demand currently met by

imports from Central Asian countries. In December 2011, the Moinakskaya HPP (300 MW) was put into operation as part of the FIID State Program. At the same time, a number of other projects are being implemented for the construction of small hydroelectric power plants in Southern Kazakhstan. [11]

- Wind power industry. Due to its geographical location in the wind belt of the northern hemisphere and the presence of strong air currents, Kazakhstan has extensive opportunities for the development of wind energy. Thus, in some regions of the country, the average annual wind speed is more than 6 m / s, which makes them attractive for the development of this industry. According to expert estimates, the wind energy potential of Kazakhstan is $ 929 billion. kWh per year. Currently, the Ministry of Industry and New Technologies of the Republic of Kazakhstan has selected 10 sites for the construction of wind farms. All of them will be used for the construction of large wind farms with a total capacity of up to 1000 MW for the purpose of commercial electricity generation in the amount of 2-3 billion rubles. kWh. Currently, only one wind farm has been put into operation in Kazakhstan – in December 2011, the Kordai wind farm with a capacity of 1500 kW was launched in Zhambyl region.

- Solar power engineering. Kazakhstan has favorable climatic conditions for the development of the solar power industry. According to experts, the number of sunny hours is 2200-3000 per year, the energy of solar radiation is 1300-1800 kW per 1 m2 per year. The most suitable places for placing solar power plants are South Kazakhstan, Kyzylorda regions and the Aral Sea region. The most significant project in this area, implemented in Kazakhstan (funded by the United Nations), is to provide residents of two villages of the Aral region with drinking and hot water in 2002 by placing 50 prismatic solar installations with a capacity of 100 liters of water each and 50 solar desalinators that make water from the Syrdarya River potable.

According to the U.S. Energy Information Administration for 2010, the Republic of Kazakhstan, along with other CIS countries, occupies one of the last places in the world in terms of energy intensity of GDP (Kazakhstan – 183rd place, Russia – 185th place, Belarus – 179th place). The high energy intensity of the GDP of the Republic of Kazakhstan is partly explained by a number of objective reasons:

1) cold, sharply continental climate. Low average outdoor temperature and a significant length of the heating season compared to the countries of continental Europe;

2) a significant share of energy-intensive industries (mining and metallurgy) – 38% of GDP of the Republic of Kazakhstan in 2012. Industrial consumers account for about 67% of the electricity produced;

3) the vast territory of the country and, as a result, the need to transmit electricity over long distances lead to significant losses in electric networks. The Republic of Kazakhstan ranks 9th in the world in terms of land area, while the population density is 19 times lower than in the European Union. [12]

In the structure of primary energy consumption by major sectors of the economy, the share of energy is 47.71%, industry-20.36%, transport-16.24%, housing and communal services and the population-15.69%. Despite the existence of objective reasons for the high energy intensity of the GDP of the Republic of Kazakhstan, there is a significant potential for improving energy efficiency and energy saving, since the energy intensity of the GDP of the Republic of Kazakhstan is twice as high as that of most developed countries, which are comparable in terms of cold climate and population density. The share of industry in total electricity consumption is explained not only by the predominance of heavy industry in the economy, but also by the high depreciation of industrial assets and the use of outdated technologies. [13] Currently, the efficiency of using energy resources in Kazakhstan does not exceed 30%, i.e. more than 2/3 of the energy consumed is non-production losses. Meanwhile, the current level of technology development makes it possible to have an energy efficiency of at least 50-60%. The introduction of energy-saving technologies to ensure the specified level of energy efficiency could solve these problems. High energy consumption reduces the competitiveness of products on the world market. In this regard, the driving forces of the state policy on energy saving and energy efficiency were put forward to the state.

The process of forming the state policy in the field of energy saving was initiated by the Law of the Republic of Kazakhstan "On Energy Saving" adopted on December 25, 1997. It was he who put at the forefront of the state's energy policy the problem of improving the efficiency of using fuel and energy resources. However, it was declarative in nature, and many of its provisions turned out to be ineffective. On January 13, 2012, the President of the country, in place of the previously existing Law "On Energy Saving", signed the Law of the Republic of Kazakhstan "On Energy Saving and Energy Efficiency Improvement", as well as the new Law" On Amendments and additions to certain Legislative acts on energy saving and energy Efficiency Improvement". Regulatory acts containing prescriptions for the legal regulation of the energy saving system apply not only to legislation in the field of energy efficiency and renewable energy sources. [14] There are also regulations of civil, tax, investment legislation, legislation on pricing, natural monopolies and other branches of law that directly (and to a considerable extent) affect energy conservation. The main management tool in the field of energy saving and efficient use of energy in any country should be national,

regional and sectoral energy saving programs. [15] It is with programs that practical energy saving begins. Therefore, they should be integral elements of the country's socio-economic development programs and perform not only economic functions, but also be a practical tool for solving social, economic and environmental problems. The reduction of energy intensity is achieved through the natural renewal of the economy and the implementation of targeted projects in the field of energy efficiency. Probably, the law refers to the state program in the field of energy saving and energy efficiency improvement. In 2009, in order to implement the state policy in the field of rational and efficient use of energy, the "Energy Saving Program for the period up to 2015"was developed. In 2011, the Government approved a "Comprehensive Plan for Energy Conservation". Its implementation should reduce the energy intensity of GDP by 10%, and the annual savings from its implementation should amount to 16 billion kW.h of electricity, 7 million tons of coal, or the monetary equivalent of $1.3 billion. [13]

In the context of integrating the three pillars of sustainable development (economic development, social progress, and environmental responsibility), Kazakhstan has launched three major national initiatives:

–The "Green Economy" (or "Green Growth"), according to the Rio+20 outcome document, "in the context of sustainable development and poverty eradication, will increase our ability to use natural resources efficiently with fewer negative consequences for the environment, increase resource efficiency and reduce waste."

–The Green Bridge project is aimed at promoting partnership among European countries. Asia and the Pacific, which develops plans for the transition from current traditional development models to green growth concepts.

–The "Global Energy Strategy" is focused on ensuring energy sufficiency based on the integration of all primary energy sources.

The economy of the Republic of Kazakhstan is characterized by a higher energy intensity of GDP with a relatively low level of labor productivity. The specific energy intensity of the country's GDP in terms of PPP is 2.5 times higher than the average for the OECD countries and 3.5 times higher than the energy intensity of the EU GDP. This means that the country needs three and a half times more energy per unit of GDP. The most energy-intensive industries are mining and metallurgy. Industry consumes more than 50% of electricity, while more than 35% is consumed by the 15 largest enterprises. Another major consumer of energy resources in the republic is the sector of electricity and heat generation, which accounts for 20-25%. A significant share of heat consumption is occupied by the housing sector (27.9%). The huge energy-saving potential available in the energy sector and industry had good prerequisites for implementation, starting from the first days of independence of Kazakhstan. However, in the process of new construction and modernization of existing enterprises, in the presence of low energy prices, the main emphasis fell on the imaginary economic feasibility without due consideration of energy efficiency and energy saving requirements.

In this regard, the decision on the development and large-scale implementation of green technologies should be carefully weighed. Given the possible economic risks, it is still advisable for Kazakhstan to focus on selective areas of alternative energy development. At the same time, it should be borne in mind that, judging by the pace of development of renewable energy sources in the world, at some point the world will switch to renewable energy sources. In this case, countries that do not develop RES risk being left behind by technological progress. [14].

However, the development of renewable energy in Kazakhstan at this stage is hindered by a high level of initial capital investments and a long payback period. Taking into account the existence of significant and relatively inexpensive hydrocarbon reserves, the state needs to create conditions under which it would be economically profitable for investors to invest in the construction of renewable energy facilities. Given the significant costs required for the construction of renewable energy facilities, as well as the development, purchase and installation of the necessary equipment, direct financing should be considered projects at the expense of the national and local budgets under the public-private partnership scheme. Investment risks in this case can be divided proportionally between the state and the private partner, and the responsibility for production costs and direct management of the object will be carried out by the private party. The benefit of such cooperation will be that the state will be able to get the object at a lower cost, while the amount of investment of the business partner will also be more accessible for search. This mechanism does not provide for a significant increase in the tariff, because the private investor will only have to recoup his invested share, and accordingly the cost of energy will be proportionally lower. It is also necessary to consider the possibility of introducing certain tax incentives for banks that support "green" technologies. This economic incentive will primarily encourage banks themselves to develop new types of lending and, accordingly, to develop risk management and analytical services in the field of alternative energy [15].

It should be noted that in the conditions when the cost of extraction of mineral resources is constantly growing, and the level of emissions of harmful substances remains unacceptably high, the development of renewable energy in Kazakhstan needs to pay more attention. Only with comprehensive state support and the creation of economic incentives for investors will this sector be able to take a strong position in the electricity balance of Kazakhstan.

For Kazakhstan, which is experiencing a need for the development of renewable energy, it is of particular interest to study the experience of developing green energy in China. This problem also becomes relevant in the process of preparing the international specialized exhibition "EXPO-2017 "in Astana on the theme" Future Energy ". [16]

The Government of the People's Republic of China (PRC) defines the development of renewable energy sources (RES) as one of the most promising areas of energy. (Lee.C.,2008: 50-65) Currently, the share of green energy in the total energy balance is extremely low and occupies only about 1.5% (excluding hydroelectric power plants-15%), but the Chinese leadership allocates huge financial resources for the development of renewable energy, which is due to the following circumstances:

– insufficient capacity of conventional energy sources to meet the growing needs of the economy;
– increased competition for access to limited global hydrocarbons;
– environmental degradation and climate change due to the use of high-waste types of energy production. [17]

In the short term, China plans to reduce the negative impact on nature through the introduction of alternative energy sources, strengthen national energy security, and create favorable employment opportunities in the technological sectors of the economy. [18] Currently, there are quite a large number of different and often very different forecasts regarding the increase in the share of alternative energy in the total energy balance of China. In turn, the official authorities of the People's Republic of China are making quite ambitious plans in this direction. At the NPC session held in mid-March (The new leadership of the People's Republic of China has set a goal to increase the share of alternative energy sources to 10% of the total energy consumption in the country by 2015. So, according to the Development and Reform Committee, by 2020, China will receive about 20 million kW of electricity from renewable sources, such as water, solar and wind energy. [19]

There are also more ambitious forecasts about the future of renewable energy. According to forecasts of the State Energy Administration of the People's Republic of China, by 2030, the share of clean energy in the structure of energy consumption will make up 50%. [19] According to the goals and objectives of the New Energy Development Program, in the short term, China will focus mainly on the development of 3 types of alternative energy. First of all, we are talking about the use of solar, wind and geothermal energy. At the same time, no less significant importance is attached to the development of hydropower, which currently accounts for 15% of the total energy generated.

Wind Power industry. Today, China ranks first in the world in terms of operating wind power capacity. According to official data, the total capacity of wind farms operating in the country in 2012 increased to 61 GW. According to forecasts of Chinese experts, 100 GW of electricity will be generated by wind in the country by 2015, and 400 GW by 2030. During this period synchronous development is planned all three types of wind power: onshore, offshore, and water.

Solar power industry. Another promising type of alternative energy sources is solar energy. At the moment, China is the second country after Germany in terms of the amount of energy received from solar panels. According to forecasts of Chinese experts, by 2015, China plans to increase the volume of solar energy to 10 GW, and by 2020 - to 50 GW. The largest Chinese suppliers of solar panels and their components are: SunPower (SPWR), Suntech Power (STP) LDK Solar (LDK), Yingli Green Energy (YGE), Trina Solar (TSL) and JA Solar Holdings (JASO) (19 – can't be here).

Hydroelectric power industry. China's hydropower reserves are estimated at 542 GW, and it ranks first in the world in this indicator. That is why hydropower is a priority area within the framework of the Renewable Energy Development Program. According to forecasts of Chinese companies by 2020, 2030 and 2050, the capacity of installed hydropower units in China will reach 300, 400 and 450-500 GW.

So, as it became clear, the Chinese government is currently implementing the world's largest "The strategy for the development of renewable energy sources". As part of the implementation of the concept of energy security until 2015, the Chinese government plans to invest more than 200 billion US dollars in the construction of new renewable energy facilities, which will increase the share of the green economy in the total energy balance of the country from the existing 1.5% to 10% in 2015 and up to 50% by 2030. [20]

Moreover, Xinjiang accounts for the lion's share of planned and already under construction wind farms and solar panels. Given the similarity of climatic conditions in the XUAR and Kazakhstan, China's experience in the construction of renewable energy facilities is the most valuable. This will also enable the necessary

amendments to Kazakhstan's Green Bridge program to be made in a timely manner**,** which designed to create conditions and infrastructure for expanding access to green technologies and investments. [21]

The conclusion of agreements with the Central Asian republics on the supply of energy resources to China and the construction of export pipelines create a qualitatively new geopolitical situation in this region. In this context, it should be noted that when implementing projects related to the Central Asian region, the Chinese leadership will rely mainly on Kazakhstan, which creates competitive advantages for the republic.

The prospects for creating world-class renewable energy in Kazakhstan are initially much more promising due to extremely favorable natural factors, primarily owing to the large areas for installing solar panels and better wind conditions. It should be taken into account that the greatest benefit from the development of renewable energy sources will be obtained through the creation and production of own innovative wind turbines in Kazakhstan, which provide additional cost and production advantages. [22] As a result, through the transition to a green development model, Kazakhstan can achieve:

–effective provision of energy security;

–technical re-equipment and reconstruction of power plants and networks;

–increasing the efficiency of energy consumption;

–ensuring environmental protection and protecting the population from harmful effects.

Conclusion. To achieve the goals of implementing alternative energy based on RES, the following recommendations have been developed:

1. Develop scenarios for diversifying energy production from renewable sources. The regions should: take into account current and prospective capacity allocation and make a detailed analysis in the form of scenarios for the placement of renewable generation capacities; forecast the market and potential use of renewable energy, as well as describe the actions necessary to achieve the targets for the development of renewable energy. Increasing the share of renewable energy sources in energy production will reduce the dependence of economic sectors on fossil fuels, reduce the level of environmental impact, and increase the growth rate of the country's economy. The advantages of renewable energy sources are the availability and prevalence of resources (wind, solar radiation, geothermal energy), modularity and scalability of power plants.

2. In the cities of the country, the potential of renewable energy sources should be evaluated: hydropower, wind energy, solar energy, biomass energy, geothermal energy, and secondary energy resources: waste heat and overpressure. [24]

To model the development of energy based on renewable energy sources, various scenarios of the industry up to 2030 are considered. [25] Scenarios (basic, pessimistic, optimistic) should be formed based on:

1. Modeling the potential contribution of renewable energy sources to the country's energy balance, estimating the normalized cost of energy for new fuel and renewable energy capacities;

2. Calculation of the structure of the cost of electricity production from renewable sources (broken down by source) and comparative analysis of changes in the cost of fuel energy, taking into account the increase in fuel prices;

3. Estimates of the normalized cost of energy produced using VER (with distribution by secondary resources and technologies of their use).

4. Drawing up a plan for every five years that shows the normalized cost and share of traditional and alternative energy;

5. Calculate the energy cost and share in total energy production for RES mentioned in the scenario above: - For example, the cost of energy generated from coal in 2017 is on average x tenge per kWh and will be xx% of annual energy production, and the cost of energy from RES (distributed by source) is y tenge per kWh and corresponds to yy% of annual volume.[26]

The relevant recommendations should focus on initiatives and mechanisms that set university policies in the field of alternative energy for accelerated economic growth in Kazakhstan, taking into account the issues of protection and environmental protection. Efforts aimed at economic growth will take into account the increase in domestic energy production.

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