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Table of Contents:

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Kazakhstan: Assessment of Renewable Energy Support and a Green Economy

Sergey BESPALYY
Innovative University of Eurasia, Kazakhstan
sergeybesp@mail.ru

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Abstract

The growth of renewable energy sources (RES) shows the desire of the government of Kazakhstan to meet challenges that affect the welfare and development of the state. National targets, government programs, policies influence renewable energy strategies. In the future, renewable energy technologies will act as sources of a green economy and sustainable economic growth. The state policy in the field of energy in Kazakhstan is aimed at improving the conditions for the development and support of renewable energy sources, amendments are being made to provide for the holding of auctions for new RES projects, which replaces the previously existing system of fixed tariffs. It is expected that the costs of traditional power plants for the purchase of renewable energy will skyrocket, provided that the goals in the field of renewable generation are achieved. This article provides an assessment of international experience in supporting renewable energy sources, as well as analyzes the current situation in the development of renewable energy in Kazakhstan and the impact on sustainable development and popularization of the «green» economy. The study shows that by supporting the development of renewable energy sources, economic growth is possible, which is achieved in an environmentally sustainable way.

Keywords: renewable energy sources; energy efficiency; decarbonization; energy intensity; energy saving technologies; green economy; sustainable development.

JEL Classifications: Q42; Q57; R11.

Introduction

Compared to the traditional energy carriers of the last century (oil, gas and coal), the rate of growth and commissioning of renewable energy capacities in the new century - starting in 2000 - was truly impressive (although the increase took place from an initially low level). In 2018, the total installed solar PV capacity worldwide reached 505 GW (with a CAGR of 49% over the 10-year period 2006-2016). The installed capacity of wind turbines in 2018 was slightly higher (591 GW), while the increase in capacity was about half that of solar energy (20% per year in 2006-2016). If we take output as a parameter, rather than capacity, the trends will be broadly similar: in 2018, global solar energy production was 584.6 TWh, and its annual growth rate in 2007-2017. were at the level of 28.9%; at the same time, the production of wind energy amounted to 1270 TW*h, demonstrating the growth rate at the level of 12.6% per year. It is predicted that the total volume of new renewable energy capacities that will be commissioned globally over the next years - in 2019-2025. - will be roughly equivalent to the total existing capacity in 2018 and will amount to 1,100 GW.

2018 saw several important advances in the development of renewable energy:

- The cost of the cheapest offer of solar (photovoltaic) and wind (produced by onshore wind farms) energy (bids selected through auctions) fell below $ 25 / MWh, which in many cases is competitive with the prices of fossil fuel capacities;
- The number of countries generating electricity from offshore wind farms has increased to 15;
- Based on the results of the December auctions for the right to lease offshore areas for offshore wind energy facilities off the northeast coast of the United States, a record for the total volume was set;
- Germany has announced plans to completely phase out coal by 2038.

If we talk only about the capacity for the production of electricity using renewable energy sources (not including hydropower), then at least 45 countries exceeded the 1 GW mark, and in 17 countries the total capacity of wind, solar, bioenergy and geothermal energy facilities exceeded 10 GW. At least 9 countries produce more than 20% of electricity at wind farms and solar power plants.

Nevertheless, despite all these achievements and demonstrated rapid growth rates, RES accounted for only one third of the total increase in electricity generation in 2018 (although their share in the increase in new capacity was more than three fifths). At the same time, progress in the renewable energy sector continues to be mainly related to electricity generation, and the growth in the use of renewable sources for heating and cooling, as well as in transport, is much slower (for example, less than a third of countries in the world have mandatory rules (codes) for energy conservation in buildings that provide for energy efficiency standards for heating and cooling). At the same time, the volume of new investments in the use of RES for electricity generation and as a fuel (including - in this case - hydropower projects with a capacity of no more than 50 MW) in 2018 worldwide amounted to 288.9 billion US dollars, which 11% less than in the previous year.

The strategy «Kazakhstan-2050» assumes that natural gas reserves will be used as a «bridge» in the transition from coal to the use of alternative energy sources (RES and nuclear energy) for electricity generation. By 2050, it is planned to provide 50% of the total electricity production in Kazakhstan from renewable and alternative energy sources.

According to the Ministry of Energy of Kazakhstan, in 2019, there were 58 facilities for the use of renewable energy sources, which is about 1% of the installed capacity of generation facilities. By 2020, the Government expects to bring the installed capacity of renewable energy facilities to 2000 MW, of which wind power plants will provide 960 MW, solar power plants - 750 MW and hydroelectric power plants - 290 MW. The share of renewables is expected to increase to 3% of total production in 2020 and to 50% in 2050.

Strategic plan of the Ministry of Energy of Kazakhstan for 2017-2021 aims to ensure the systematic development of renewable energy sources and eliminate the risks of oversaturation of renewable energy sources in the country. The Plan clearly states that the Ministry needs to take restrictive measures in terms of the development of RES in the long term in a volume not exceeding 3% of the total electricity production by 2020 and 10% by 2030. The Plan emphasizes the need to take into account the integration of RES into the Unified energy system of Kazakhstan.

1. Materials and Research Methods

The main goal of the research consists of two main stages:

- the first stage includes an assessment of the state and instruments of support of renewable energy sources in Kazakhstan;
- the second stage includes identifying the impact of the development of renewable energy sources on the environment, as well as proposing measures for the further growth of renewable energy sources with an assessment of sustainable development.

The article provides an analysis and assessment of international research, as well as an overview of Kazakhstani sources devoted to empirical research on the support of renewable energy sources in Kazakhstan, an analysis of statistical information on the growth trends of renewable energy sources. It was revealed that the goals set by the country for the next 10–20 years largely correspond with the development of renewable energy sources and with the goals of transition to a green economy. This is reflected in the general policy of resource use and environmental protection for the future, available economic and legal instruments.

The collected empirical material and its analysis made it possible to determine measures in the formation of effective instruments for supporting renewable energy sources in Kazakhstan.

2. Results and Discussion

Kazakhstan possesses significant resources of fossil fuels. In terms of proven reserves of oil, coal and uranium, the country is among the twelve leading countries, and in terms of natural gas reserves - in the top twenty. Kazakhstan is the world leader in terms of annual uranium production, ranks tenth among countries in the world in coal production and twentieth in terms of oil production.

The reserves of fuel and energy resources are unevenly distributed throughout the country: large coal deposits are located in the northern and central regions, uranium reserves are concentrated mainly in the southern and central regions of the country, oil and gas deposits are located in the western region, and insignificant gas and coal resources are available in the southern region.

Energy intensity of GDP is relatively stable: in the period 2008-2019. it averaged 0.45 toe / 1000 US dollars. However, for several reasons, such as a cold climate, a large number of energy-intensive industrial enterprises and a significant length of transport infrastructure, the amount of energy consumed per unit of GDP (energy intensity) in Kazakhstan is much higher than the indicators of developed countries.

Final energy consumption in the industrial sector decreased by 6.03%, from 53.0% in 2008 to 49.8% in 2015. In 2015, the industrial sector accounted for half of the total final energy consumption (TEC). The share of the residential sector in 2015 accounted for 19.3% of total consumption, which indicates that there has been an increase since 2008. The share of the transport sector in 2015 was about 14%, and since 2008 there has been some growth. The commercial and utilities sector was characterized by volatile dynamics, and in 2015 it accounted for about 11% of the TFC.

The energy performance of buildings is one of the national performance indicators. UNDP conducted an energy audit of buildings, which showed that the average electricity consumption in the residential sector in Kazakhstan is 270 kWh. This exceeds the level of consumption in Europe (100-120 kWh), as well as in the Russian Federation (210 kWh). The main reasons are the cold climate and the high level of heat loss due to insufficient thermal insulation. There is great potential to reduce heat loss and electricity consumption through the modernization of lighting systems in the residential, commercial and municipal sectors.

Although the state program «Energy Saving-2020» has set a goal to reduce the energy intensity of GDP by 40% by 2020, this goal has not been achieved. Nevertheless, energy efficiency has become one of the national policy priorities in Kazakhstan. The most important recent achievement in energy conservation policy in the country is the reduction in the share of incandescent lamps from 74% to 18% of the total number of lighting lamps between 2012 and 2019.

Improving energy efficiency at the national level is extremely important from an environmental and economic point of view. The implementation of energy efficiency measures could reduce energy consumption and therefore increase energy export potential, increase the competitiveness of manufacturing industries and reduce emissions of many pollutants and greenhouse gases.

The energy intensity of the country's GDP remains high in the world rankings. Thus, according to the International Energy Agency, in 2017 the average world energy intensity of GDP was 0.18 tons of oil equivalent, in OECD countries - 0.11 toe, and in Kazakhstan - 0.42 toe. One of the reasons for this is the significant share of energy-intensive industries such as mining and metallurgy, which consume about 67% of the generated electricity.

At the heart of the rapid global expansion of renewable energy capacity lies - in no small measure - the decline in cost from the implementation of a coordinated policy aimed at supporting the widespread adoption of renewable energy sources.

China is one of the best examples in this regard. At present, it accounts for one third of the total global RES capacity - in 2018 alone, 44 GW of solar energy (photovoltaic installations) and 21 GW of wind energy capacity were added to the country's assets (which was half of the global growth for both technologies for year). China's renewable energy base currently generates enough electricity to power Germany, the world's fourth largest economy. But just 10 years ago, there was almost no photovoltaic installation in China, and there were only a few thousand wind turbines, 80% of which were made abroad. The catalyst for the development of renewable energy has been the desire to reduce air pollution in eastern cities of China.

The change in the global paradigm of energy development towards renewable energy sources (mainly wind and solar generation) was primarily due to the international climate agenda. Countries that do not experience a deficit in the supply of fuel resources, nevertheless, are actively developing renewable energy sources in order to replace, first of all, coal generation, which is characterized by the highest greenhouse gas emissions (Mallett, 2013). For example, in the EU-28 countries, the commissioning of new capacities in 2018 consisted of 88% of wind and solar power plants.

Over the past ten years, the total installed capacity of operating solar power plants in the world has increased more than 24 times, wind power plants - by 3.7 times. The total installed capacity of wind and solar power plants in the world in 2018 exceeded 1,000 GW, which is approximately 15.5% of the total installed capacity of power plants in the world.

The growth of renewable energy capacities in the world during this period was accompanied by a decrease in the specific indicators of capital investments for wind and solar power plants by 15% and 20% and, as a consequence, a decrease in the cost of generating electricity from renewable energy sources (Lewis, 2014). According to forecasts of the International Renewable Energy Agency (IRENA), capital investments will continue this trend and will decrease by 12% for wind farms and 57% for solar power plants by 2025.

Kazakhstan's contribution to global greenhouse gas emissions does not exceed 1%, however, the country is one of the ten countries with the highest carbon intensity of GDP. In order to achieve the assumed international obligations and the set internal goals for the transition to a «green» economy, the development of renewable energy sources was actually chosen as the main instrument of the country's climate policy.

As a result, the country's renewable energy sector has developed at an impressive pace over the past five years. Thus, the production of electricity at new solar, wind and small hydroelectric power plants increased 155 times, and the total installed capacity of renewable energy sources (excluding large hydroelectric power plants) reached 632 MW, which is approximately 2.4% of the total installed capacity of power plants in the republic.

As world practice shows, the development of wind and solar energy took place mainly within the framework of state support mechanisms, without which such plants are uncompetitive compared to traditional ones (Lema *et al.* 2015). In Kazakhstan, the development of renewable energy sources has also acquired a high level of state support. Thus, in 2009, the Law «On Supporting the Use of Renewable Energy Sources» was adopted. Later, in 2013, a mechanism of state support for the renewable energy sector was launched.

It is based on a centralized guaranteed purchase through the «Financial Settlement Center of RE» (FSC) of all electricity produced by renewable energy sources at fixed rates. However, in contrast to the traditional approach, when payment for RES generation is carried out directly by end users, in Kazakhstan the responsibility for the implementation and success of RES support was assigned to traditional power plants. Conventional consumers of RES electricity, which include traditional power plants and electricity importers, were legally obliged to buy electricity from the FSC in proportion to their share in the total electricity generation.

The legal framework created in Kazakhstan to support renewable energy sources provides for the most favorable level of regulated stability and predictability for investors.

The main mechanisms for supporting renewable energy sources:

- guarantees of tariff stability - tariffs are issued for 15 years with annual indexation depending on the inflation rate. For projects financed with loans in foreign currency, tariffs may be indexed taking into account the exchange rate difference;
- guarantees of purchase of the entire volume of generated electricity;
- guarantees of connection and access to the grid - obligations of grid companies for the priority connection of renewable energy facilities;
- exemption from payment for services for the transmission of electricity through electric grids.

Fixed tariffs for renewable energy sources were adopted in Kazakhstan at a fairly high level, several times higher than the marginal tariffs of traditional power plants, which made it possible to attract the attention of investors, Table 1.

Table 1. Comparison of cap and fixed tariffs in 2018

Unit of measurement	Limiting tariffs				Fixed tariffs			
	Coal-fired CHPP	Gas CHPP	GTPP	HPP	Wind power plants	SES	Small HPPs	BioTES
Tenge / kW * h (excluding VAT)	7.5	7.6	12.7	4.5	22.7	34.6	16.7	32.2

Source: National Energy Report 2019

As a result, the total number of applications for the construction of renewable energy facilities in 2015 amounted to about 7 GW with a total installed capacity of the Kazakhstani energy system of 21 GW. Due to the impossibility of integrating such a number of RES capacities into the energy system, the unstable nature of energy generation at solar and wind power plants and the lack of maneuverable capacities, the question soon arose about the need to limit the introduction of RES. In 2016, amendments were introduced to the legislation, providing for the gradual introduction of renewable energy capacities with the approval of targets, Table 2.

Table 2. Target indicators for the development of the RES sector until 2020, MW.

Type of renewable energy	2020 (approved)	2025 (projected)
Wind power plants, MW	933	1200
Photovoltaic power plants	467	1100
Small hydroelectric power plants	290	219
Biogas plants	10	15
Total RES capacity	1700	2615

Source: Law of the Republic of Kazakhstan «On Support of Renewable Energy Sources», 2016 No. 165-VI

The approval of the target indicators meant that in conditions of high interest in the implementation of renewable energy projects and with a significant number of applications for the construction of facilities, the need to create transparent conditions for the selection of projects. Taking into account the proposals, a variant of the auction mechanism for the selection of projects was chosen. In 2017, amendments were made to the Law of the Republic of Kazakhstan «On the Support of Renewable Sources» to provide for holding auctions to reduce the cost of electricity among new RES projects (this mechanism does not apply to existing and under construction RES projects that have already received fixed tariffs).

The results of the first auction in 2018 demonstrated the efficiency and transparency of the new selection mechanism, which led to a significant reduction in tariffs for supporting renewable energy sources, Table 3. Thus, for solar power plants the average cost reduction of kWh was 34%, for wind and hydroelectric power plants of low power - about 13%. Participants in trades held on the electronic platform were able to offer their tariffs during a 3-hour trading session. A 15-year contract has been signed with the supplier with the lowest tariff. In this case, tariffs will be indexed.

Table 3. Reduction of tariffs for renewable energy sources based on the results of the auctions in 2018, tenge / kW * h

Object types	Minimum tariff (auctions)	Average tariff (auctions)	Starting value of the tariff
Wind farm	12.8	19.8	22.7
Solar farm	18	22.6	34.6
Small hydroelectric power plants	13.1	14.5	16.7

Source: Settlement and Financial Center for Renewable Energy Support

The auction mechanism for the selection of renewable energy projects is a worldwide trend. According to IRENA, more than 67 countries have already implemented an auction / tender mechanism for selecting renewable energy projects. At the same time, the principles for selecting projects vary.

113 companies from 9 countries participated in the auctions. As a result, 36 projects with a total capacity of 857.9 MW were selected. The greatest demand was for the placement of solar power plants, according to the FSC, Table 4.

Table 4. Target indicators and commissioned RES capacities, results of auctions in 2018, MW

Types	2018, capacities selected	2019, commissioned capacities	2020, targets
Wind farm	501	227	933
Solar farm	270	250	467
Small hydroelectric power plants	82	200	290

Source: Settlement and Financial Center for Renewable Energy Support

The essence of the mechanism introduced in Kazakhstan is to conduct an electronic auction among investors in renewable energy sources to reduce the cost of electricity produced.

The winner of the auction is the investor who offered the lowest electricity price. FSC enters into an agreement with the winners for the purchase of all electricity produced from the moment the power plant is launched at the price determined at the auction At the same time, investors undertake to start construction and commission facilities within the time frame established by law. Auction winners contribute 10,000 tenge (US $ 26) of financial security for each kW of their project. Failure to comply with the terms of the start of construction and commissioning of the power plant entails the imposition of fines in the amount of 30% and 70% of the financial security, respectively, and termination of the contract.

Consider changes in support policies in OECD countries. Off-market privileges and support have been standard practice in promoting renewable energy development. However, the growth in renewable energy generation, combined with the chronic problem of «shortage» of money (when the price of electricity on the wholesale market does not cover all the costs of its production) led to an even greater drop in prices and the need for early decommissioning of thermal power plants, has not yet been completed. At the same time, thermal generation is still needed to balance the volatile RES production, depending on weather conditions.

In this regard, many countries and the European Federation of Energy Traders announced the need to withdraw or reduce the level of support for renewable energy sources. Major changes in support and new requirements for RES include the following aspects:

- responsibility for balancing should be assigned to all types of generation, including renewable energy sources;

- cancellation of priority dispatching and network access;
- dispatching should be based on the cost of electricity, and not on the obligation to pay preferential fixed tariffs;
- the procedure and cost of connecting to the grid for RES should be the same as for traditional power plants;
- the final prices of renewable energy sources should reflect the costs of electricity transmission;
- preferential fixed tariffs should be phased out;
- the price of electricity on the wholesale market must be cleared of the influence of mechanisms for supporting renewable energy sources and policies in the field of climate improvement, environmental taxes and fees, with their transfer to the state budget.

With an increase in the share of renewable energy generation (especially wind power plants and solar power plants), the ability of the wholesale electricity price to respond to changes in the balance of supply and demand, as well as to the need for investments (in energy storage systems, demand management, flexible generation) increases. In this connection, in the USA, Canada, and Europe, there is an acute issue of the abolition of operating privileges and benefits for connecting renewable energy facilities to the network.

Despite the significant increase in the capacity of renewable energy sources and the effective reduction in the cost of the policy to support them, there are risks of long-term development of renewable energy sources associated with an increase in the financial burden on traditional power plants.

The revenues of traditional power plants, which are obliged to purchase RES electricity in full through the RFC, are limited by the maximum tariffs for electricity and capacity. At the same time, according to the latest amendments to the legislation, the maximum tariffs for electricity and capacity for traditional stations have been reduced by an average of 20-25% and will remain unchanged until 2025.

In turn, the generation of electricity from renewable energy sources can grow to 5.6 billion kWh by 2022, that is, 7 times compared to 2018. As a result, the costs of traditional power plants for the purchase of renewable energy sources will increase significantly, while their income remains unchanged.

Currently, the share of costs of traditional power plants for the purchase of renewable energy (from the RFC) does not exceed 2-4.5% in the total cost structure. By 2021, the costs of power plants for the purchase of renewable energy (if the target indicators are achieved) will already amount to 15-30% of the total costs, Table 5. At the same time, as already noted, the maximum tariffs for electricity and capacity will remain at the approved for 2019-year level until 2025. Together with rising fuel costs and other costs, this can lead to a critical financial situation in conventional energy. As a result, this will contribute to the growth of non-payments in the purchase of electricity from renewable energy sources and the general financial instability of the electricity sector.

Table 5. Costs for the purchase of RES electricity, 2016-2022, billion tenge

Indicator	2016	2017	2018	2019	2020	2021 (forecast)	2022 (forecast)
Costs in monetary terms	10	15	20	60	100	140	170

Source: Settlement and Financial Center for Renewable Energy Support

Thus, the current model of implementation and financing of support for renewable energy in Kazakhstan, combined with the tariff policy for conventional power plants, poses a significant risk to the sustainable development of both renewable energy sources and conventional generation.

Kazakhstan has been declaring its interest in the construction of a nuclear power plant for many years. A potential project for the construction of a nuclear power plant has a number of advantages: nuclear fuel is produced domestically, there are no emissions of greenhouse gases or other harmful substances, modern nuclear power has very little radiation impact on the environment (less than coal combustion), and only a small amount of radioactive waste that can be stored in remote and safe areas.

In the normal operation of nuclear power plants, the health risks are much lower than the risks associated with the operation of coal-fired power plants. At the same time, there is a risk of the release of large quantities of fission products into the environment in the event of an accident. The construction and operation of a nuclear power plant can potentially have the environmental impacts associated with projects of this kind. It is important to ensure compliance with international standards for the construction and operation of power plants and communicate the compliance strategy to all stakeholders.

Green economy and alternative energy. The environmental policy is being built in accordance with the Kazakhstan-2050 Strategy. The transition to a «green» economy has become a new direction in the country's

development. For this, the «Concept for the transition to a green economy» was adopted. Measures for the transition to a green economy:

- energy saving and energy efficiency improvement;
- development of the electric power industry;
- air pollution reduction and conservation;
- effective management of ecosystems.

The concept for the transition to a green economy sets ambitious goals for increasing the share of alternative (including nuclear) energy in the energy balance: 30% in 2030 and 50% in 2050, while maintaining the existing volumes of coal production. These goals do not find application in the current conditions: in 2017, wind and solar energy sources together produced only 0.43% of electricity, while hydroelectric power plants accounted for 10.90% of the country's electricity generation. Nuclear energy has not yet been developed in Kazakhstan.

The Concept focuses on five key areas related to climate change, for which appropriate investments are planned to be attracted from funds of private investors. These areas include:

- Greening the electricity sector: transferring generating capacities from coal to gas, combined with a significant increase in the share of alternative energy sources;
- Improving energy efficiency in the manufacturing industry: additional investments in energy-saving technologies in key manufacturing industries, including metallurgy, chemical, mining, food, pulp and paper, construction and mechanical engineering;
- Improving energy efficiency in the transport sector: additional investments in energy saving technologies in the transport sector;
- Improving energy efficiency in the heating sector: additional investments in improving the efficiency of boiler houses, reducing losses in heating networks of district heating systems and energy saving measures in buildings;
- Sustainable agriculture: investing in water efficiency and land productivity.

In 2018, the concept was revised. The document now includes a separate chapter on climate mitigation, directly linked to the low-carbon strategy.

Subsidization schemes for green projects. There are several subsidy schemes for green projects in Kazakhstan, but they are not large-scale. For example, the Ministry of Energy provides subsidies for projects to create stand-alone renewable energy plants. Imported equipment for renewable energy sources is exempt from customs duties in accordance with the Law «On Supporting the Use of Renewable Energy Sources».

Another area of support is improving energy efficiency. Kazakhstan's Ministry of Investment and Development and the Damu Entrepreneurship Development Fund have begun supporting renewable energy and energy conservation enterprises with a much broader goal of helping the country move towards a green economy. As a result, in 15 cities, including Nur-Sultan, Kostanay, Shymkent and Taraz, by 2020, energy-saving technologies have been introduced to reduce specific carbon emissions and improve energy efficiency of infrastructure.

The total cost of the project is estimated at US $ 6 billion and is planned to be supported through subsidies using the same mechanism used by the Damu Entrepreneurship Development Fund. The project envisages the use of commercial loans for the implementation of projects related to low-carbon technologies, with the coverage of 10% of the bank loan rate by the state in order to improve the financial performance of the project and reduce the payback period.

While Kazakhstan seeks to promote the creation of new sectors that have a positive impact on the environment (within the framework of the Concept for the transition to a green economy), some historical circumstances hinder this intention. For example, Kazakhstan remains one of the last three countries in the world to produce and export chrysotile asbestos, instead of which substitutes, alternative materials and new technologies that are less harmful to human health and the environment are used in OECD countries. Volumes of asbestos production in Kazakhstan in 2008-2019 ranged from 243,400 tons to 179,800 tons.

Investing in the environment and people will make economic growth even higher in the long term. A green economy is a strategy that can ensure that long-term economic growth can be even higher with greener, greener businesses.

Green jobs. Kazakhstan does not record green jobs using any internationally recognized definition. For example, the International Labor Organization (ILO) definition of jobs that are simultaneously consistent with the principles of employment in the production of green products and services, employment in green processes and decent work. The concept for the transition to a «green» economy provided that as a result of the transformations carried out as part of the creation of a «green» economy, by 2030, 500-600 thousand new jobs will be created in

five industrial clusters («green construction» - construction of buildings taking into account environmental norms and requirements, agriculture, energy sector, waste management and water resources management).

According to estimates contained in the Concept for Green Economy Transition, the total investment requirements for its implementation in the period from 2014 to 2049 will amount to USD 20 billion. This amount covers energy supply and consumption, water resources, air pollution, waste management and efficient agricultural practices.

This indicator is quite large and amounts to 1.8% of GDP in the period from 2020 to 2024 and about 1% of GDP for the entire implementation period.

While the Concept assumes that most of the investment will be funded by private investors, it does not indicate the sources and measures to stimulate such private sector investment (Table 6).

Table 6. Investment needs for the implementation of the Concept for the transition to a green economy

Need	2014-2015	2016-2017	2018-2019	2020-2024	2025-2029	2030-2039	2040-2049
Funding needs as a percentage of GDP	0.3	0.4	1.2	1.7	0.7	0.5	0.6
Average annual funding requirements for the period (US $ billion)	0.6	1.0	3.1	5.5	3.0	3.0	3.8

Source: Green Economy Transition Concept

Among the various sectors and activities included in the Concept for the transition to a green economy, the development of renewable energy and gas infrastructure, energy efficiency in buildings, heat supply, transport, industry and more efficient use of water resources account for 87% of total investment needs. Despite the fact that Kazakhstan does not assess the level of costs specifically for adaptation to climate change, the targets (and the corresponding costs) for the sustainable use of water resources and efficient and highly productive agriculture included in the Concept for the transition to a green economy, to a large extent associated with adaptation (Bespalyy 2021).

Green public procurement (GPP) can be an important driver of innovation, encouraging industry to develop environmentally friendly jobs, products and services. GPPs can also provide financial savings for government agencies, especially if costs are taken into account throughout the entire life cycle of the contract, and not just the purchase price. The 2015 Public Procurement Law requires organizers of competitive public procurement procedures to establish several criteria for determining a supplier. One of the criteria is the availability of certified environmental management systems and / or confirmation of compliance with the standards of environmentally friendly products in accordance with national legislation in the field of technical regulation. The Law also mentions the principles of procurement of innovative and high-tech goods, works and services that can be linked to green procurement.

Despite such high expenditures on procurement and procurement reforms, Kazakhstan is currently not tapping into the potential of sustainable public procurement to pursue green growth opportunities.

In the statistical system, environmental expenditures mainly consist of recurrent expenditures and investments from the public and private sectors. According to the definition of the Agency on Statistics of Kazakhstan, operating costs include production costs for environmental protection, environmental payments, payments for the use of natural resources and compensation for damage.

The volume of current expenditures on environmental protection increased from 91 billion tenge in 2008 to 175 billion tenge in 2015, but in 2016 it decreased to 152 billion tenge. Investments in environmental protection in the period from 2012 to 2019 fluctuated within a fairly wide range from 75 billion tenge (0.2% of GDP), in 2012 to 103 billion tenge (0.3%) in 2014. and 43.9 billion tenge (0.1%) in 2019. Current spending and investments in environmental protection as a percentage of GDP decreased from 1.03% in 2009 to 0.42% in 2019.

Investments in measures to reduce air pollution over the past few years accounted for the largest share of investments in environmental protection - about 40% of the total investment in 2019.This is followed by investments aimed at protecting water resources (23%), waste management (19%), as well as the protection of soil, groundwater and surface waters (10%). The total value of investments fluctuates from year to year: 50 billion tenge in 2008 (0.3% of nominal GDP), 90 billion tenge in 2010 (0.3% of nominal GDP), 103 billion tenge in 2014 (0.3%) and 44 billion tenge in 2019 (0.1%).

Environmental spending also varies significantly across regions. For example, the Aktobe, Atyrau, Karaganda, Mangistau and Pavlodar regions have relatively high levels of environmental protection spending,

especially in the Atyrau region, where current spending on environmental protection in 2019 was twice the 2008 level.

There are several public financial institutions that are investing in projects designed to facilitate the country's transition to a green economy. However, at the same time, the country does not have a clear definition of 5 types of activities in the field of «green finance» and the corresponding instruments that would be agreed at the national level and could be provided by these government agencies. In addition, these institutions are not required to incorporate climate or environmental risks into their corporate governance frameworks.

JSC «National Management Holding Baiterek» (NMH «Baiterek») was established in 2013. Development Bank of Kazakhstan (DBK), established in 2001 and currently owned by JSC NMH «Baiterek», in the period from 2001 to 2019 invested funds in 127 projects, the total amount of loans for which amounted to 3.47 trillion. tenge (10.86 billion US dollars); some of these projects are related to the development of renewable energy and energy conservation. These include a small HPP with a capacity of 25 MW on the Turgusun River (5 billion tenge from DBK), Moinakskaya HPP with a capacity of 300 MW on the Charyn River (38.8 billion tenge from DBK) and a 50 MW wind power plant in the village of Kostomar (30.5 billion tenge from DBK).

Damu Entrepreneurship Development Fund JSC was established in 1997 and also belongs to Baiterek NMH JSC. Damu Fund has been supporting SMEs in Kazakhstan over the past two decades, playing an important role in reducing the overall level of interest rates on loans to SMEs. Examples of financial instruments provided by the Damu Fund are lending on concessional terms through second-tier banks within the framework of targeted programs for specific areas and industries; microcrediting through microcredit organizations; subsidizing loans to reduce the interest burden on loans; and the provision of a guarantee instrument in the form of incomplete guarantees as collateral for bank loans.

The Damu Fund and the Ministry of Industry and Infrastructure Development of Kazakhstan signed an agreement to provide financial support to enterprises planning to implement energy saving projects in 2017. The UNDP / GEF Sustainable Cities for Low Carbon Development project agreed to provide a grant of US $ 3 million. The Damu Fund also entered into an agreement with the European Investment Bank (EIB) in 2016, according to which the EIB provided the Damu Fund with credit lines guaranteed by the NMH Baiterek; credit lines should be available for green projects that contribute to climate change mitigation, energy efficiency, energy efficiency and environmental protection.

National Wealth Fund Samruk-Kazyna JSC owns assets of 64.7 billion US dollars (about 21.2 trillion tenge), and the number of its personnel is 327,000 people. Its task is to improve national welfare and support the modernization of the country's economy. Subsidiaries of the Fund (for example, Samruk-Energo JSC) finance several projects in the field of renewable energy, although the latter still constitute a small share in the total investment of Samruk-Kazyna. These renewable energy projects include 45 MW and 50 MW wind farms near Ereimentau (total project cost; 43 billion tenge) and a 2 MW solar power plant in Kapshagai (total project cost; 1.7 billion tenge) which together account for about 2% of total assets.

The Astana International Financial Center was established in 2015 and became fully operational in 2018. One of the six priority tasks of the Center is to promote the development of green finance by providing the necessary conditions and infrastructure.

The Astana International Financial Center and the EBRD worked on the Kazakhstan Green Financial System project, which focused on developing a green bond market in the country. The Center has added elements related to green bonds to the Astana International Exchange's rulebook, which will clarify the definitions of green projects eligible, for example, to issue green bonds, listing conditions for issuers and reporting rules after issue of bonds.

Environment-related FDI accounted for 0.2% of gross foreign investment in 2019, up from a high of 1% recorded in 2014. This suggests that FDI is mostly directed to brown industry. For example, in 2015, 53% of the total FDI inflow into the country (or USD 72 billion) came from exploration, followed by mining and quarrying (19%). A certain amount of FDI (10%) is attracted by the manufacturing industry, with the largest inflow of FDI in 2018 in the metallurgical and metalworking industry (84%), followed by the production of food and tobacco products (7%).

The climate of Kazakhstan creates good conditions for the development of wind energy in the country. About 50% of the country's territory has an average annual speed of 4-5 m / s (at an altitude of 80 m), despite the fact that it is this wind speed that is the norm for the construction of wind farms in Europe.

According to UNDP / GEF, the potential of wind energy in Kazakhstan exceeds the needs of the entire country by 10 times. In total, wind farms installed in windy places can generate about 920 billion kilowatt-hours of electricity per year, and this is a potential that can be realized.

Kazakhstan possesses significant resources of solar energy. The estimated potential generation of solar energy in the country is 2.5 billion kW/h in the city. For comparison, in 2019, Kazakhstan generated only 94 490.4 million kW/h, which indicates a large unrealized potential.

Meanwhile, this area is interesting for investors: in 2017, the construction of the largest solar power plant in Central Asia began in the city of Saran (Karaganda region) with the participation of Czech and Slovak investors.

On the map of solar resources of Kazakhstan, the most promising regions for the construction of solar power spaces in Kazakhstan can be identified - these are Mangistau, Kyzylorda, Turkestan, Zhambyl, Almaty, Karaganda, as well as East Kazakhstan regions.

Conclusion

1. Taking into account the predicted by IRENA the decrease in the cost of construction of wind power plants and solar power plants in the period after 2025, when setting targets for the development of renewable energy sources until 2025, the rate of commissioning of their capacities should be reduced, with the postponement of the main inputs to the subsequent period.

Revise the mechanism for supporting renewable energy sources through traditional generation in the direction of non-discriminatory mechanisms generally recognized in world practice. If the existing mechanism is preserved, at least introduce a surcharge into the marginal electricity tariffs for traditional power plants, taking into account the growth of costs for renewable energy until 2025.

2. Provide for amendments to the tariff regulation of power grid companies, stimulating the development of networks and services, in order to integrate RES capacities.

3. After 2025, provide for the transition to market mechanisms for paying for RES electricity through the mechanism of contracts for differences.

4. By 2025, introduce payment for services for the transmission of electricity through electric grids for power plants using renewable energy sources.

5. Provide for the development of opportunities for the structure of the energy market through the growth of variable and distributed generation. Changes are needed in the regulatory standards system. Some regulations may be related to infrastructure or market structure. This will make it possible to make the country's energy system more flexible.

6. Prepare solutions in the field of electric mobility for the energy system of Kazakhstan. Energy efficiency development is possible with synergy between the energy and end-use sectors.

7. Promote attraction of investments in the development of renewable energy technologies. State authorities should move away from the practice of providing grants and loans, and switch participation in the form of providing financial guarantees to cover investment risks, thereby having a beneficial effect on attracting private investors and allowing the development of the electricity market.

8. Introduce new capital market instruments, ensure the popularization of the environmental bond market. Fixed Income Company (YieldCo), an instrument to raise equity financing for renewable energy while improving market liquidity.

9. State Unified Accumulative Pension Fund to act as an institutional investor, invest in large renewable energy projects. These investments can provide stable income over the long term.

10. Develop the use of renewable energy business models: corporate procurement of renewable energy, leasing with or without securitization.

11. Develop infrastructure for sustainable development. The need for infrastructure investment in Central Asia is estimated at US $ 492 billion for the period 2015-2030. In Kazakhstan, there is a need to develop a transformation agenda to fundamentally align incentives and infrastructure financing to achieve climate and development goals.

12. Given that Kazakhstan has a large territory, and many rural areas are remote from republican roads, a state policy is needed in the development of autonomous energy systems, possibly within the framework of a public-private partnership, while measures are needed to stimulate and simplify access to debt and grants. financing.

13. Creation of a new technological order, based on the principles of a «green» economy, which should replace the carbon and eco-wasteful one. The green economy model should complement, but not supersede, the sustainable development model.

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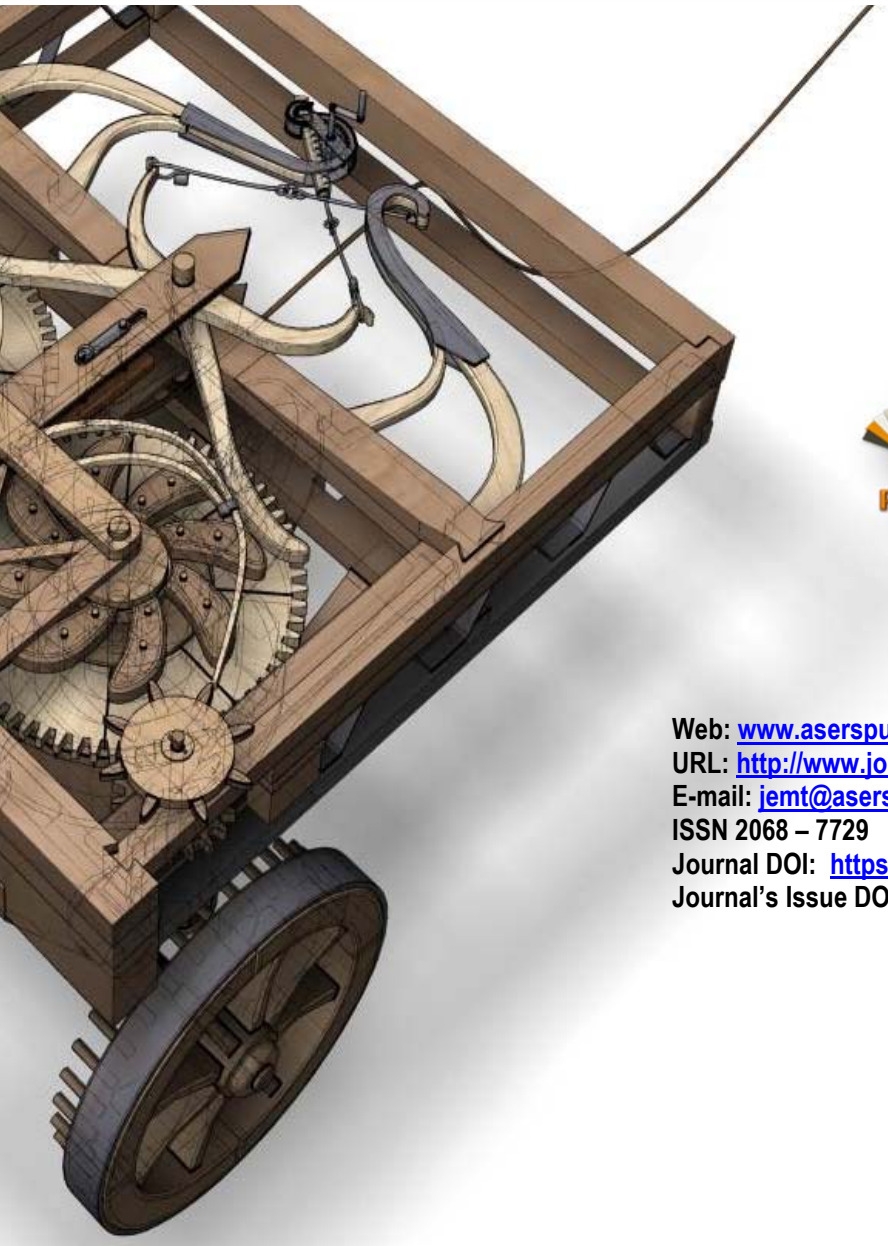

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