WORLD BANK GROUP

SAMRUK KAZYNA

Green Economy: Realities & Prospects in Kazakhstan

August 2018

TABLE OF CONTENTS

PREFACE 4
ACRONYMS AND ABBREVIATIONS 5

1. Introduction 6
2. Overview of green growth policies in Kazakhstan 7
3. Green growth in Kazakhstan 8
4. Renewable energy in Kazakhstan 11
4.1 Hydropower plants 14
4.2 Wind power plants 15
4.3 Solar power plants 16
4.4 Key risks and challenges for RES development in Kazakhstan 18
5. Energy saving and energy efficiency in Kazakhstan 20
6. Green transportation in Kazakhstan 23
7. Waste management in Kazakhstan 24
8. Development of sustainable and effective organic agriculture 25
9. Sustainable use of water resources 26
10. Conclusion 28

REFERENCES 30
APPENDIX 32

PREFACE

Kazakhstan has a vast cumulative potential of renewable energy sources, while at the same time the country is the largest greenhouse gas emitter in Central Asia. Despite significant economic, social and environmental benefits, the share of renewable energy sources in Kazakhstan's electricity production remains low at 1.1% in 2017. The government targets to raise this to 50% by 2050. As long as Kazakhstan experiences issues with economy and energy sources diversification, inclusive green growth concept is especially relevant to the country.

This report analyzes the current state of green economy transition, including development of renewable energy sources, green construction, green transportation, waste management, sustainable and effective organic agriculture, sustainable use of water resources. The report draws attention on key risks, challenges and obstacles for green economy development in Kazakhstan, as well as provides recommendations and measures to resolve existing challenges. In addition, the report considers the government's green economy transition policies, which are yet to meet the country's targets on large-scale transition to green economy. This report may benefit parties interested in sustainable economic growth: the government, energy producing companies, investors in renewable energy sources, and society in general.

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
CIS	Commonwealth Independent States
CO2	carbon dioxide
EBRD	European Bank for Reconstruction and Development
EUR	Euro
FAO	Food and Agriculture Organization of United Nations
HDI	Human Development Index
GBPP	Green Bridge Partnership Program
GCF	Green Climate Fund
GDP	gross domestic production
GW	gigawatt
HPP	hydropower
MW	megawatt
MSW	municipal solid waste
m3	cubic meter
NOx	nitrogen oxides
ha	hectare
IMF	International Monetary Fund
KW	kilowatt
kWh	kilowatt hour
KZT	Kazakhstan tenge
LEED	Leadership in Energy and Environmental Design
OECD	Organization for Economic Cooperation and Development
PV	photovoltaic
RES	Renewable energy sources
SOx	sulphur oxides
SPDAC	Development of the Agroindustrial Complex
TWh	terawatt hour
UNEP	United Nations Environment Program
USD	United States dollar
WB	World Bank

1. Introduction

Over the past decades, majority of developed and developing countries prioritized sustainability of economic growth, enhancement of resource use and reduction of harmful effects on the environment. The concept of green growth, which focuses on achieving sustainable growth through the efficient and responsible use of natural resources, has become an integral part of economic policy for numerous governments since its introduction in late 2000's (Organization for Economic Cooperation and Development or OECD, 2009).

While rapid economic growth can be achieved by aggressive consumption of scarce resources, disregard towards pollution and environmental costs or other unsustainable policies, eventually such expansion is destined to backfire wiping out any positive gains or achievements as evidenced by numerous examples worldwide (International Monetary Fund or IMF, 2011). Inclusive green growth goes beyond efficient use of natural resources and environmental protection; this concept emphasizes the importance of balanced and widespread growth as the only sustainable option for long-term development.

Inclusive green growth is especially relevant for Kazakhstan due to the focus on:

- **Sustainable economic growth.** Kazakhstan economy has low diversification with oil & gas, mining and agriculture playing key roles in economic growth. Concurrently, commodities and primary goods occupy a large share of Kazakhstan's exports. External trade and economic diversification are constrained by a number of factors including inefficient logistics and underdeveloped infrastructure, which play a key role in the region, since Kazakhstan is landlocked and depends on neighboring countries for access to global markets. Underdeveloped or deteriorating infrastructure results in high costs and losses, especially in transportation and power transmission (Asian Development Bank or ADB, 2006).

- **Renewable natural capital** (i.e. fresh water and sustainable agriculture) **and clean physical capital** (e.g. solar panels, wind turbines, and green public transport systems). Kazakhstan continues to experience legacy problems with access to fresh water and electricity generation and distribution. In addition, unsustainable agriculture practices and consumption of natural resources exacerbated some environmental problems. Thus, Kazakhstan witnessed an environmental disaster in the Aral Sea region and faces serious water security risks in the nearest future (United Nations Environment Program or UNEP, 2014).

- **Developed human and social capital** (e.g. equal access to opportunities and social services). Despite a relatively high Human Development Index (HDI) a large part of the region's population is unemployed, unproductively or informally employed, while poverty rates remain elevated especially in rural regions (World Bank or WB, 2013). Moreover, quality of life in the region is dragged down by lack of access to basic services, electricity and fresh water in some areas. Access to basic social services and essential infrastructure is complicated by low population density and a large share of population living in rural areas.

2. Overview of green growth policies in Kazakhstan

In line with the global drive for inclusive and sustainable growth, Kazakhstan has adopted national development programs and policies to create preconditions for sustainable development. Kazakhstan became the first country in the Central Asia that established an institutional foundation for the transition towards green growth through the adoption of several legislative documents, including the Environmental Code (2007), the Law on Support for the Use of Renewable Energy (2009), the Concept for the Transition to Green Economy (2013). The authorities established a productive relationship with numerous international financial institutions and strategic partners in regards to the promotion and development of renewable energy sources, clean technologies and infrastructure. In addition, Kazakhstan is promoting international cooperation for sustainable development under the Green Bridge Partnership Program (GBPP).

Kazakhstan faces structural imbalances, socio-economic and environmental challenges, such as over-dependence on commodity exports, uneven distribution of wealth, low standards of living and limited access to basic services. Environmental problems include water scarcity, inefficient use of natural resources, high-energy intensity, unsustainable agriculture practices and food security issues as well as poor waste management.

To date, Kazakh government adopted a number of strategies, development programs and action plans that target sustainable growth, but it is clear that underlying problems remain unresolved, while regional cooperation efforts have limited effectiveness. Resolving and overcoming environmental, social and economic issues would require comprehensive policies from the government as well as joint collaboration between regional authorities.

Kazakhstan is endowed with robust renewable energy potential that can fuel sustainable economic development and growth. Kazakhstan's wind energy potential is 10 times larger than the country's projected electricity needs by 2030. Kazakhstan adopted primary legislation on renewables and established support measures, such as grid access and feed-in tariffs. However, Kazakhstan is the only country, which has both solar and wind power generation capacities in the region, leading the drive for renewable energy.

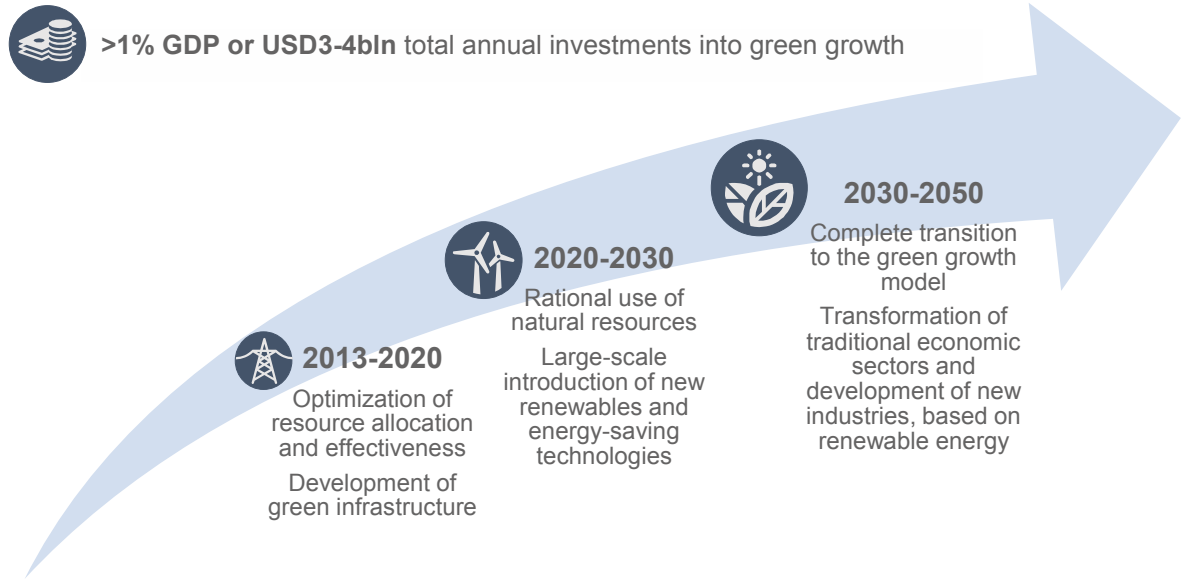
Development and widespread adoption of renewable energy sources (RES) in Kazakhstan is constrained by:

- High subsidies for traditional energy sources.
- Low electricity prices
- Limited long-term financing
- High initial investment costs due to imported technologies
- Limited expertise in RES
- Lack of awareness

3. Green growth in Kazakhstan

Transition to green growth is an essential priority for Kazakhstan, since the country's economic development is currently heavily concentrated on extractive industries and commodity exports. Concurrently, most sectors of the economy have relatively high levels of energy intensity and pollution as well as low energy efficiency. Kazakhstan's Green Economy Concept targets improving efficiency of resource use and promoting new technologies to ensure sustainable growth for future generations.

Timelines of Kazakhstan's transition to green economy (2013-2050)



Source: Kazakhstan's Ministry of Energy, Samruk-Kazyna

The concept focuses on seven key directions[1]:

- Development of renewable energy sources
- Energy saving and energy efficiency
- Development of sustainable and effective organic agriculture
- Waste management
- Sustainable use of water resources
- Development of green transportation
- Conservation and effective management of ecosystems

[1] *This report focuses mostly on the first two directions due to information availability and relatively more projects under implementation.*

Targets and target indicators of transition into green economy

Indicator	Target description	2020	2030	2050
Water resources	• Eliminate the shortage of water resources at the national level	Provide water to population by 2020	Provide water to agriculture by 2040	Solve the problem of water supply once and for all
	• Eliminate the shortage of water resources at the basins' level	Fastest possible covering of deficiency in basins (by 2025)	By 2030 no deficiency in each basin	
Agriculture	• Labor productivity in agriculture	3 times increase		
	• Wheat yield (KZT/ha)	1.4	2.0	
	• Costs of irrigation water (m3/KZT)	450	330	
Energy efficiency	• Reducing energy consumption of GDP, compared with the level of 2010	25% (10% by 2015)	30%	50%
Electric utility industry	• Share in electricity generation: • alternative sources	Solar and wind: at least 3% by 2020	30%	50%
	• Gas-fired power station • Gasification of regions	20% Akmola and Karaganda regions	25% Northern and eastern regions	30%
	• Decrease from the current level of CO2 emissions in the electric utility industry	Level of 2012	15%	40%
Air pollution	• Emissions of SOx, NOx in the environment		European level of emissions	
Waste disposal	• Provide solid municipal waste disposal to population		100%	
	• Sanitary storage of waste		95%	
	• Share of recycled waste		40%	50%

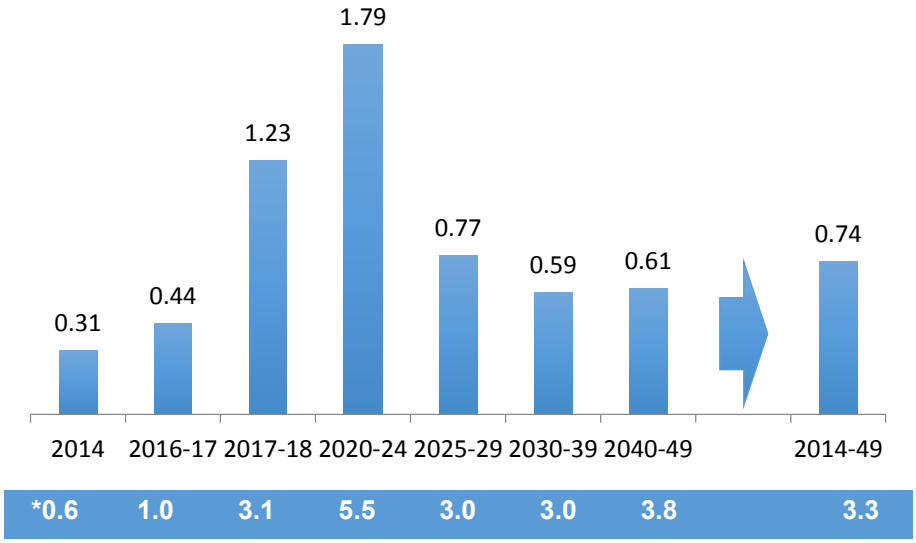
Source: Kazakhstan's Green Economy Concept

The implementation of **green technologies** is expected to **improve energy efficiency in the Kazakhstan's economy by 40-60%** and **reduce water consumption by 50%**. In addition, transition to a green growth model will **create more than 500,000 new jobs** in traditional and new industries, while improving living conditions and providing a high quality of life for the entire population of the country (Green Economy Concept, 2013).

Transition to green growth would require effective coordination of efforts between the authorities, domestic and international investors, and the society. Consequently, joint implementation of government policies would result in dynamic and sustainable economic growth, which would be resilient to adverse economic and environmental developments.

The total investment required to implement the program is estimated to average at USD3-4bln annually for the period of 2014-2050. The largest annual investment will be required in 2020-2024 at approximately 1.8% of GDP. It is planned that most of funding will be attracted from private investors.

Funding needs for Green economy transition, % of GDP



**Average annual funding needs for period, USD bln in 2010 terms*
Source: Kazakhstan's Green Economy Concept

Total funding needs in sector breakdown, USD bln

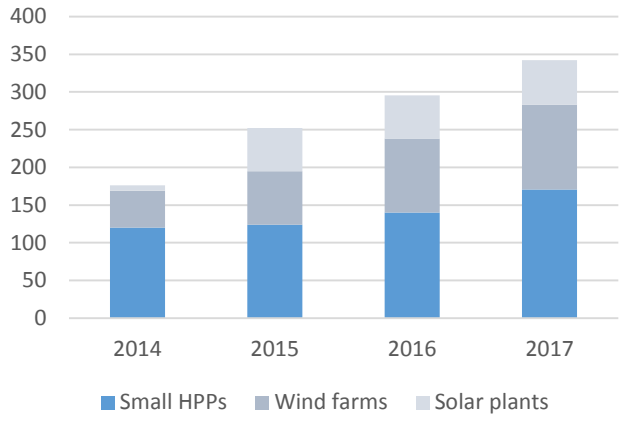
Main sectors	USD bln
Renewable energy sources and gas	52
Increase in energy efficiency in housing and public utilities, transport, industry	37
Increase in water use efficiency	14
Greenhouses	4
Introduction of advanced methods of soil cultivation in agriculture	4
Installation of dust and gas cleaning equipment in power plants	4
Waste utilization program	4
Total	119

Source: Kazakhstan's Green Economy Concept

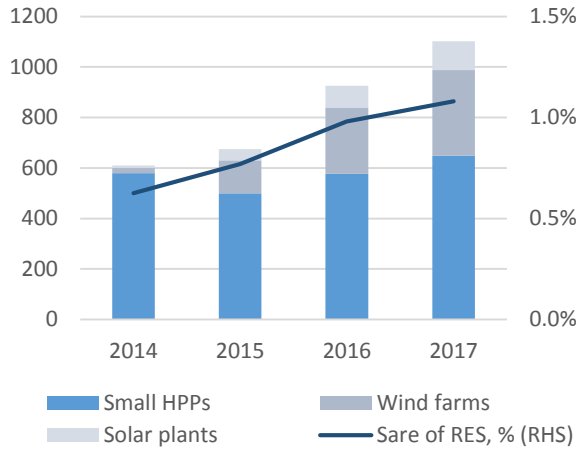
4. Renewable energy in Kazakhstan

Renewable energy sources include solar, wind, small hydropower (HPP), biofuel, geothermal and several other types of plants. Given Kazakhstan's geography and climate conditions, small hydropower, solar and wind energy are the most promising renewable sources of energy. According to official estimates, the hydropower potential of medium and large rivers stands at 55 bln kWh, while small rivers have a potential of 7.6 bln kWh per year. Concurrently, solar energy and wind energy potential is estimated at about 2.5 bln kWh per year and 1,820 bln kWh per year respectively. Thus, cumulative potential of renewable energy sources amounts to 1,885 bln kWh per year, equivalent to a total capacity of 4.3 GW.

Kazakhstan's renewable energy capacities, MW (2014-2017)



Electricity generation from RES, mln kWh vs. % of total (2014-2017)



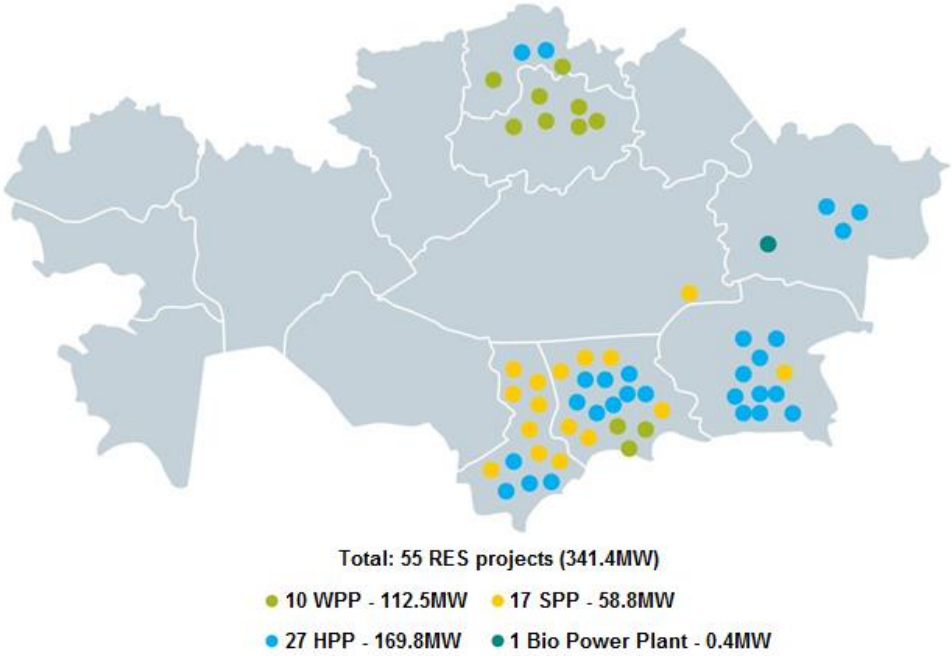
Source: Kazakhstan's Ministry of Energy, Samruk-Kazyna

The main drivers for the development of renewable energy projects in Kazakhstan are:

1) Government's commitment to achieving environment-friendly sustainable economic growth.
2) Aging power generation infrastructure, which suffers from relatively high (6%) transmission and distribution losses. Development of renewables can reduce losses by reducing the distance for transmission.
3) Kazakhstan has a relatively high share of rural population (43%), which currently accounts for approximately 10% of the country's total electricity consumption. RES may be a convenient source of energy for remote villages and regions.
4) High carbon dioxide emissions due to heavy reliance on coal for electricity production. Low carbon intensity of renewables presents an attractive option for policymakers and investors.

In 2017, the number of operating renewable power plants rose to 55, while their generation capacity increased by 15.5% YoY to 341.4MW in 2017 (169.8MW from HPPs, 112MW from wind farms and 59MW from solar plants) vs. 295.7MW in 2016 (139.9MW from HPPs, 98.2MW from wind farms and 57.3MW from solar plants). This was due to commissioning of new HPP and wind power capacities of 30MW and 14MW respectively. Capacity of biogas power plants in Kazakhstan remained unchanged at 0.4MW, while installed solar capacities increased marginally by 1.7MW. Total volume of generated electricity stood at 1.1 mln kWh in 2017 vs 0.9 mln kWh in 2016. Providing 1.1% of the total electricity production in 2017 vs. 1.0% in 2016.

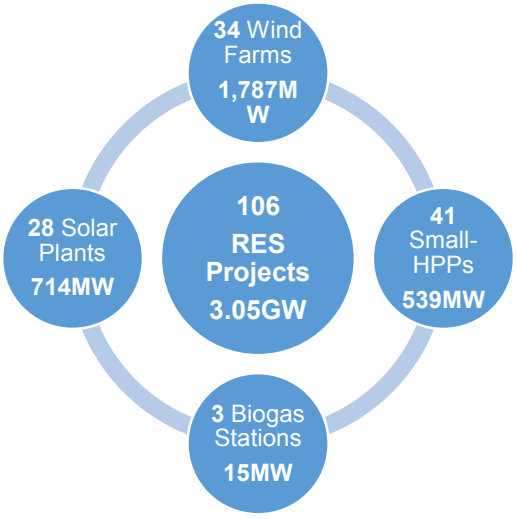
Map of operating RES in Kazakhstan by type (2017e)



Source: Kazakhstan's Ministry of Energy

Power generation from renewable sources continues to grow substantially, although the share of renewables in the country's total energy mix remains low. The share of wind and solar energy projects in the Kazakhstan's energy balance stood below 0.6% as of end-2017. At the same time, hydropower plants contributed approximately 12% of the total electricity produced in Kazakhstan, of which the majority is produced by large HPPs, most of which were built more than two decades ago.

Kazakhstan's RES Development Targets by 2020



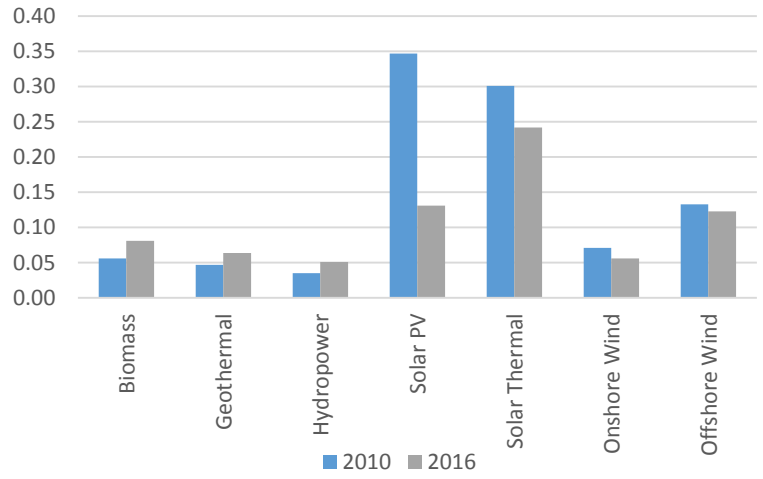
Source: Kazakhstan's Ministry of Energy

By 2020, the share of electricity generated by RES is expected to increase to 3% of the country's energy mix, driven by growing capacities wind power plants and small HPPs. Total number of RES projects is anticipated to reach 106 plants of all types, including 34 wind farms (1,787MW), 41 small HPPs (539MW), 28 solar (714MW) and 3 biogas stations (15MW). Consequently, total renewable capacities

are forecasted at 3,05GW. By end-2018, 18 more wind farms, 13 hydro power stations and seven solar energy stations will be put into operation.

Over the past decade, the costs of solar PV technologies decreased by more than 80%, while costs associated with wind turbines declined by 30-40%. Looking forward, the cost of RES projects is anticipated to decrease further by 25-50% depending on technology. Consequently, the pace of RES installments is anticipated to accelerate exponentially between 2020 and 2030 as the renewable energy generation technologies become more affordable and price-competitive.

Global indicative generation costs for new plants, USD per kWh



Source: International Renewable Energy Agency, Samruk-Kazyna

The Government provides RES energy producers with preferential fixed tariffs and other forms of state support. Preferential fixed tariffs for RES producers are set for a period of 15 years subject to annual inflation indexation. In 2017, the methodology for tariff indexation was revised to compensate the exchange rate volatility for investors, which were negatively affected by the shift to a free-floating exchange rate regime. Since 1 October 2017, tariffs for electricity generated were set at KZT28.31 (USD0.087) per kWh for wind farms, KZT43.21 (USD0.133) per kWh for solar power plants and KZT20.86 (USD0.064) for small hydro power plants.

Moreover, in order to develop the use of renewable energy, the Government reimburses 50% of the costs of RES installations (>5kW) for households and businesses, which do not have a connection to electricity grid. Average cost of such renewable projects stands at KZT4-5mln and the authorities plan to provide such grants to at least 401 farms, while the total number of isolated farms is estimated at 1,200.

Other support measures include:

- Mandatory connection of RES facilities to transmission or distribution networks. The grid company has to cover all the costs of connecting an RES facility (including grid reinforcement), except for the cost of the line between the RES facility and the grid and other components on the generation side.
- Priority and mandatory transmission of electricity generated using RES.
- Mandatory purchase of electricity generated using RES by the single offtaker Financial Settlement Center (FSC).

- Exemption of RES from payment of electricity transmission fee.
- No licensing requirement for energy generation.

In addition, Kazakhstan provides other forms of support to all investment projects:

- Exemption from customs duties.
- Government in-kind grants.
- Tax preferences and investment subsidy.

Financing and institutional framework

Kazakhstan's Government is working closely with several international financial institutions, notably the European Bank for Reconstruction and Development (EBRD) and the ADB, in developing the institutional framework for the development of renewables. Currently, the EBRD is the primary investor into Kazakhstan's green economy with a portfolio of 25 projects in the country's power and energy sector. Total number of projects stands at 236 for a total investment amount of EUR7.3bln, including 115 active projects (EUR2.7bln), 43% of which are concentrated in the energy sector. The EBRD participated in Kazakhstan's largest solar (Burnoye Solar Plant and its Extension project), wind (Yereymentau Wind Farm) as well as the Kazakhstan Renewable Energy Financing Facility projects among others.

The latest renewable project financed by the EBRD is the planned 14MW Zadarya plant in the South Kazakhstan region. France-based Urbasolar SAS has attracted around USD12.7mln in funding, including USD8.8mln provided by the EBRD and USD3.9mln financed by the Clean Technology Fund (CTF). The project will be carried out through a special purpose company Kaz Green Tek Solar. The plant will be constructed in two phases over a nine month period, and will comprise over 54,000 270W solar PV panels planted over an area of 30 hectares.

In October 2017, the EBRD received approximately USD110mln in funds from the Green Climate Fund, an international fund financed by 194 governments that supports investments in low-emission and climate-resilient initiatives in developing countries. Total investments under the GCF-EBRD Kazakhstan Renewables Framework are anticipated at USD557mln, including USD214mln from EBRD and USD137mln from sponsors. Implementation of this project is expected to result in the construction of 8-11 renewable energy projects with a total capacity of 330MW, which will reduce CO2 emissions by 12.9 mln tons (GCF-EBRD, 2017).

4.1 Hydropower plants

Kazakhstan currently has 15 large hydropower plants (HPP) (>50MW) with a total capacity of 2.25 GW or 13% of the country's total generating capacity. HPPs generate around 8 TWh per year or 8% of total power generation. Kazakhstan's large hydroelectric facilities are located primarily along the Irtysh River, which flows from China across northeast Kazakhstan.

More recently, Kazakhstan prioritized the development of small- and medium-scale hydropower plants, which offer numerous benefits in terms of cost, speed of construction, reliability and reduced environmental impact. Small hydro projects have another advantage, they may be built in isolated areas away from the national electricity grid, or in areas with low, seasonal or unstable electricity demand. These advantages make small-HPP plants extremely competitive against traditional sources in Kazakhstan's southern and eastern regions with a large number of small, but powerful rivers.

Total capacity of small- and medium-sized HPPs stood at 169.7MW as at end-2017, located mostly in South Kazakhstan, Zhambyl and Almaty regions. The capacity of small HPPs grew by 30MW in 2017, driven by deployment of numerous private plants, such as the Mankent HPP (2.5MW, KZT283mln) in South Kazakhstan region. By 2020, Kazakhstan plans to deploy 41 small-HPPs with a total capacity of 539MW providing 17.6% of Kazakhstan's total renewable energy capacity. Concurrently, the Government plans to modernize and renovate several large HPPs, further increasing the role of hydropower in Kazakhstan.

Almaty region is one of the largest producers of renewable energy from water resources with five small HPPs with a total installed capacity of about 20MW. By 2020, the region will see the deployment of 11 new projects, including a cascade of HPPs with a total capacity of 42MW on the Koksu River and a single HPP with a capacity of 60.8MW on the Shelek River.

4.2 Wind power plants

Kazakhstan is endowed with considerable wind resources, which are sufficient for the introduction of industrial scale wind farms. Almost 50% of Kazakhstan's territory has average wind speed suitable for energy generation (4-6m/sec) with the strongest potential in the Caspian Sea, central and northern regions. However, the most promising sites are located in the Almaty region: Djungar Gates and Shelek Corridor. Average annual wind speeds at these sites is 9.7 m/s, while the density of the wind flow is about 1050 W/m2. This implies a generation potential of up to 1 bln kWh per year at each of these sites. Consequently, wind power may be a convenient vehicle to fulfil electricity deficits in the entire South Kazakhstan region.

Wind energy offers has an important advantage over other renewables. Wind power plants reach peak generation potential during the winter (due to higher wind speed), which coincides with the seasonal peak in demand for electricity. Kordai Wind Power Plant was the first small-scale wind power plant (1.5MW) introduced in Kazakhstan in 2012. In December 2014, the first stage was completed with the commissioning of nine wind turbines, which increased the capacity to 9MW. In October 2015, the last 10 units were assembled and the industrial wind farm started operating at full capacity 21MW.

Yereymentau Wind Farm

New large-scale deployments over the coming years made wind farms the second-largest RES in the country. By 2017, total capacity of wind farms reached 112.5MW, driven by such projects as the Yereymentau Wind Farm, which was commissioned in 2015.

Construction of the Yereymentau Wind Farm started in Akmola region in 2013 and the project was completed in late-2015. This wind power plant consists of 22 wind turbines with a total capacity of 45MW. The project was financed with financial aid from the EBRD (KZT14bln or EUR59.2mln) and the CTF (EUR18mln of concessional financing), while the loan was guaranteed by JSC Samruk-Energy, the ultimate owner of the power plant. The project currently produces approximately 172 mln KWh of clean energy, allowing for the reduction of emissions by 120,000 tons of CO2 equivalent per year. Yereymentau Wind Farm was one of the primary sources of energy for the EXPO-2017 event in Astana.

The wind plant is guaranteed to remain operational for at least 20 years. Samruk Energy plans to increase the capacity of the plant to 95MW using identical wind turbines, which will be produced domestically under the license. Furthermore the capacity may be potentially increased up to 300MW.

Samruk Energy also considers a KZT24bln project to deploy another 50MW wind power plant in the same region with an annual capacity of up to 180 mln kWh. In total, Kazakhstan plans to construct 33 wind farms with capacity of 1,737MW by 2020. Four wind power plants will be launched in Almaty region, including two in Shelek corridor and another two in the Djungar gates area.

United Energy Aktobe

Samruk-Energy and United Energies AG announced plans to produce wind turbines similar to the ones used in the Ereymentau wind farm. Total investments are anticipated at EUR84mln and the construction is expected to start in Aktobe in 2018. Produced equipment will be used in Kazakhstan's planned wind farms, such as Ereymentau-2 and Karkaralinsk (60MW, Karagandy region). Moreover, turbines may be exported to Iran and Azerbaijan, which plan to develop their wind power industry. Thus, Kazakhstan may be able to improve the cost effectiveness of wind power plant projects in Kazakhstan through cheaper turbines, while developing its own machinery manufacturing industry.

The main problem of renewable resources energy is its instability. As it is impossible to accumulate electricity in sufficient quantities, the energy failures must be either regulated or compensated by other sources. This aspect is extremely important for industrial companies, which consume almost 70% of electricity in Kazakhstan.

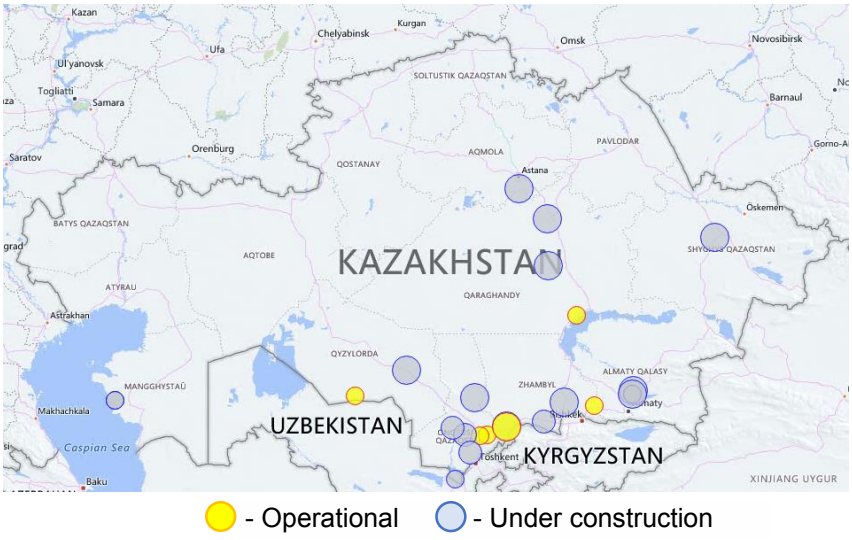
4.3 Solar power plants

Kazakhstan has areas with high insolation, particularly in the south of the country, receiving between 2,200 and 3,000 h of sunlight per year, which is equivalent to 1200–1700 kW/m2 per year. Solar energy potential in Kazakhstan is estimated at 2.5bln kWh per year. This corresponds to an area of approximately 10sq. km of solar cells at an efficiency of 16%. The average efficiency of modern solar panels varies in the range of 15-25%. However, promising technology developments show the efficiency up to 53%.

Solar energy can be used extensively in two-thirds of the territory of the Republic of Kazakhstan. In the southern regions, the solar radiation duration is between 2,800 to 3,000 hours per year, and the annual input of solar energy ranges from 1,280 to 1,870 kWh per 1 sq. meter. Moreover, in June, the amount of energy per 1 sq. m on a horizontal surface ranges from 6.4 to 7.5 kWh per day. This makes South Kazakhstan, Kyzylorda and the Aral Sea region extremely favorable for solar power generation.

In 2012, the first solar power plant in Kazakhstan and Central Asia was deployed in the Zhambyl region. Total capacity of the plant reached 7MW, while its cost stood at USD1.3mln. At present, there are six solar photovoltaic (PV) plants located in southern regions, with a combined capacity of 59MW, the largest of which being the Burnoye solar station in Zhambyl region.

Map of operational and planned solar power plants in Kazakhstan (as at 1Q18)



Source: Kazakhstan's Solar Atlas, Samruk-Kazyna

Burnoye Solar Power Plant

Burnoye solar power plant is the largest PV plant in Central Asia with a total capacity of 50MW. The project was financed by the EBRD and commissioned in 2015, less than a year after the beginning of construction. The plant consists of 192,000 solar panels over an area of 150 hectares and produces more than 73 mln kWh of electricity per year. The planned extension of the plant to 100MW in 2Q18 will increase generation capacity 146 mln kWh per year, making it one of the largest renewable energy sources in the Commonwealth Independent States (CIS). Total project cost is estimated at USD100mln.

After the deployment of numerous solar farms in 2015 and 2016, development of solar power slowed down due to numerus factors, including exchange rate volatility, weaker than anticipated demand for energy in general. Over the course of 2017, the installed capacity of solar farms remained virtually unchanged, however, numerous projects are expected to become operational in 2018. Looking further, by 2020 17 additional solar PV projects should come online, increasing production by 724.8MW.

Astana Solar

In 2012, Kazatomprom JSC established a company for the production of PV modules from Kazakhstani silicon KazPV. Concurrently, Kazakhstan established a fully integrated production cycle of photovoltaic modules, from extraction and processing of quartz (KazPV) to the assembly of finished solar panels (Astana Solar). The plant is currently capable of producing up to 217,000 PV modules per year equivalent to 60MW of power. However, the capacity may be raised up to 100MW, since confirmed reserves of the extremely pure quartz at the Sarykul deposit stand at 1.7 mln tons.

It is worth mentioning that the automated waste gas cleaning system installed at the KazPV plant collects up to 99% of silicon dust, which reduces harmful environmental effects and allows the company to produce up to 2,000 tpy of microsilicon, which can be exported to global markets. Kazakhstan has a comprehensive agenda in terms of production and exports of solar power equipment and prerequisites. In 2014, KazPV group of companies signed an agreement with and Qatar Solar Energy Qatar, and the American Clean Power for the supply of up to 2,500MW of solar silicon, photovoltaic plates and gray cells for solar power plants.

Finished PV modules are certified by Certisolis, one of the leading independent laboratories in Europe, making Kazakhstani solar panels an attractive option for solar power projects in a number of developed and developing countries. Moreover, tariffs for electricity generated by Kazakhstani PV modules or photoelectric modules based on Kazakhstani silicon were fixed for 15 years at KZT70 subject to yearly indexation. This makes KazPV modules an attractive option for domestic producers of solar power.

4.4 Key risks and challenges for RES development in Kazakhstan

In spite of considerable renewable energy potential provided by a large territory with a variety of climate conditions, there are still significant barriers for the introduction and development of RES:

- **Cheap electricity from traditional sources**

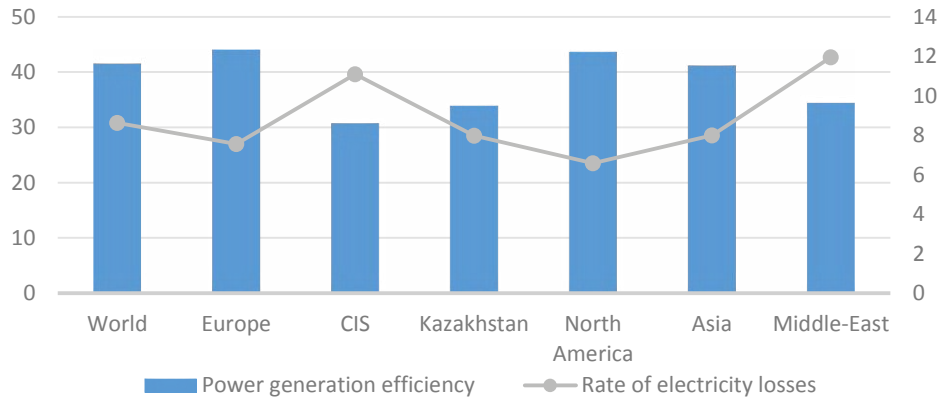
At present, traditional fossil-based power plants in Kazakhstan are more cost-competitive compared to renewables. As such, Ekibastuz GRES-1, a coal-fired thermal power plant, produces electricity at a cost of KZT8.65, while tariffs of Yereymentau wind farm stand at KZT22.68. Kazakhstan also has the largest recoverable coal reserves in Central Asia, and is the second largest coal producer in the region. Coal, produced in the northern regions, is the dominant source for electricity generation.

Nevertheless, Kazakhstan is committed to developing alternative energy sources to ensure sustainable growth in the medium-term. Other alternative sources of energy include nuclear power, which has enormous potential in Kazakhstan. The country is the world's largest exporter of uranium ore, but there is no domestic nuclear generation at present.

- **Transmission losses and inefficient technologies**

Kazakhstan's economy is highly energy-intensive, using two to three times more energy than the average for the OECD countries. A large part of power generating equipment (65%) has been in use for more than 20 years, including approximately 31%, which have been operating for more than 30 years. Electrical generating equipment and network depreciation is estimated at 70% and 65% respectively. Consequently, electricity transmission losses are estimated at 6.7% in general across transmission and distribution systems as at 2014.

Efficiency of the Kazakhstan's electricity generation and distribution (2015)



Source: Enerdata, Samruk-Kazyna

- **Limited regulatory and legal frameworks to stimulate the use of renewable energy, inconsistent government policies and high administrative barriers**

The current mechanisms for guaranteed purchase of energy and fixed tariffs does not provide sufficient incentives for investors, due to bureaucratic and administrative bottlenecks as well as volatility of business environment.

- **Limited technological base, awareness and information barriers**

Low awareness of the importance, advantages and potential of renewable energy among the society and major stakeholders is one of the key constraining factors for RES adoption in Kazakhstan. The Government's current top-down approach demonstrates limited effectiveness, since it does not translate into widespread adoption of renewables in the economy. Thus, comprehensive awareness campaigns on renewable energy would enable a faster transition to RES.

- **Foreign exchange volatility and a high-risk business environment**

Volatility of the national currency in 2015 and 2016 significantly affected the development of renewables in Kazakhstan due to weaker demand for electricity, lower tariffs in USD terms and rising equipment costs. The country's shift to a floating currency limited potential return on investment and threatened future development of RES. New tariffs, which were adopted in 2017 taking into account currency fluctuations, may have limited effectiveness.

- **Limited capacity of the Unified Power System (UPS) of Kazakhstan**

At present, UPS cannot effectively accommodate renewable sources, since their electricity generation is subject to seasonal and climatic fluctuations. The network is configured for permanent sources. To prevent destabilization of the system, the Government enforced a plan for RES allocation, which specifies the maximum generating capacity for each type of renewable energy source and each zone. Maximum RES capacity is determined by the Ministry of Energy and is currently set at 1,400MW for wind and solar power plants in total.

Such capacities are sufficient to reach the medium-term target of 3% generation by RES in the total energy mix, but achieving the long-term target of 10% by 2030 and 50% by 2050 would require a significant modernization of the entire UPS. With an increase in the share of RES in the country's energy mix, KEGOC would need to introduce additional highly maneuverable sources of generation in order to maintain the reliability of the UPS.

Maximum generating capacity by plant type and zone, MW (2018-2020)

Maximum capacity	Solar	Wind	Total
North	139	631	770
South	288	182	470
West	40	120	160
Total	467	933	1400

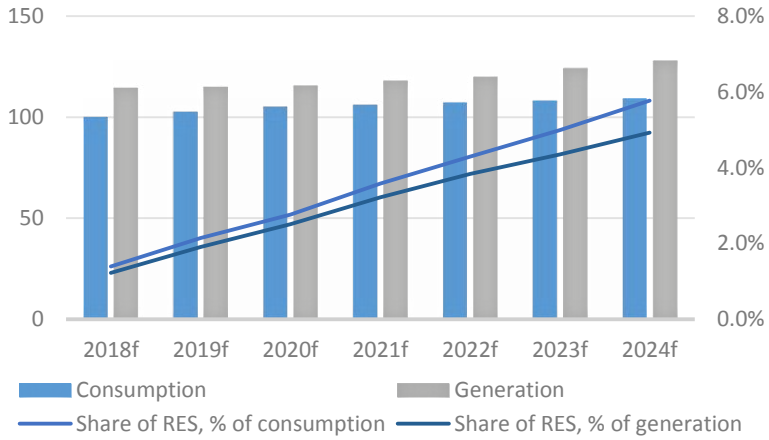
Source: Ministry of Energy, Samruk-Kazyna

Due to aforementioned factors, the majority of large wind and solar projects developed in Kazakhstan, such as the Yereymentau wind farm and the Burnoye solar power plant, have been financed by the authorities, state-owned entities and International Financial Institutions. So far, largest energy projects did not catalyze significant private investment and spearhead the development of the industry in

Kazakhstan. Consequently, the country's renewable sector may develop slower than anticipated dragged down by economic developments and weaker competitiveness against traditional fossil fuels.

Thus, reaching the target of 3% RES generation in the total energy mix by 2020 may be over ambitious. The latest KEGOC forecast of the electricity balance for 2018-2024 estimates the share of renewables at 2.5% of total production and 2.8% of total consumption in Kazakhstan by 2020.

Forecasted electricity generation, consumption and share of RES, bln kWh vs. % (2018f-2024f)

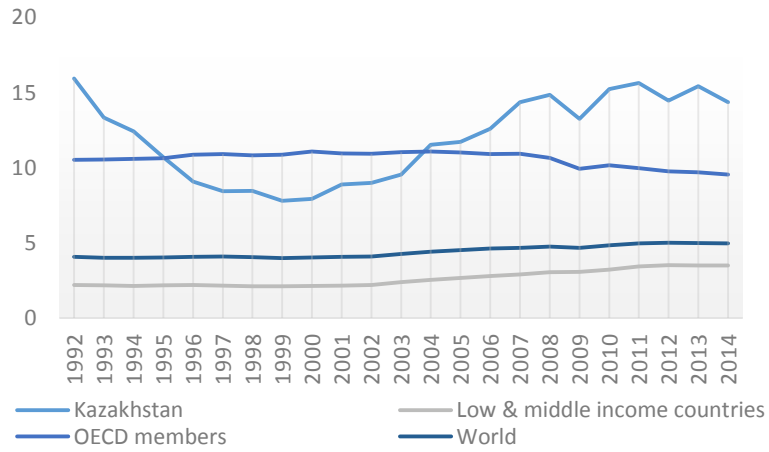


Source: KEGOC, Samruk-Kazyna

5. Energy saving and energy efficiency in Kazakhstan

Industrial production accounts for more than 50% of total energy consumption, while housing and communal services and transport consume 30% and 20% respectively. The amount of economic losses due to inefficient use of resources is estimated at USD4-8bln per year and may increase up to USD14bln by 2030. Concurrently, economic benefits from energy savings are anticipated at USD3-4bln per year (up to USD10bln by 2030).

CO2 emissions per capita, tons per capita (1992-2014)

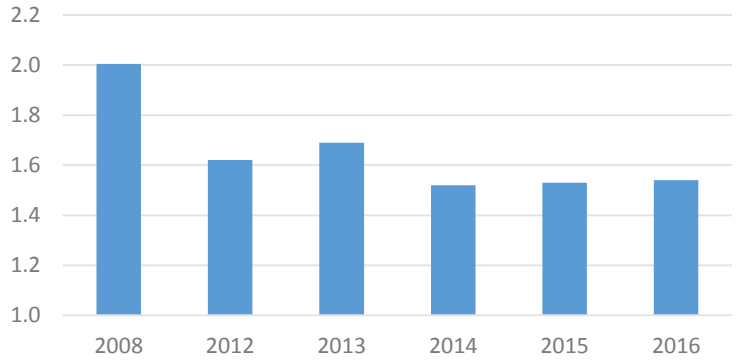


Source: World Bank, Samruk-Kazyna

By 2020, Kazakhstan plans to reduce its energy intensity by at least 25% compared to 2008 levels. To achieve this target, the authorities adopted a Law on Energy Saving and Energy Efficiency and the Comprehensive Energy Efficiency Plan for 2016-2020, which prioritizes implementation of energy-

saving technologies in mining, manufacturing and transportation industries, as well as housing and utilities sectors.

Kazakhstan's energy intensity, oil equivalent per unit of GDP (2008-2016)



Source: Statistics Committee, Samruk-Kazyna

This program targets a mandatory 30% reduction in energy consumption by industrial enterprises, increase of energy efficiency in housing and utilities as well as a 30% reduction of energy consumption per square meter of housing, tightening construction regulations and standards starting from 2015. Other measures include renewal of aircrafts and railway locomotives, stimulating purchases of fuel-efficient vehicles by the population, reduction of energy consumption by the public administration sector by 25% by 2020, transition to light-emitting diode lighting as well as modernization of the street lighting in cities and towns. In total, the Government plans 78 different initiatives in various sectors within the energy saving program, total financing is estimated at KZT1.1tln by 2020.

Green construction

A large part of the real estate in Kazakhstan is obsolete, many of the residential and business complexes do not employ modern energy-saving technologies, which results in significant energy losses. Thus, residential sector is the third-leading energy consumer in the country after the mining and manufacturing sectors. Real estate, primarily residential, accounts for 13.5% of power and 24% of total heating demand. In this light, raising energy efficiency of the residential sector becomes a national strategic priority for Kazakhstan.

Like many other emerging economies, Kazakhstan is becoming increasingly interested in green construction. Green building (also known as green construction or sustainable building) refers to using processes that are environmentally responsible and resource-efficient throughout a building's life cycle: from siting to design, construction, operation, maintenance, renovation to demolition. Although new technologies are constantly being developed to complement current practices, the common objective of green buildings is to reduce the overall impact of the built projects on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation

Green construction has been gaining popularity globally over the last 40 years, construction of efficient and energy-saving buildings has become a real trend. Global green building continues to double every three years, driven by emerging economies like Brazil, India, Saudi Arabia and South Africa.

As a result of the increased interest in green building concepts and practices, a number of organizations have developed standards, codes and rating systems. Green building rating systems such as Building Research Establishment Environmental Assessment Method or BREEAM (United Kingdom), Leadership in Energy and Environmental Design or LEED (United States and Canada), German Sustainable Building Council or DGNB (Germany) help consumers determine a structure's level of environmental performance. LEED and Energy Star certified buildings achieve significantly higher rents, sale prices and occupancy rates as well as lower capitalization rates potentially reflecting lower investment risk.

McGraw-Hill Construction study found that green buildings offer significant operational cost savings compared with traditional buildings. Respondents of the survey expect an average of 14% savings in operational costs over five-year for new green buildings and 13% savings in operational costs for green retrofit and renovation projects. Building owners also report that green buildings-whether new or renovated-command a 7% increase in asset value over traditional buildings.

Opportunities and Obstacles in Green Construction

Opportunities	Obstacles
Lower operating costs (e.g. utilities costs, total lifecycle costs) - most green buildings cost a premium of <2%, but yield 10 times as much over the entire life of the building	Higher perceived first costs - new appliances and modern technologies tend to cost more money
Higher property value	Lack of political support/incentives – green growth is a relatively new trend which needs more public attention
Healthier environment for the people	Lack of market demand
Higher rental rates	Lack of public awareness
Higher occupancy rates	Lack of trained/educated green building professionals
Environmental benefits	Access to capital

Source: Samruk-Kazyna

Despite such significant economic, social and environmental benefits, green construction in Kazakhstan is very underdeveloped. Kazakhstan Green Building Council (KazGBC) was established in 2013 to support green construction. Kazakhstan's first planned green projects are Greenville cottage houses and the new educational building of Kazakh-British Technical University in Almaty, as well as Talan Towers and Green Quarter in Astana. There are other buildings, which are planned to be renovated to receive a green status.

The largest green construction project in Kazakhstan is Green Quarter, which is developed by Samruk-Kazyna Development and BI Group. The concept of this residential complex was developed by Aedas, a British architectural firm, one of the largest architectural companies in Europe. Total cost of the project stands at KZT44bln. Green Quarter is the only LEED certified project of its kind in the CIS. LEED is one of the most popular green building certification programs, that includes a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes, and neighborhoods that aims to help building owners and operators be environmentally responsible and use resources efficiently.

Smart City

Modern technologies provide effective solutions to power supply problems in fast-growing cities. KEGOC has been implementing several breakthrough technologies and principles for the last ten years to raise the efficiency and optimize electricity transmission. Some elements of an intelligent power system are already being implemented in the UPS. These include relay protection devices, SCADA dispatch control system, ASKUE commercial accounting system, fiber-optic communication lines, controlled shunting reactors, phase-turn transformer and others. Further development of these initiatives is included in the project for the automation of UPS regime management in Kazakhstan. Upon the completion of this project, KEGOC will be able to increase the load of the existing electric networks by up to 10%.

Within the framework of the international specialized exhibition EXPO-2017, Kazakhstan's Government launched a unique project to create an intelligent power grid Smart Grid in collaboration with Siemens. Such project is unique for Kazakhstan and is the first one in the CIS. The main advantages of Smart Grid are:

- General increase in effectiveness and controllability of the power grid, reduction of accident downtime from several hours to several minutes due to self-diagnosis and self-restore functions, which allow the system to identify emergency sections of the network and automatically reroute electricity flows.
- Improvement of the operational characteristics and reduction of network operating costs by 20%.
- Reduction of commercial and technical losses, reduction in under-delivery of electricity by 50%
- Reduction of power outages for consumers.

In the near-term, this project will become a single energy management center for the entire left bank of Astana city and subsequently for the entire city. Looking forward, the Government plans to introduce smart city principles in five largest cities of the country - Smart Astana, Smart Almaty, Smart Karaganda, Smart Ontystuk, Smart Aktobe. Successful implementation of this initiative within the Digital Kazakhstan program will improve the quality of life of the population and the quality of public services.

6. Green transportation in Kazakhstan

Kazakhstan is the largest GHG emitter in Central Asia, while the transport sector is its fastest growing source of CO2 emissions. The Government has implemented several measures, which are aimed at limiting the harmful environmental effects of growing number of cars and other transport vehicles. The authorities are committed to reducing the growth of the transport-related greenhouse gas emissions in the largest cities, while simultaneously improving urban environmental conditions by improving the management of public transportation and air quality.

Kazakhstan's automobile manufacturers have started producing electric vehicles in limited amounts. At the end of 2014, Ust-Kamenogorsk-based AZIA AVTO plant produced the first KIA Soul EV. In July 2016, SaryarkaAvtoProm plant in Kostanay manufactured a pilot batch of electric cars of the Chinese brand JAC. Finally, in July 2017, AZIA AVTO presented the electric LADA Vesta EV during the EXPO-2017 exhibition. Local production of e-cars can lower the cost of electric vehicles, but there are other bottlenecks, which limit the potential of e-transport in Kazakhstan. Kazakhstan's Ministry of Energy is actively working on the development of infrastructure for e-vehicles, including charge stations.

7. Waste management in Kazakhstan

Waste management in Kazakhstan is regulated by the Environmental Code. In 2014, the Ministry of Environment and Water resources adopted the Program of Modernization of Municipal Solid Waste Management for the years 2014-2050. The basis of the development of this program was the Green Economy program. The program aims to enhance efficiency, reliability, environmental and social acceptability of municipal solid waste (MSW) collection, transportation, processing and disposal services. The target indicators are the share of recycled MSW is up to 40% by 2030 and 50% by 2050 and storage of residual MSW volumes at sanitary landfills to increase to 100% by 2050. The financing of the implementation of the program for 2014-2050 is estimated at KZT128bln. The Waste management program is still at a very early stage of implementation.

Waste component ratio (%)

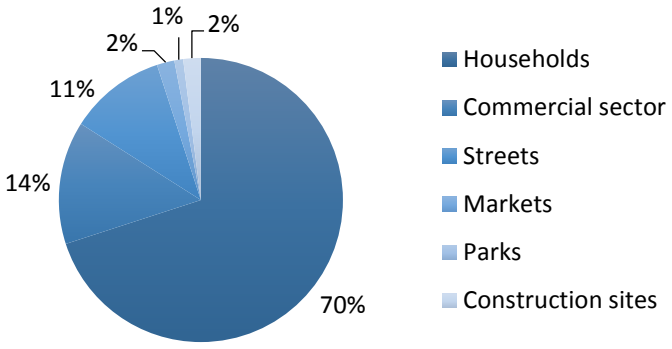
Paper and cardboard	Plastics	Metal	Glass	Organics	Others
27-30%	8-13%	3-4%	5-7%	30-34%	8-14%

Source: Feasibility Study Reports (2011-12) for nine cities of Kazakhstan

The accumulated MSW in Kazakhstan amounted to 103.4mln tons based on data of the Ministry of Energy. The annual growth of MSW stood at 5-6mln tons, which is forecasted to increase to 8mln tons annually by 2025 (World Bank, 2017). The main reasons of a significant waste accumulation are inefficient management, lack of economic incentives for the development of historical and newly formed wastes, inadequate regulatory base.

In 2016, 162 enterprises operated in the country, mainly small and medium- sized businesses, annually treating over 300ths tons of recyclable materials, producing more than 20 types of products: plastic, metal, wood, glass, paper, rubber chips and rubber products, biogas, fertilizers and pyrolysis fuels. These enterprises recycle 6% of total MSW, higher than in 2015.

Type and share of generated MSW in Kazakhstan



Source: World Bank (2017)

According to World Bank (2017), Kazakhstan's major challenges around municipal waste management are:

1) increasing generation and accumulation of MSW;
2) inefficient waste collection and transportation;
3) inadequate environmental management of landfill (open dump sites);
4) lack of waste separation;
5) low recycling rate of municipal wastes.

Key findings of World Bank on Solid Waste Management in Kazakhstan

Category	Key findings
Tariffs	• Too low and do not cover the full costs of solid waste management • Households pay just 0.33-0.44% of their average disposable income, while internationally accepted norm is about 1-1.5% • The authorities are reluctant to increase the tariffs
Financing	• Closing of dumps and non-sanitary landfills will involve high costs. Tariffs cannot cover the costs and the authorities have to finance. • Landfilling is the cheapest cost option for final disposal and the dominant practice. • Unless the gate fees at landfills are substantially increased, it will be difficult to implement alternative treatment options (except for separation at source)
Private sector involvement	• Private sector is represented by more than 130 companies operating, primarily, in waste sorting and recycling. • There is a governmental policy to privatize the municipal waste collection companies to decrease the financial burden on the state budget.
Municipal responsibility	• MSW collection and landfilling in Kazakhstan are mainly handled by municipal companies (100% owned by Municipality) • Being not a Municipal organization, it will result in higher costs, as VAT and profit margin should be included in the tariff calculation of a company.

Source: World Bank 2017

In order to solve existing issues related to MSW pollution, effective MSW management, the following measures should be taken:

1) To use conventional methods and techniques, such as planning, subsidizing, designing and etc.
2) To use innovative solutions such as payments for ecosystem services, geoinformation systems etc.
3) To introduce of a regional approach along the whole technological network of waste management from separate collection at source to disposal of an inert part of MSW at engineering landfills.
4) To amend the current methodology for the calculation of tariffs to include not only for the transportation of municipal solid waste and but its collection, disposal and burial.
5) To introduce a landfill inspection by a public or independent expert institute.
6) Waste management infrastructure interventions must be complemented by behavioral changes from the general public.
7) To introduce tax measures as well as regulation to stimulate the re-use of resources,
8) To introduce the exemption of legal entities and individual entrepreneurs (the main activity of which is the collection, transportation, sorting, recycling and disposal of waste) from corporate income tax, from value added tax, from land tax and property tax; the application of lowering coefficients to the profit from the sale of products produced with the use of recyclable materials; granting tax holidays.

8. Development of sustainable and effective organic agriculture

In the light of increasing demand for organic products from European countries and from the US, organic agriculture could be one of the area particular interest for Kazakhstan (OECD, 2015). Organic farming is regulated by the law “On the production of organic products” adopted by the Parliament and signed by the President in 2015. Kazakhstan has great opportunities in the development of organic agricultural production due to the presence of significant land and natural resources, the possession of a traditional culture of land cultivation without using synthetic fertilizers and pesticides.

Currently, there is no official data on production of organic products, and organic farmers and producers. However, according to Food and Agriculture Organization of United Nations (FAO), there are 29 producers and 19 processers in the market, mostly in Akmola, Almaty and Kostanay regions.

In Kazakhstan, the absence of standardization, certification, control systems and labeling requirements is currently limiting development of internal and export markets for organic products. However, there are some active international certification bodies in the market and some private companies also developing such systems (FAO, 2016).

Key advantages and challenges on transition into organic farming

Advantages	Challenges
• The possibility of selling organic products at higher price; • Higher competitiveness due to improvement in quality; • Increased export potential due to higher demand for organic products from external markets; • Usage of a wide variety of legumes in crop rotations, which allows solving the problem of feed and maintaining the level of nitrogen in the soil; • More rationalized usage of labor power and increased profit of the enterprises; • Care for the environment and health; • The high cost of mineral fertilizers and pesticides.	• Tightening of competition in the internal market after the World Trade Organization accession; • Low access to financing; • Low stability the agricultural sector due to high level of debt burden of agrofarmers; • Lack of technology and lack of experience in production and processing of organic products; • Psychological difficulties of transition to new methods of farming after long-term practice of traditional farming; • Due to the fact that organic farming is more complex than traditional farming, there is an increased likelihood that the producer can make mistakes, which can significantly reduce crop yields, increase morbidity, weed infestation and pest infestation; • Low level of information and knowledge about the methods and approaches of organic farming; • Additional costs for certification; • The ban on the use of synthetic preservatives in products can significantly shorten the period of its usage.

Source: FAO, 2016

9. Sustainable use of water resources

There are about 39 thousand rivers and temporary streams in Kazakhstan, among them over 7,000 are more than 10 km long. Most of the rivers in Kazakhstan belong to the internal closed drainage basins of the Caspian and Aral Seas and Balkhash, Alakol and Tengiz Lakes. According to the Water Law of the Republic of Kazakhstan water bodies of special state significance are the Caspian Sea, Balkhash, Zaisan, and Alakol Lakes, and Irtysh River. In total Kazakhstan counts over 48 thousand lakes with the total water surface area 4500 km² and capacity about 190 km³/s.

Kazakhstan's government prioritized the use of transboundary rivers, restoration of irrigated lands, construction and reconstruction of reservoirs in its policies on water resource management, including the State Program for the Development of the Agroindustrial Complex (SPDAC).

Irrigated lands are 8-10 times more productive than non-irrigated. Efficient use of irrigation may raise labor productivity in agriculture and ensure sustainability of economic development and food security. The SPDAC targets restoration of systems for regular irrigation (610'000 hectares) and liminal irrigation (approximately 370'000 hectares), thus increasing the total area of irrigated land by 40%.

Restoration of irrigated lands enabled by modern technologies for channeling and water metering systems, will increase the efficiency of canals and irrigation systems, as well as significantly improve water management.

Water resources in Kazakhstan are regulated by the Water Code. Water Resources Committee of the Ministry of Agriculture performs strategic, regulatory, realization, control and supervision functions in the sphere of water recourses use and conservation.

In 2014, the State Program for Water Resources Management in Kazakhstan 2014-2020 was adopted. It contains four priorities: 1) transition to economically sustainable distribution of water resources to enhance water resources management efficiency; 2) Transition to the use of least expensive methods for conservation of water resources; 3) transition from inefficient operation of infrastructure to maintenance of the infrastructure in a proper condition; 4) transition from overlapping and ill-defined areas of responsibility in management of water resources to a well-defined management pyramid. The estimated amount of financing for the period from 2014 to 2040 is KZT8.2 tln, of which KZT5.4 tln will be financed by the republic and local budget and the remaining by non-budgetary funds.

As a part of Nurly Zhol State Program for Infrastructure Development, it is planned to reduce wear of the heating, water supply and disposal systems from 67% to 53% and to improve quality of the services provided to consumers.

A number of institutional and policy measures have been implemented to enhance the sustainability of water resource use and water security; however, the country is still facing a number of problems of water use in a sustainable manner. According to Switzerland Global enterprise industry report, key challenges in water management in Kazakhstan are:

- Water resources utilization has low efficiency in Kazakhstan compared to the other states, as it requires three times more water per dollar of the GDP compared with Russia or the US, and six times more than Australia;
- Current tariff system and approved tariffs, especially in the agriculture, do not cover the required operational costs and depreciation charges;
- Insufficient water saving stimulation in all sectors, especially in the agriculture, where losses reach 66%;
- Lack of investments in the infrastructure both in construction of new facilities to provide water access and in maintenance of the existing infrastructure facilities;
- Aged water management infrastructure due to underinvestment and lack of maintenance;
- Lack of information database on water facilities and water bodies (state water cadastre).

In 2017, Islamic Development Bank provided a loan to RSE Kazvodkhoz under the state guarantee for the restoration of irrigation and drainage in the Almaty region (35,400 hectares) and the South-Kazakhstan region (101,000 hectares).

A loan agreement was also signed with the European Bank for Reconstruction and Development to implement the project on reconstruction of water management and irrigation and drainage systems of Aktyubinsk, Zhambyl and South Kazakhstan regions on an area of 92,700 hectares with the aim of resuming land irrigation.

The Action Plan for the implementation of the SPDAC for 2017-2021 provides for the reconstruction of 41 emergency reservoirs, the main purpose of which is the safe operation of water management facilities. In addition, it is planned to build 22 new reservoirs with total additional water accumulation of 1.9 bln m3 totaling KZT57.2bln in 7 regions. In 2017, National Company Kazakhstan Garysh Sapary planned to launch a geoportal on water resources using space monitoring data.

10. Conclusion

Kazakhstan has a vast RES potential that can drive sustainable and inclusive economic growth, providing affordable electricity in the most distant regions. Historically large-HPP plants contribute a significant proportion of Kazakhstan's energy mix, but the region has potential for biomass, wind and solar energy. The share of RES in the country's energy mix remains low. In the near future, cost reductions provided by technological developments and improved cost-competitiveness of these technologies will enhance RES capacities in the region.

Kazakhstan is the only country, which has both solar and wind power generation capacities in the Central Asian region, leading the drive for renewable energy. The HPP potential of medium and large rivers in Kazakhstan stands at 55 bln kWh, while small rivers have a potential of 7.6 bln kWh per year. Concurrently, solar energy and wind energy potential is estimated at about 2.5 bln kWh per year and 1,820 bln kWh per year respectively.

In 2017, the number of operating renewable power plants rose to 55, while their generation capacity increased by 15.5% YoY to 341.4MW in 2017 vs. 295.7MW in 2016. Total volume of generated electricity stood at 1.1 mln kWh in 2017 vs 0.9 mln kWh in 2016. Providing 1.1% of the total electricity production in 2017 vs. 1.0% in 2016. The share of RES in total electricity production is targeted to reach 3% by 2020, 10% by 2030 and 50% by 2050.

Despite slow growth of RES generation, the Government expects to reach the aforementioned targets. This will be possible due to a rapid decline of RES costs, which will drive the exponential increase in RES generation from 2020 to 2030. The cost of generating power from onshore wind decreased by approximately 25% since 2010, while solar photovoltaic electricity costs dropped by 73%. Looking forward, RES electricity costs are expected to decline further. Consequently, Kazakhstan's government is considering raising the target for RES generation from 10% to 15% by 2030. By end-2018, 18 more wind farms, 13 hydro power stations and seven solar energy stations will be deployed.

The Government provides RES energy producers with preferential fixed tariffs and other forms of state support. Preferential fixed tariffs for RES producers are set for a period of 15 years subject to annual inflation indexation. In 2017, the methodology for tariff indexation was revised to compensate the exchange rate volatility for investors, which were negatively affected by the shift to a free-floating exchange rate regime. Moreover, in order to develop the use of renewable energy, the Government reimburses 50% of the costs of RES installations (>5kW) for households and businesses, which do not have a connection to electricity grid.

While Kazakhstan recognizes the need to transition to green economy and sustainable growth, promoting implementation of renewable energy projects and energy-saving technologies, currently implemented policies are not yet sufficient to meet its targets. The authorities initiated a number of pro-environment reforms and massive projects, but the overall institutional environment remains unfavorable for the large-scale implementation of green technologies.

Special attention and resources need to be allocated to increasing institutional capacities and governance. Subsidies and other incentive policies may need to be reviewed to accommodate a larger number of investors and projects, as well as provide a more automated institutional framework for new green projects.

The Government needs to improve the reliability and effectiveness of current financing mechanisms and readjust incentives for investors in order to launch a large-scale transition to sustainable growth. This could be achieved through a comprehensive reform of national economic, budget, tax, investment and environmental frameworks and specific instruments that could support business and individual; green initiatives in Kazakhstan.

References

ADB, OECD, UN, World Bank, 2012. *A Toolkit of Policy Options to Support Inclusive Green Growth*

Avantgarde – SEEPX, 2017. *Vision of the development of the electric power industry in the Republic of Kazakhstan until 2050*

FAO, 2016. Development of organic agriculture in Kazakhstan

Gayane Minasyan 2017. Developing integrated and green solutions for municipal solid waste management in Kazakhstan, World Bank

Government of Kazakhstan, 2013. *National concept for transition to a green economy up to 2050*

Government of Kazakhstan. *Kazakhstan-2050 development strategy*

Government of Kazakhstan. Modernization program of municipal waste management for 2014-2050

GWP, Global Water Partnership, 2014. *Integrated water resources management in Central Asia: The challenges of managing large transboundary rivers*

IRENA, International Renewable Energy Agency, 2016. *Renewable Energy Country Profiles*

Johannes Koettl, Isil Oral, Indhira Santos, 2011. *Employment Recovery in Europe and Central Asia*

Kaliaskarov, Z.K., Alieva Zh.N., Usubalieva S. Dh., and Bekkuliev A.A. 2017. Contemporary problems of municipal solid waste management in the Republic of Kazakhstan

KEGOC, yearly report 2016

Marat Karatayev, Michèle L. Clarke, 2016. *A review of current energy systems and green energy potential in Kazakhstan*

Marat Shibutov 2017. Industry report. Water management in Kazakhstan, Switzerland Global enterprise

OECD/IEA, 2014. *Eastern Europe, Caucusus and Central Asia Highlights. Energy Policies Beyond IEA countries.*

Stéphane Hallegatte, Geoffrey Heal, Marianne Fay, David Treguer, 2011. *From Growth to Green Growth: A Framework*

UNEP, 2012. *Measuring Progress towards an Inclusive Green Economy*

UNEP, 2014. *Waste management, climate change adaptation and green economy on the menu for Central Asian countries and the UN Environment Program*

UNEP, 2016. *Stocktaking on Inclusive Green Economy in Central Asia and Mongolia: A Sub-Regional Perspective*

United Nations. *Green Bridge Partnership Program 2011-2020*

World Bank, 2011. *The Changing Wealth of Nations: Measuring sustainable development in the new millennium*

World Bank, 2012. *Inclusive Green Growth: The Pathway to Sustainable Development*

World Bank, 2014. *Central Asia Energy-Water Development Program. Progress Report 2014*

World Bank, 2014. *World Bank and International Fund for Saving the Aral Sea Will Cooperate on the Aral Sea Basin Management Program*

Appendix

Green Growth and the World Bank

In the May 2012 report Inclusive Green Growth the World Bank defined green growth as ***"growth that is efficient in its use of natural resources, clean in that it minimizes pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters. And this growth needs to be inclusive"***.

Green Growth is a tool for achieving the broader goal of sustainable development and implies a medium- to long-term policy strategy that:

- Understands and addresses potential poverty and resource scarcity gaps.
- Provides opportunities for fostering alternate economic, production and livelihood models.
- Intends to shield development and growth prospects from resource price volatility as well as the impacts of environmental degradation.
- Green Growth that is inclusive can help to implement social and sustainable development goals.

Although economic growth has lifted more than 660 million people out of poverty over the past 20 years, it has often come at the expense of the environment. Long-term sustainability of growth and progress on social welfare are threatened by inefficient and wasteful use of the earth's natural capital resources without adequate reinvestment of other forms of wealth or sufficient reckoning of the true social costs.

Inclusivity is at the heart of the **Green Growth** concept: the report states that there are still many people who have been excluded from the benefits of economic growth. Approximately 1.3 bln people still do not have access to electricity, 2.6 bln people do not have access to sanitation and 900 mln lack access to clean drinking water.

Green Growth policies must be developed to ensure maximized benefits and minimized costs to the poor and most vulnerable, and policies and actions with irreversible negative impacts must be avoided. The five key messages from WB vision of Green Growth are:

- Greening growth is necessary, efficient, and affordable.
- Obstacles to greening growth are political and behavioral inertia, and a lack of financing instruments.
- Green growth should look at what needs to be done in the next 5-10 years.
- The way forward requires a blend of economics, political science, and social psychology.
- There is no single green growth model.

Disclaimer & Disclosures

Samruk Kazyna JSC

This document is issued by Joint Stock Company «Sovereign Wealth Fund «Samruk-Kazyna» (JSC "Samruk-Kazyna").

The Research report (hereinafter referred to as "Report") is based on the information taken from the sources which the JSC "Samruk-Kazyna" considers reliable and takes every care and precaution to ensure that information related to the Report published on the corporate website of JSC "Samruk-Kazyna" is accurate and regularly updated, but JSC "Samruk-Kazyna" makes no guarantee, warranty of any kind, express or implied, or makes no representation as to the accuracy or completeness of the information contained in the Report or otherwise, and it should not be relied on as such. JSC "Samruk-Kazyna" may change the information contained in this Report at any time without notice.

JSC "Samruk-Kazyna" or any of its officers, employees shall not be liable for any direct, indirect or consequential loss or damage suffered by any person as a result of using and/or relaying on the information contained in the Report as a consequence of any inaccuracies in, errors or omissions, if any, from the information which the Report may contain or otherwise arising from the use and/or further communication, disclosure, or other publication of the information contained in the Report.

This Report is solely intended for general informational purposes. This Report is not in any sense a solicitation or offer of the purchase or sale of securities or any assets in any jurisdiction.

The World Bank

This report has been initially peer-reviewed by the staff of The World Bank. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent.

The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Nothing herein shall constitute or be considered to be a limitation upon or waiver of the privileges and immunities of The World Bank, all of which are specifically reserved.