



On approval of the Strategy for achieving carbon neutrality of the Republic of Kazakhstan until 2060

Decree of the President of the Republic of Kazakhstan dated February 2, 2023 No. 121

Subject to publication in the Collection
of Acts of the President and Government
of the Republic of Kazakhstan

DECREE:

1. Approve the attached Strategy for achieving carbon neutrality of the Republic of Kazakhstan until 2060.
2. The Government of the Republic of Kazakhstan take measures arising from this Decree.
3. Entrust control over the implementation of this Decree to the Administration of the President of the Republic of Kazakhstan.
4. This Decree comes into force from the date of its signing.

K. Tokaev

President of the Republic of Kazakhstan

APPROVED

By Presidential Decree
Republic of Kazakhstan
dated February 2, 2023 No. 121

STRATEGY

achieving carbon neutrality of the Republic of Kazakhstan until 2060

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1. Introduction

Low-carbon development is a prerequisite for sustainable development and aims to prevent the catastrophic consequences of global change the climate.

According to the Sixth Assessment Report of the International Panel on Climate Change (hereinafter - IPCC), anthropogenic greenhouse gas emissions (hereinafter referred to as GHG) have reached the highest levels in human history, which is already having a significant negative impact on the Earth's climate system. This carries direct physical risks and threats to ecosystems, infrastructure, human life and health. In response to these challenges and to mitigate these risks, countries around the world are actively accepting international obligations.

At the meeting of the General Assembly of the United Nations (hereinafter referred to as the UN) on September 25, 2015, the resolution "Transforming our world: the 2030 Agenda for Sustainable Development" was adopted. According to this resolution, 193 UN member states pledged to ensure sustainable, inclusive and progressive growth, social inclusion and environmental protection in an environment of partnership and peace.

In December 2015, the Paris Agreement was adopted to support environmental integrity, a green economy, transfer of high-impact technologies and adaptation to a changing climate. The main objectives of this Agreement are to keep the increase in global average temperature below 2°C above pre-industrial levels (1850-1900 levels) and to make efforts to limit the increase in temperature to 1.5°C.

The 2021 IPCC estimates that climate change will intensify in all regions over the coming decades and, unless action is taken immediately and large-scale reduction of GHG emissions, limiting warming to 2°C will unattainable.

In this regard, to implement the Paris Agreement, all parties submit their climate action plans - Nationally Determined Contributions (NDCs) - every five years. Countries are also developing strategies

low-carbon development, providing a long-term horizon for NDCs. The main goal of these strategies is to achieve a balance between anthropogenic emissions from sources and their absorption by GHG sinks.

By September 2022, 52 countries have adopted their low-carbon development strategies. At the same time, the European Union (hereinafter referred to as the EU) and the United States of America (hereinafter - the USA) have set goals to achieve carbon neutrality by 2050, China - by 2060.

At the same time, 13 countries with a share of global gross domestic product (hereinafter - GDP) of 25% have established legal obligations to achieve zero emissions targets (Canada, Spain, Portugal, Germany, Great Britain, Norway, Japan and others).

33 countries with a share of global GDP of 50% have included their zero-emission targets in policy documents/declarations (USA, Australia, Turkey, Chile, Italy, the Netherlands, India, Saudi Arabia, Brazil, Argentina and others)

Climate strategies (sustainable development strategies) are also being developed at the level of cities and large companies. Given that urban areas account for 65% of global energy consumption and 70% of GHG emissions, more than 120 cities have announced they will achieve carbon neutrality by 2050 (100 of them - by 2030).

According to the Carbon Disclosure Project, in 2021, 13,000 companies (or 64% global market capitalization) have disclosed some climate impact information, of which about 200 have specific data on their carbon footprint and strategies to achieve carbon neutrality. These companies regularly report on their development of the green agenda.

Initiatives are being formed in certain areas of low-carbon development . Thus, 200 countries announced a gradual reduction in coal generation without CO₂ capture and a complete abandonment of ineffective fuel subsidies that artificially reduce the price of coal, oil or natural gas.

At the same time, 29 countries, including Canada, Denmark, the USA, Italy, Switzerland, and the UK, pledged to stop financing the energy sector (in particular, fossil fuel projects) by the end of 2022 and preferred more environmentally friendly areas. Denmark, France, Greenland, Ireland, Quebec, Sweden and Wales announced the end of licensing for oil exploration and production and gas.

100 countries have signed a commitment initiated by the US and the EU to reduce methane emissions by 30% by 2030.

120 countries, which account for about 90% of the world's forests, have pledged to stop deforestation by 2030. This list includes Canada, Brazil, China, Indonesia, USA, UK, Russia.

More than 100 governments, cities, states and major businesses have signed a pledge to transition to zero-emission vehicles and end the sale of internal combustion engine vehicles worldwide by 2040.

Countries are introducing separate forms of regulation, including quotas for GHG emissions, carbon taxes and fees for non-quota entities, developing their own carbon regulation systems, introducing protective mechanisms, including carbon labeling systems and

cross-border mechanisms.

The most decisive climate policy is carried out by the EU, which introduces a number of measures are in place to transition to a carbon-free economy by 2050.

The European Green Deal envisages expanding the sectoral coverage of the Emissions Trading System (ETS) and introducing a carbon tax on most other GHG emissions not regulated by the ETS.

The European Commission, as part of the ambitious Green Deal package of measures (policy areas range from ambitious emissions reductions to investment in cutting-edge research and innovation) has developed a transboundary carbon management mechanism (hereinafter referred to as TCRM). This mechanism involves levying an additional fee on goods depending on the volume of specific GHG emissions during their production in relation to the import of carbon-intensive goods.

products.

The adoption of MTUR is already leading to the refusal of large export-oriented companies from environmentally polluting raw materials and semi-finished products, with the help of which final goods are produced. This also happens for products whose carbon footprint is unknown.

In addition, as part of the Financing Sustainable Growth Action Plan, the EU Commission has created a clear and detailed EU taxonomy - a system for classifying economic activities according to the sustainable development goals. The goal of the taxonomy is to guide investment into "sustainable" projects and activities while reducing investment in carbon-intensive assets.

A new EU green trade strategy is being prepared to integrate the bloc's economic and climate priorities reflected in the Green Deal.

Given the international significance of the climate agenda, there has been a significant increase in sustainable investments, investments based on ESG principles, which have tripled over the past 8 years and doubled over the past 8 years. the last 5 years, amounting to 46 trillion US dollars at the end of 2021.

The financial sector is increasingly focusing on ESG investing and climate change risks, including stranded asset risks. Investments are re-evaluated based on their alignment with climate goals. Major investors, including international development banks, are announcing plans to divest from fossil fuel sectors. Companies face increasing pressure to disclose climate information and risks, including information on the carbon footprint of products and measures to decarbonize supply chains. All these trends will continue in the coming years and decades and will have an impact

significant impact on the global and regional economy.

By 2025, ESG funds will have more assets under management than other non-ESG funds, with the market share of ESG funds rising to 57% in 2025 from the current 15%. Moreover, a financial alliance of 450 companies from 45 countries (investment, insurance and pension funds, banks, stock exchanges, etc.), whose members manage 40% of the world's financial assets, have declared a goal to completely reduce GHG emissions by 2050.

Kazakhstan signed the Paris Agreement on August 2, 2016 and ratified it on December 6, 2016. Before officially signing the Paris Agreement in September 2015, Kazakhstan demonstrated its commitment to its goal by presenting its NDC under the UN Framework Convention on Climate Change, which aims to achieve the following goals:

unconditional reduction of GHG emissions by 15% by December 2030 compared to 1990;

a conditional reduction of GHG emissions by 25% by December 2030 compared to 1990, subject to additional international investment, access to the low-carbon technology transfer mechanism, funds from the Green Climate Fund and a flexible mechanism for countries with economies in transition.

In December 2020, at the Summit on Ambitious Tasks in Connection with Climate Change (organized by the UN, Great Britain, France in partnership with Chile and Italy), the President of the Republic of Kazakhstan Tokayev K.K. announced a new goal for Kazakhstan to achieve carbon neutrality by 2060, reaffirming Kazakhstan's commitments under the Paris Agreement.

Thus, this Strategy for achieving carbon neutrality of the Republic of Kazakhstan until 2060 (hereinafter referred to as the Strategy) was developed taking into account global climate trends and in fulfillment of relevant international obligations. The strategy defines national approaches, the strategic course of public policy for the consistent transformation of the economy to ensure prosperity, sustainable economic growth and equitable social progress and is adopted to ensure consistency

and coordination of government policies.

The strategy takes into account the need to adapt the economy of Kazakhstan to global climate trends, such as the introduction of MTUR, dissemination of ESG principles, promotion and attraction of green investments, energy efficient production, electrification and others.

2. Analysis of the current situation

Since the mid-20th century, Kazakhstan has been faced with the negative consequences of climate change.

Every decade since 1940, the country's average annual temperature has increased by 0.28°C. Particularly high growth is observed in the autumn period (0.31°C)

At the same time, there is a significant decrease in average annual precipitation by more than by 0.2 mm over 10 years.

The economic situation of the last decade of the 20th century led to a decrease in the consumption of fuel and energy resources, which was reflected in a decrease in emissions PG.

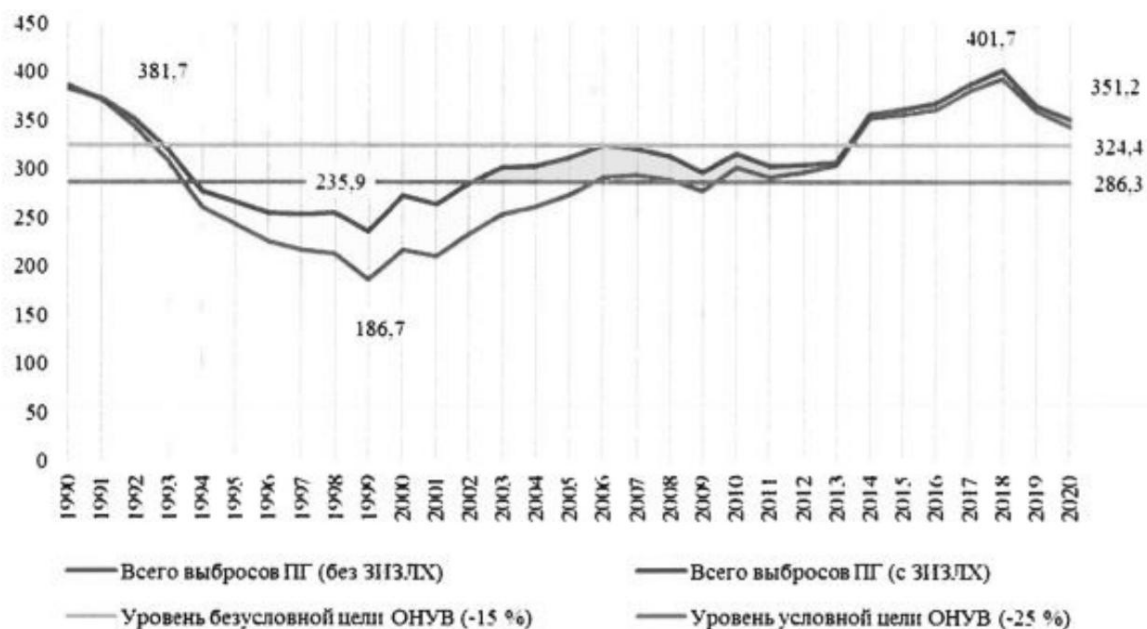
Since the early 2000s, as economic recovery accelerated, GHG emissions also showed an increasing trend before the global financial and food crisis of 2008.

In 2018, net emissions amounted to 401.7 million tons of CO equivalent, exceeding the level emissions in 1990 by 5.2%.

In 2019, there was a downward trend in GHG emissions: their volume amounted to 364.7 million tons of CO₂-eq, which was 9.2% lower than in 2018 and 4.5% lower lower relative to 1990. The reduction in emissions was due to a decrease in fuel consumption.

In 2020, national net emissions are 351.2 million tons of CO equivalent. - were below the 2018 emissions level by 12.6%, 1990 - by 8%. The decrease is due to the COVID-19 pandemic (Figure 1).

Figure 1. Dynamics of GHG emissions



Note: built on based on national inventory data 2022

The structure of national GHG emissions is dominated by three GHGs with a total share of more than 99.5%:

81.6% of national GHG emissions are represented by carbon dioxide (CO₂), which is mainly released during the combustion of organic fuel, as well as in arable farming;

12.4% - methane (CH₄), released mainly in the processes of extraction, transportation, transshipment / storage of fuel, biodegradation of organic waste and raising animals for meat, milk, wool and hides;

5.6% - nitrous oxide (NO₂)

Other types of GHGs enter the atmosphere as a result of industrial processes.

The largest share of GHG emissions in Kazakhstan belongs to the Energy sector (77.6% of national net emissions), followed by the importance of contribution to national emissions by the Agriculture sector with a share of 11.6%, and then in descending order: Industrial processes and use of products (hereinafter referred to as IPIP) (6.3%), "Land Use, Land Use Changes and Forestry" (hereinafter - LULUCF) (2.4%) and "Waste" (2.1%) (Table 1).

Table 1. Changes in GHG emissions in Kazakhstan by IPCC sector 1990 and 2020, million tons of CO₂-eq.

GHG source and sink sectors	1990	2020	Change from 2020 to 1990, %
Energy	316,92	272,50	-14,02
PIIP	19,29	22,29	+ 15,54

Agriculture	44,74	40,72	-8,98
yyyyy	-3,91	8,38	+314,30
Waste	4,65	7,35	+58,17
TOTAL net emissions PG	381,69	351,24	-7,98

Energy

According to the IPCC, the Energy sector (equivalently the energy sector or energy system) covers emissions arising from the combustion of fuels, as well as fugitive emissions of fuels.

The energy sector includes primary energy extraction (oil, coal, peat, shale, natural gas, waste, hydropower, biomass, wind, solar and geothermal energy), transportation, conversion into secondary energy (electricity, heat, gasoline, diesel, hydrogen, biofuels), transmission and distribution, final demand for energy services in transport, buildings and industry, and fugitive emissions from primary energy production, transportation and distribution.

Kazakhstan has the world's largest deposit of thermal coal, which practically lies on the surface of the earth; accordingly, the cost of its production is the lowest in the world.

The country is also rich in coking coal reserves with high methane content of coal seams, which is mined underground.

At the same time, along with the presence of significant reserves and active use of fossil energy resources, Kazakhstan has significant potential for the development of renewable and alternative energy, namely wind, solar, geothermal, nuclear, hydrogen and bioenergy.

The energy sector is the largest source of GHG emissions in Kazakhstan. In 2020, 77.6% (272.5 million tons of CO₂ equivalent) of all annual GHG emissions in Kazakhstan accounted for the energy sector, due to the widespread use of fossil fuel.

III emissions from primary energy production (extraction sector) account for 16.6% of all GHG emissions (58.3 million tons of CO equivalent). Of these, 8.1 percentage points are fugitive emissions, with 6.7 percentage points covered by fugitive emissions from coal mining (23.7 million tons of CO equivalent in 2020).

Final energy demand consists of direct combustion of fuels in industry, transport, agriculture, and residential and non-residential buildings; use of electrical and thermal energy. In the structure used inside countries' fuel and energy resources (150.7 million tons of oil equivalent) oil and petroleum products account for 41%, coal and coal products - 29.4

%, natural gas, including compressed gas (motor fuel), - 7.6%, electricity - 16.2%, heat energy - 5.8%. The share of renewable energy sources (hereinafter referred to as RES) in the country's domestic energy consumption was 2%. At the same time, the same share of renewable energy sources in electricity generation was 3.0% in 2020 and 3.6% in 2021.

Despite the fact that in the structure of used fuel and energy resources, coal and coal processing products make up 29.4% (in comparable energy units), the contribution of coal to national net emissions exceeds 55.7%. Therefore, the gradual withdrawal of the Kazakh economy from coal dependence is important for low-carbon development and achieving carbon neutrality by 2060.

Electricity and heat production

Electricity and heat production covers enterprises whose main activity is supplying the population with public services: electricity and heat production, combined heat and electricity production.

The heat and power generation sector is relatively small from an economic point of view, accounting for 1.6% of total value added and 1.7% of employment in Kazakhstan. However, it is vital for the normal functioning of the Kazakh economy and society. In 2020, the country's power plants and thermal stations (boiler houses) generated 108.1 billion kWh and 91.2 million Gcal. The sector's contribution to national net GHG emissions amounted to 31.6% or 110.9 million tons of CO equivalent.

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In 2020, coal combustion produced 68.9% of electricity and 99% heat energy. 20% of electricity was generated using natural gas, fuel oil - 0.05%. Hydroelectric power plants (hereinafter referred to as HPPs) generated 8.8% of the electricity. Wind power plants (hereinafter - WPP), solar power plants (hereinafter - SPP) and biogas plants (hereinafter - BGU) provided 2.2% of the generated electricity (including small hydroelectric power plants, the share was 3.0%).

Most power plants operate on outdated technologies with excess design service life. In 2020, there were 179 power plants in Kazakhstan: 68 thermal power plants (hereinafter - TPPs) (28 coal, 38 gas, 2 fuel oil), of which 41 are combined heat and power plants (hereinafter - CHP); 51 hydroelectric power plants (45 of them are small hydroelectric power plants with a capacity of up to 35 MW), 28 wind power plants, 31 solar power plants and 1 biogas power plant. The average age of coal power plants was 55 years, gas power plants - 40 years, hydroelectric power plants - 56 years. About 39% of installed generating capacity is over 40 years old and 64% is over 30 years old.

The distribution systems of both electricity and heat are also worn out, which lead to high losses during energy distribution (up to 35% of total

electricity losses in some regions) and are one of the factors increasing GHG emissions from the sector.

The sector's outdated assets lead to the need to modernize and update power and heat production technologies and provide an opportunity to replace existing outdated carbon-intensive equipment and infrastructure with modern low-carbon and carbon-free technologies, such as gas-fired thermal power plants in the initial stage, as well as the active and comprehensive implementation of alternative and renewable energy sources.

Kazakhstan has created the necessary conditions for the development of renewable energy sources:

- 1) a single purchaser of electricity has been determined - quasi-state enterprise LLP "Settlement and financial center for support of renewable energy sources";
- 2) a standard form of contract for the purchase of renewable energy electricity has been determined - Power Purchasing Agreement contract;
- 3) the terms of the priority investment contract are determined for RES;
- 4) tariffs are determined at RES auctions;
- 5) priority dispatch of renewable energy sources and unhindered access to the National Electric Grid of the Republic of Kazakhstan.

Currently, there are 142 renewable energy facilities in the republic with an installed capacity of 2332 MW:

- 43 wind farm facilities with a capacity of 894 MW;
- 54 solar power plants with a capacity of 1150 MW;
- 40 hydroelectric power plants with a capacity of 280 MW;
- 5 bioelectric power plant facilities with a capacity of 8 MW.

The created conditions for the development of renewable energy sources are aimed at supporting large-scale production of electricity from renewable energy sources. Existing mechanisms to support small-scale electricity production from renewable energy sources are not functioning to the fullest.

In Kazakhstan, thermal energy production is carried out by 37 thermal power plants and about 2,500 boiler houses of various capacities. The total available electrical capacity is 6,517 MW (33.8% of the total available power of power plants), thermal capacity is 20,135 Gcal/h. Today 38% are steam and 17% hot water boilers

24% of steam and 60% of gas turbines are in operation with an extension of the park period resource set by manufacturers and require phased modernization. 76% of thermal power plants have operated for more than 50 years, their average wear and tear is 66%.

The total length of heat supply networks is 11.4 thousand km, their average wear is 57% (6.5 thousand km), including 3.2 thousand km that needs complete replacement.

Transportation

In the IPCC Common Reporting Format, the energy sector covers fuel combustion in the Transport group, which includes all types of transport activity (excluding military transport). Emissions from fuel for any aircraft or maritime transport involved in international transport must be excluded and should be reported separately.

Currently, the transport sector accounts for 6.6% of value added and about 6.9% of employment in the economy. Economic development in recent decades has stimulated activity in the transport sector and, as a result, increased the amount of transport used and the corresponding GHG emissions. Over the past 15 years, car ownership by both households and businesses, as well as road passenger volumes, have tripled.

However, the transport sector runs almost exclusively on fossil fuels and is therefore one of the main sources of GHG emissions.

In addition, a significant share of road transport in Kazakhstan consists of private cars. This is also reflected in the structure of GHG emissions from this sector.

The large share of road transport in GHG emissions from fuel combustion reflects the relatively high level of motorization in the country, while at the same time the vehicle fleet largely consists of old and obsolete vehicles.

Buildings (housing and communal services sector)

In the IPCC Common Reporting Format, the energy sector covers fuel combustion in the Residential and Commercial groups, which together form the buildings sector. This sector includes fuel consumption in residential buildings, population, in commercial and institutional buildings.

Kazakhstan's climatic conditions, with very cold winters and hot summers, stimulate high energy demand for heating and cooling buildings. The average level of energy consumption in the buildings sector is about 270 kWh/m² and is more than twice as high as in Europe (100-120 kWh/m²), and also significantly higher than energy consumption in Russia (210 kWh/m²).

The main reason for such low energy efficiency of buildings, in addition to harsh climatic conditions, is high energy losses due to insufficient thermal insulation of buildings. Heat losses in buildings are caused by flaws in the planning of the ventilation system (56% of all losses), losses through (insufficiently insulated) walls (22%), windows (14%) and floors (8%). However, residential and non-residential buildings accounted for 43.3% of total final energy consumption in Kazakhstan in 2020.

The proportion of buildings that do not meet modern energy standards is quite high. Overall, of the 2.4 million buildings in Kazakhstan, 31.5% are over 50 years old and another 32.9% are over 25 years old.

Investments in thermal modernization of buildings are hampered by low tariffs for heat and electricity, since this implies a very long horizon for refinancing investments in energy efficiency through energy savings.

Considering climatic conditions and the problem of thermal insulation, heat production is the most important source of emissions from buildings. Most heat is produced by direct combustion of fossil fuels or in small boiler houses. In rural areas, most of the heat is produced by burning coal and petroleum products.

In large cities, centralized heating supplies about 50% of consumption. However, lack of investment in aging distribution networks results in energy distribution losses amounting to up to 30% of the energy supply.

Industry

In Kazakhstan, the manufacturing industry accounts for about 12.9% of the total volume of domestic production and 6.6% of employment.

Over the past 20 years, industrial production in Kazakhstan has increased significantly, leading to an increase in associated GHG emissions. By 2020, emissions from fuel combustion in industry reached 144.2% compared to the 1990 level. Industry is also the largest consumer of final energy (31.1%, or 12.5 million tons of oil equivalent in 2020).

Industry produces more than a fifth (21.6%) of all GHG emissions in the economy. At the same time, GHG emissions in ferrous and non-ferrous metallurgy amounted to 70.4% of GHG emissions in industry in 2020.

The share of GHG emissions from IPIP in total net emissions is 22.3 million tons of CO₂-equivalent, or 6.3%. Emissions from IPPPs have increased since 1996, driven primarily by the minerals industry, whose emissions have increased 2.1-fold since 1990. Overall, by 2020, emissions from IPPPs were 15.5% higher than 1990 levels.

The largest share of GHG emissions from industrial processes occurs in the production of basic materials - cement, aluminum, cast iron and steel. In Kazakhstan, these industries produce 91% of all emissions from industrial processes (54.0% in metallurgy and 37.1% in the mineral industry).

Agriculture and forestry

The subsection covers two sectors in the IPCC reporting format.

The Agriculture, Forestry, Fisheries and Fish Farming sub-sector of the energy sector includes the combustion of fuels in agriculture, forestry, fisheries and fish farming, such as fish farms.

The sector "Agriculture and forestry, other types of land use" covers GHGs produced by agriculture, net CO emissions from soils,

used in agriculture, and net CO emissions from deforestation and other

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types of land use.

Agriculture and forestry provide about 6.2% of Kazakhstan's GDP and 13.5% jobs in the country. 41.1% of the population of Kazakhstan lives in rural areas.

Agricultural activities are affected by the consequences climate change and simultaneously affects climate conditions, water availability, land degradation, deforestation and other processes.

In 2020, the agriculture and forestry sectors (including land use) together with fuel combustion emitted 52.1 million tons of CO equivalent, or 14.8% of national net GHG emissions. Fuel combustion itself accounts for 3.0 million tons of CO₂-equivalent, or 0.8% of national net GHG emissions.

The majority of GHG emissions not associated with fuel combustion in agriculture come from livestock farming (62.5%). Since reaching a low in 1998, GHG emissions from domestic fermentation have grown at an average rate of 3.5% per year. This increase in GHG emissions reflects both an increase in the animal population and an increase in productivity of dairy and other livestock over time.

The sector's GHG mitigation effect—GHG sequestration through carbon sequestration in soils and biomass—occurs in forests, croplands, grasslands, wetlands, human settlements, and other lands across the country. When it comes to LULUCF, forestry is the largest carbon sink in Kazakhstan (10 million tons of CO equivalent in 2020). The Forest Fund of the Republic of Kazakhstan manages 30.1 million hectares of forests; forest planting (public and private) and sustainable reforestation are necessary steps to expand forest cover. At the end of 2020, an ambitious plan was announced to plant more than two billion trees by 2025.

Inappropriate handling of soils in agriculture (non-compliance with crop rotation, insufficient and untimely fertilization, and so on) has led to a decrease in the level of humus in soils, which continues to decline from year to year, accordingly, the ability of soils to capture carbon dioxide from the atmosphere and deposit it also decreases.

The sector is vulnerable to climate impacts. Climate change is affecting the structure of precipitation and biomes in Kazakhstan, increasing the frequency and intensity of extreme weather events, increasing average temperatures and decreasing the availability of water for irrigation. Agriculture currently accounts for two-thirds of national water consumption. Climate change may lead to negative consequences for the growth of yields of most agricultural crops.

crops in almost all regions.

Agricultural development is considered a top priority as it plays an important role in providing employment, especially in rural areas, and for social and food security reasons, while its importance in mitigating climate change is increasingly recognized. However, limited access to finance prevents many farmers from developing a more productive and sustainable agricultural sector. More than 80% of agricultural infrastructure is outdated. Currently, only 1% of agricultural land in Kazakhstan is devoted to organic agriculture.

Waste management

The waste management system is mainly dominated by waste disposal and incineration. Today, the waste management sector accounts for 0.3% of total value added and 0.9% of total employment in the economy, while GHG emissions from waste account for 2.1% of total emissions.

The waste sector accounts for emissions of methane (CH₄) and carbon dioxide (CO₂), released as a result of anaerobic decomposition of organic waste and sludge at municipal solid waste landfills (hereinafter referred to as MSW) or during wastewater treatment under anaerobic conditions.

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GHG emissions from waste have been continuously increasing since 1994. 52.2% of GHG emissions in this sector accounts for solid waste management, 47.4% - for wastewater treatment, 0.4% - for burning.

Waste generation is increasing due to population growth and the increase in waste per capita. In 2020, 54.7% of solid waste was buried in landfills, 24.4% was sorted for further processing. In addition, despite the high proportion of wastewater treatment, the sludge remaining after treatment (about 20% of dry matter) is sent to sludge sites and landfills.

Separate collection of various solid waste streams (for example, paper, glass, organic waste) and their preliminary sorting before disposal are practically absent, which increases the flow of waste to landfills. It is estimated that about 37% of the generated solid waste (about 2 million tons per year) can be used to produce biogas.

Most landfills are in poor condition, have exhausted their capacity and require reclamation. Low tariffs for collection and sorting of solid waste make investments in waste management projects uneconomical and impede compliance with regulatory requirements.

With regard to wastewater, a similar situation arises: insufficient provision of treatment facilities in cities and large urban-type settlements. The condition of existing treatment facilities is unsatisfactory with

worn-out equipment and often outdated technologies and cleaning methods.

There is no infrastructure for sludge treatment and disposal. Currently, sewage treatment plant sludge is not processed, but is collected and buried at sludge beds or landfills, regardless of the organic content in it substances.

Risks and opportunities

The current situation is complicated by the presence of internal and external risks.

Over the past decades, Kazakhstan has prioritized the rapid expansion of fossil fuel production and mining products, creating an economic model that is based on the country's rich natural resources and dependent on the export of fossil fuels and minerals. This strategy has generated significant economic growth, and Kazakhstan's economy has nearly tripled since 1998.

Global trends in recent years have led to stricter environmental requirements for manufactured products, which is a signal for enterprises with low levels of energy efficiency and high levels of carbon intensity. These include plans by financial institutions and investors to divest from fossil, high-carbon assets in favor of green investments; growing demand for disclosure of information on GHG emissions and measures to reduce them, including across the supply chain; plans to implement border carbon adjustment mechanisms.

Decarbonization in major export markets could sharply reduce future global demand for high-carbon goods, which in turn increases the risk of stranded assets associated with the extraction, processing and use of fossil fuels (particularly in the energy, construction and industrial sectors).

This risk is especially high for Kazakhstan, whose economic model is based on the export of fossil fuels. This model has led to historically high levels of investment in the extractive sectors and a lack of investment in other sectors of the economy. As a consequence, there is significant deterioration of fixed assets and the operation of outdated technologies, which lead to high energy intensity of both the economy as a whole and in the context of its industries and, accordingly, large-scale modernization is required.

The key barrier to the upcoming modernization is the imperfection of the tariff setting system. In particular, the current system is limited in stimulating investment in distribution networks and generation technologies electricity and heat.

At the same time, new opportunities are opening up for the country in the area of attracting “green” finance, transfer of carbon-free technologies, integration into the global carbon market, implementation of carbon and climate projects under the auspices of the Paris Agreement, as well as participation in new international markets for “green” energy resources and products and innovative technologies.

The perceived threats posed by global climate change, the economic and political challenges posed by growing international ambitions to combat with climate change, and the emerging opportunities necessitate the need for Kazakhstan to accelerate the process of decarbonization of the national economy. Successful implementation of decarbonization will depend on the success of initiatives to develop the gas resource base.

3. Basic provisions: purpose and principles, economic effect, approaches and vision

3.1. Purpose and principles

The main goal of the Strategy is to achieve sustainable economic development Kazakhstan towards climate change and carbon neutrality by 2060.

The medium-term goal of the Strategy (in accordance with the NDC of the Republic of Kazakhstan) is to reduce emissions GHG by 2030 by 15% relative to 1990 emissions levels (unconditional target) and achieving a reduction of 25%, subject to receiving international support for decarbonization of the economy (conditional target).

Achievement of the Strategy goal will be measured by the following targets indicators (Table 2).

Table 2. Target indicators for GHG emissions, capture and absorption

	1990	2020	2030	2040	2050	2060
	Actual emission level achieved		Unconditional target ONU* ONUV*	Indicative emissions and level **		Strategically tune target
National e net emission ii GHG, million tons of CO ₂ -eq.	381,7	351,2	324,4	209,9	95,4	0,0
Net-absorbing unit PG (-)/ n e t t o - GHG emissions (+) in the LULUCF sector, million tons of CO ₂ -eq. 2	-3,9	8,4	-20,3	-28,3	-40,3	-45,2
GHG emissions, million tons of CO ₂						

without eq. accounting yyyy	385,6	342,9	344,7	238,3	135,8	45,2
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Note:

* Conditional NDC target minus 25% from year level 1990 (286,3 million tons CO₂-eq.)

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There will be subsequent updates. The indicative level will be revised when

Strategies.

The implementation of the Strategy is based on the following principles:

1) focus, unity and integrity: all planned initiatives are aimed at achieving the goal and are coordinated with each other;

2) feasibility: suggests a technologically feasible, but least expensive way of low-carbon development and achieving carbon neutrality;

3) transition justice: creating new opportunities in affected regions decarbonization policy, with targeted support from the population;

4) circular economy: an economy based on the use of secondary resources and consumption reduction;

5) phasing: implementation of strategic initiatives through short-term and medium-term plans with ongoing analysis of previous stages and everything strategic cycle;

6) openness and interaction with society: broad involvement of all stakeholders at all levels of monitoring and decision-making, including representatives of central and local authorities, the quasi-public sector, science, business (associations and enterprises), non-governmental organizations and local communities;

7) rationality (balance): maintaining a balance between achieving the goal and ensuring security (economic, energy, social) and stability.

3.2. Investment need

Economic development, driven by investment activity in the new emerging environment, will increasingly require the creation of market conditions to increase the attractiveness of capital and financial markets, as well as for investment by domestic and foreign companies and private households.

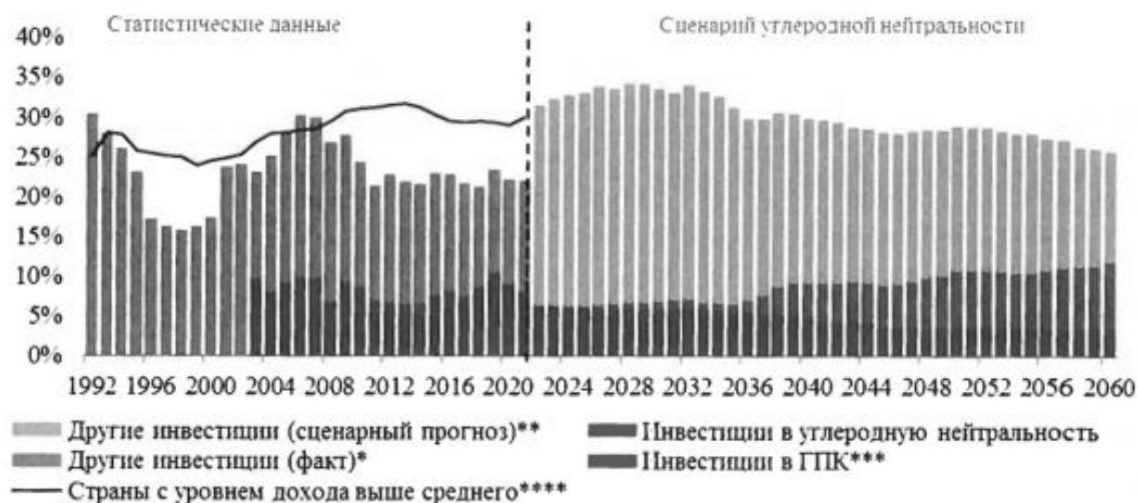
It is important to emphasize that a significant proportion of low-carbon and zero-carbon investments will be carried out in place of high-carbon projects. This substitution effect is illustrated in Figure 2, which compares historical investment levels relative to GDP and forecast under a carbon neutrality scenario.

In recent decades, the share of investment in Kazakhstan's GDP has been at a rare level. with the exception of being consistently lower than the average for the group of upper-middle-income countries (the World Bank classifies countries with per capita income levels between US\$4,096 and US\$12,695 as upper-middle-income countries).

Carbon-intensive investments are increasingly being reduced, and investment funds are being redirected to low-carbon and zero-carbon activities. Relative to GDP, green investments will require a similar share of the total investment that currently falls on the mining and metallurgical complex.

Given the extremely high depreciation of fixed assets, the level of investment will have to increase significantly until 2030. However, if green technologies are chosen to replace outdated equipment, these investments will contribute to significant reductions in GHG emissions without the need to mobilize additional investments specifically in decarbonization.

Figure 2. Ratio of total investment in the economy to GDP (statistical data and carbon neutrality scenario forecast), %



* Before 2003, total investment, including mining

** Scenario forecast data may differ slightly from

World Bank data due to differences in accounting for reinvested earnings

*** Mining industry, from 2022 – scenario forecast

****Gross national product per capita per year between \$4096

US and US\$12695

Source: World Bank data, Office of National Statistics).

(1992 – 2019

The share of investment in GDP is not much higher than historical levels. In the phase of the most intensive investments until 2030, the share of investments in GDP reaches 34

%, which is slightly higher than the average for the group with above-average income and investment levels in Kazakhstan in 2006-2007. After 2030, the share of investment in GDP decreases and by 2060 again reaches the current level.

Net investment in low-carbon technologies that support low-carbon development and carbon neutrality is estimated at US\$610.0 billion - 19.6% of gross fixed capital formation. Direct government investment in achieving carbon neutrality will represent only a small share of 3.8% of total investment.

More than half of the required investments, or 386.3 billion US dollars, are existing and circulating investments in the economy, which will be reoriented from commodity sectors to greener sectors of the economy, the rest, or 223.7 billion US dollars, are new investment resources.

At the same time, the investment need until 2030 is \$10 billion USA. The remaining US\$600 billion will be invested by the end of 2060.

Given that the expected total GHG emission savings over the same period are 9.335 billion tons of CO equivalent in a carbon neutral scenario,

decarbonization price is relatively low - 65.4 US dollars per tonne of CO -

equivalent.

2

The majority of investments will be made by private and public enterprises and households, as well as from a specially created carbon fund, consolidating all environmental payments, international grants and investments for greening and decarbonization of the economy.

Overall low carbon development and achieving carbon neutrality will affect the economy of Kazakhstan as follows:

- sustainable economic growth;

- increasing the investment attractiveness of the economy;

- high level of technological development and competitiveness;

- formation of new highly productive jobs while maintaining

- high level of employment;

- growth in the volume of Kazakhstan's non-resource exports;

- improving the quality of the environment and the environmental well-being of the population.

3.3. Approaches and vision

Achievement of the Strategy's goal will be ensured through the comprehensive implementation of low-carbon policies and the application of sectoral (energy, industry, agriculture and forestry, waste management) and cross-cutting approaches (just transition, green financing,

research and development (hereinafter referred to as R&D) and education, public consciousness, international cooperation, adaptation to climate change, carbon management system).

At the same time, low-carbon policy will be accompanied by steps to ensure favorable investment climate.

For this purpose, it is envisaged to create a favorable legislative and institutional environment, support the creation and development of the necessary financial and physical infrastructure of the green economy. Particular attention will be paid to efforts to continuously attract and support private investment (including international) in the decarbonization process.

The state will stimulate the accelerated modernization of existing production facilities and infrastructure, provide targeted measures to support social vulnerable groups of the population.

Important aspects of the transition to carbon neutrality are the development of regulation through the introduction of information technology and the transition to digital platforms for processing, control and monitoring on the principles of objectivity and transparency.

For these purposes, it is planned to digitalize monitoring of the composition and volume of GHGs, in including the development of a targeted program for monitoring satellite data to control emissions at the national, sectoral and regional levels.

Space-based monitoring of emissions through remote sensing satellites will ensure transparency, objectivity and comparability of data for participation in international economic mechanisms in accordance with the Paris Agreement.

agreement.

The digitalization of business processes in the mining and metallurgical, oil and gas, fuel and energy and agro-industrial complexes will be gradually implemented, which will allow scaling up the development and implementation of low- and carbon-free technologies taking into account international standards. All processes of production, transportation and energy consumption, including housing and communal services (hereinafter referred to as housing and communal services) and households, will be gradually digitized.

The energy transition will be accompanied by the introduction of advanced international approaches and standards in all sectors of the economy in order to implement the transition to alternative and renewable energy sources. These include standards for environmentally friendly modes of transport, reduction of fuel and energy consumption, waste recycling, and energy efficiency.

In order to recognize verified reports of domestic companies on GHG emissions in other countries, a GHG validation infrastructure will be created

3.3.1. Sectoral approaches and vision for low-carbon development

Kazakhstan's achievement of carbon neutrality is an ambitious goal, which will be achieved through the implementation of initiatives in three key directions:

- 1) decarbonization of industries and processes related to fossil fuels;
- 2) decarbonization of non-fossil fuel industries and processes;
- 3) increasing natural sources of emission absorption and introducing industrial solutions for capture, use, long-term storage, carbon sequestration.

GHG emissions associated with fossil fuels will be reduced by:

- 1) transition from the use of fossil fuels and its derivatives to alternative and renewable energy sources;
- 2) increasing energy efficiency and energy saving;
- 3) electrification - replacing fuel-burning plants with technologies that powered by electricity.

Non-energy GHG emissions will be reduced by increasing carbon efficiency - the use of low or zero GHG emissions and technologies. Carbon efficiency will be improved by applying best available techniques to industrial processes and

use of carbon-free products, development of sustainable agriculture and waste management.

It is also planned to reduce GHG emissions by increasing the absorption capacity of ecosystems, as well as the use of carbon capture, use and storage technologies. For this purpose the ability will be used

store carbon in forests, soils, wood products or industrial processes. Technologies for capturing, using and storing carbon are intended to be aimed at capturing and sequestering carbon and methane.

3.3.1.1. Energy

Low-carbon development and achieving carbon neutrality in Kazakhstan by 2060 will require a deep transformation of the energy system and will consist of three main elements:

- 1) decarbonization of primary energy supplies;
- 2) decarbonization of electrical and thermal energy production;
- 3) decarbonization and highly efficient end-use of energy in buildings, transport and industry.

The largest reductions in GHG emissions in the energy sector will be achieved through a shift towards more sustainable energy sources: by gradually reducing the volume of fossil fuels, switching to the use of electricity and heat instead of directly burning fossil fuels. Decarbonization of the energy sector requires the use of natural gas as an intermediate

fuel and for this purpose geological exploration work will be carried out to identify new gas fields. Will receive active development in the process of decarbonization alternative and renewable energy sources.

Increasing energy efficiency and the transition to low-carbon technologies in all sectors of the economy will cause significant changes in the supply of primary energy. energy.

Decarbonization of the fossil fuel sector has its own challenges. The oil and gas industry, which accounts for 2.7% of the country's emissions, will reduce further by reducing methane leaks, using more energy-efficient technologies and improving

production processes.

In the coal mining sector, the reduction in GHG emissions will occur due to the reduction in the use of coal in other sectors of the economy. At the same time, due to sufficient coal reserves in the country, a long-term vision for an alternative use of coal.

Final demand will shift towards low-carbon fuels (biofuels and hydrogen) in areas where switching to electricity is still difficult. In this regard, a long-term vision for the development of hydrogen energy will be developed.

Reducing final energy demand requires significant transformations in sectors such as transport, housing and communal services, agriculture (in terms of fuel combustion) and industry.

Energy efficiency improvements in low-carbon development and achieving carbon neutrality will be significant across all sectors. Such improvements include, for example, improving thermal insulation and using modern energy-efficient appliances in buildings, switching to modern fuel-efficient vehicles and the gradual replacement of industrial equipment at the end of its service life with newer, energy-efficient technologies. Wherein To accelerate the implementation of low-carbon projects, a vision for their tariff regulation will be developed.

Decarbonization will require a widespread shift away from fossil fuels and ineffective fuel subsidies. Thus, the maximum possible transition of final energy consumption to electricity and heat, as well as to low-carbon and zero-carbon fuels.

Taking into account the goals defined in this Strategy, it is necessary to accelerate the ongoing process of transferring energy production capacities from coal to natural gas

Other approaches to decarbonizing the energy sector will also be developed as scientific and technological advances in low-carbon technologies and processes occur.

As a result of the implementation of the Strategy, there should be a change in the priorities of the energy system in the sectors of electricity, transport, housing and communal services (buildings) and industry (Table 3).

Table 3. Priorities of current and decarbonized energy systems by sectors

Sector	Current system (2022)	Carbon neutral system (2060)
Electric power industry	Coal dominance	Alternative renewable sources and energy, capture and storage carbon
Transportation	Predominance petroleum products	Electricity, hydrogen, biofuels
Building	The predominance of coal and gas in heating systems	Electrification, energy efficiency, heat supply from alternative renewable sources and energy
Industry	High demand for fossils fuel	Electrification, energy efficiency, hydrogen, carbon capture and storage

Thus, low-carbon development and a carbon-neutral system in 2060 involve the following transformations:

- 1) gradual replacement of coal with alternative and renewable sources energy;
- 2) displacement of fossil fuel combustion in the final consumption structure to the lowest possible level through electrification of energy consumption in all sectors of the economy;
- 3) transition to the use of hydrogen, biofuels and synthetic low-carbon fuels in processes that will be difficult or impossible to electrify;
- 4) application of carbon capture and storage technologies.

Electricity and heat production

The transformation of the electricity and heat energy industries will be driven, on the one hand, by changes in the technological structure of electricity and heat production and, on the other hand, by the growing demand for electricity from other decarbonized sectors. At the same time, the primary role in decarbonization

will play a role in reducing losses in the generation and transmission of electrical and thermal energy.

For low-carbon development and achieving carbon neutrality by 2060, a gradual systematic reduction in the share of coal generation will be carried out with an increase in the share of renewable energy sources and alternative energy, as well as the use of natural gas as an intermediate fuel. The capacity structure will include nuclear power plants as a stable source of energy, so a long-term vision for the development of nuclear energy will be developed.

Due to the growing share of electricity generation from renewable energy sources and alternative sources, additional input of flexible generation sources is required. In this regard, a long-term vision for the development of solar and wind generation will be developed.

In the medium to long term, there is uncertainty regarding the availability of sufficient water resources, so a long-term vision will be formed for development of hydropower.

In the medium to long term, carbon capture and storage (CCS) technology is expected to be used to capture GHGs. In this regard, a vision will be developed to decommission coal-fired capacity with a current operating life of more than 30 years and introduce carbon capture and storage technology for those units that will continue to operate after 2035. At the same time, the withdrawn coal facilities will be given priority rights to implement "green" energy projects.

At the same time, gasification of existing coal facilities can also contribute to reducing emissions.

District thermal energy production will be decarbonized by moving from coal to natural gas, using renewable energy in the form of geothermal energy (heat pumps) and biofuels. Decentralized (

individual) autonomous heat supply systems will become the main target of technological changes. In the medium and long term, the use of geothermal energy and hot water supply from solar energy will actively develop, so a vision for their development will be developed.

To decarbonize the production of electricity and heat, a transition will be made to a tariff setting system that stimulates the introduction of energy-saving technologies and changes in consumer behavior.

An important point is the development of the wholesale and retail markets for electrical energy, thermal energy, as well as the network infrastructure of the National Electric Grid and network energy storage stations.

In addition, the development of small-scale renewable energy sources will be stimulated, the development of "smart" power generation, and other approaches will be used to decarbonize the electricity and heat production sector.

Transportation

Low-carbon development of the transport sector should be carried out in accordance with the concept of "avoidance - shift - improvement". Thus, decarbonization will be carried out in three main directions:

- 1) eliminating or reducing the need for travel (avoidance);
- 2) transition to more environmentally friendly modes of transport (shift);
- 3) increasing energy efficiency and reducing vehicle emissions (improvement).

Avoidance refers to a drop in energy demand from passenger cars, optimization of passenger and freight flows, development of a public transport system, optimal planning of cities, which will reduce the need for car travel as such.

The shift includes the active use of alternative fuels and large-scale electrification of transport.

Improvement refers to the renewal of the vehicle fleet and the modernization of existing vehicles. This step will be combined with avoidance and shift.

To decarbonize the transport sector, city planning systems and transport infrastructure will be improved. Sustainable urban mobility and public transport systems will be actively developed by optimizing passenger transportation, large-scale electrification and gasification.

Further electrification of railways and optimization will be carried out freight transport.

The transition to transport using alternative and renewable energy sources, through the creation of appropriate infrastructure and the use of other incentive mechanisms.

A significant role in the decarbonization of transport will be played by the development of domestic transport production using alternative and renewable sources energy.

Other approaches to decarbonizing the transport sector will be used, which will be developed in international practice for decarbonizing transport sector.

Buildings (housing and communal services sector)

Buildings are among the largest sources of GHG emissions and therefore have the greatest impact on reducing emissions. Decarbonization of the buildings sector will

be carried out through the transition from heating based on fossil fuels to heating based on renewable energy sources and more efficient technological equipment.

To reduce GHG emissions from buildings, significant investments will be attracted in gasification and electrification of heating, as well as the use of renewable energy sources (for example, photovoltaics, thermal, solar, geothermal energy).

Steps will be taken to introduce a system of monitoring, reporting, verification of the energy efficiency of buildings and establish strict requirements for the energy efficiency of new residential, public and industrial buildings of at least class C.

Thermal modernization of buildings and the introduction of new heating technologies are necessary to significantly reduce the demand for energy for heating purposes, therefore, a large-scale implementation of automated systems for monitoring and accounting for thermal energy will be carried out.

Increasing energy efficiency through thermal modernization of buildings and the introduction of new energy-efficient technologies will lead to a reduction in energy consumption and the associated negative social costs of burning fossil fuels in buildings.

The introduction of renewable energy sources and efficient technologies for space heating and hot water supply will also receive active development.

At the same time, other developed approaches to decarbonization of the housing and communal services sector in international practice will be used.

3.3.1.2. Industry

Decarbonization of industrial processes requires significant changes. The main elements of such transformations include:

- 1) use of alternative building materials instead of cement, steel, aluminum with lower or zero GHG emission intensity;
- 2) increasing the volume of waste processing (including scrap) to reduce the need for raw material processing as the main source of emissions from the sector;
- 3) introduction of new production technologies with zero GHG emissions in combined with carbon capture and storage.

Many options for decarbonizing industrial processes involve upgrading equipment and restructuring production so that decouple production processes or allow equipment to be easily upgraded from low-carbon to zero-carbon processes (natural gas to hydrogen conversion in DRI).

Therefore, even if some technologies are still expensive for some manufacturers (hydrogen DRI or CCS in cement plants), transition technologies (natural gas DRI) and process improvements (CO injection into concrete,

which will subsequently be supplied with its own CCS plants) are preparing the ground for the complete elimination of technological GHG emissions in these industries.

Innovative low-carbon developments in mechanical engineering will also be widely introduced and other approaches to decarbonization of the industrial sector that will be available in international practice will be used.

In general, steps will be taken to decarbonize industry
reduction of heat losses in production processes and disposal
low-temperature heat.

Specialization and cooperation in the use of production will develop
the most modern energy efficient technologies and materials.

3.3.1.3. Agriculture and forestry

The sector's energy consumption mix will shift from fossil fuels to alternative and renewable energies such as biofuels and geothermal energy.

It is important to use the potential of bioenergy production on the path to decarbonization from agricultural waste. The use of controlled decomposition technologies in anaerobic digestion plants to produce biogas for heating and power generation will reduce waste and GHG emissions. Solid residues from anaerobic digestion can be used as organic fertilizer and to some extent replace chemical fertilizers.

In general, an increase in agricultural production will lead to
increasing GHG emissions, although decarbonization measures will slow this trend.

Key decarbonization actions include:

- 1) sustainable agriculture and livestock management, improvement
irrigation;
- 2) sustainable forest management and reforestation.

Increased sustainable agricultural practices will be required, especially in terms of improved livestock management and expanded irrigation systems, including (but not limited to) changes in crop rotation and crop diversification. Sustainable livestock management practices will be actively introduced, such as the sustainable use, development and conservation of livestock genetic resources, the application of technological solutions to reduce methane emissions from livestock and sustainable pasture management.

Planting cover crops, integrating livestock and
crop production to benefit from the synergies between them.

It is planned to expand the scale of climate-smart agriculture, in particular the development of carbon farming, the introduction of precision farming principles, the development of new climate-resistant crops, and the development of organic farming practices.

In terms of sustainable forest management and reforestation, steps will be taken to stop the process of deforestation, preserve forests, and restore degraded lands. A vision will be developed for the development of public and private afforestation, sustainable land management and improvement of water supply and irrigation.

To further ensure food security, agroforestry and organic farming practices will be expanded and reduced chain "producer - consumer". Building food systems based on circular economy principles and developing regenerative agricultural practices will be important.

An important point is the integration of biodiversity into agriculture.

As a result of changes in land use, the sector can become clean, which will cover GHG emissions from CO₂ absorber

agricultural production and partly in other sectors.

Thus, investing in sustainable agriculture and climate change resilience brings double benefits - not only reduces GHG emissions from agriculture and contributes to climate change mitigation, but also

improve productivity.

3.3.1.4. Waste management

The main steps to decarbonize the waste management system will be protrude:

- 1) reduction of waste generation volumes;
- 2) accelerated implementation of full coverage of solid waste collection and sorting;
- 3) increasing the share of recycled and compostable waste.

A reduction in the total volume of GHG emissions from solid waste will be achieved through the gradual elimination of open waste disposal and a significant reduction in waste disposal at landfills. These reductions more than offset the small increase in emissions resulting from the increased use of organic waste for composting and energy production. There will be incentives to accelerate the implementation of full coverage of waste collection, sorting and recycling.

It is important to ensure a transition to the use of more efficient water-saving devices and equipment in order to reduce the volume of wastewater. Therefore, additional incentives will be implemented to minimize waste and wastewater generation. Changing the technology for processing sewage sludge will increase its use for the production of biogas and fertilizers. This will not only reduce GHG emissions from wastewater, but also help increase production

renewable energy, reducing the use of fossil fuels and additionally helping to reduce GHG emissions from energy use.

In general, to decarbonize the waste management sector, a vision will be developed for the development of a circular economy model and gasification of waste (with energy generation and/or chemical production).

3.3.1.5. Cross-sectoral vision for low-carbon development

In the process of energy transition, it is envisaged to implement approaches to reduce GHG emissions that are applicable to the above sectors. These will include the introduction of financial and tax policies that encourage the reduction of anthropogenic GHG emissions in carbon-intensive industries

economy.

Government support will be provided for the implementation, replication and scaling of carbon-free and low-GHG technologies.

Tax, customs and budget policies will be changed to take into account the challenges of development with low GHG emissions and the consequences for changes in the GHG balance in budget expenditures and investments will be taken into account.

Important areas are the adoption and implementation of sectoral and regional plans to reduce emissions. Sectoral targets will be set for the transition to low-GHG development and increased energy and environmental efficiency in economic sectors.

Incentives will be applied for the use of secondary energy resources in the production of goods and for the support and dissemination of technologies for the capture, disposal and further use of GHGs.

Mechanisms will be developed to stimulate energy saving and the introduction of low-carbon and carbon-free technologies.

For the successful implementation of the energy transition, it is planned to form and development of national scientific and engineering potential.

A system of white and "green" certificates, a system of public non-financial reporting of companies and a regulatory framework for accelerating the energy transition.

3.3.2. Cross-cutting low-carbon development approaches

In order to effectively and timely implement the Strategy, the close intersectoral and interdepartmental coordination of actions between government agencies.

Low carbon development and the transition to carbon neutrality will be accompanied by broad involvement of stakeholders at all levels of decision-making, including representatives of central and local authorities, the quasi-public sector, science, business (associations and enterprises),

non-governmental organizations and local communities. Such participation of interested parties (stakeholders) is intended to contribute to greater understanding and supporting processes in achieving positive results in the medium and long term, implementing joint initiatives for low-carbon development and the transition to carbon neutrality.

Businesses can voluntarily initiate the development of corporate low-carbon development and carbon neutrality strategies. Business initiatives will provide additional impetus to low-carbon development.

At the same time, the government will take measures to support the development and implementation of corporate strategies by connecting to the green taxonomy, the best available technology framework and special economic zone mechanisms.

3.3.2.1. Just transition and job creation

Low-carbon development leads to transformation of economic structure countries, in particular industrial sectors. As a result, workers operating in these sectors of the economy related to fossil fuels will be fully provided with social protection measures.

In addition, these workers will be provided with access to retraining and obtaining “green” jobs in low-emission industries and assistance will be provided in organizing small “green” businesses.

At the same time, low-carbon development will stimulate increased employment in the sectors of agriculture, bioenergy production and waste management. In addition, additional jobs are expected to be created through the introduction of renewable energy sources, modernization of buildings and infrastructure development.

Large-scale modernization of fixed assets in the energy sector and active the development of renewable energy sources is impossible without systemic reform of tariff policy.

At the same time, possible negative effects for households will be significantly mitigated through comprehensive improvements in energy efficiency, targeted financial assistance to socially vulnerable household consumers and reducing the cost of other types of energy.

To increase public awareness, timely planning and communication of ongoing tariff reforms will be carried out, combined with an information campaign on the benefits of energy efficiency.

Mechanisms will be developed to mitigate social risks to ensure a fair and effective transition (including targeted assistance to households).

In addition, as decarbonization steps are implemented in Kazakhstan and other countries, further research will be conducted regarding the labor market and

creating jobs in new sectors that will serve as the basis for the deployment of programs and support mechanisms, including retraining and reskilling programs for workers in declining industries.

Support for workers who do not have the skills to work in new industries (including using low- and no-carbon technologies), as well as training and retraining of labor resources, especially in basic industries, will be included in government measures in the field of labor force development.

3.3.2.2. Financing and green investments

Attracting additional private investment from domestic and international sources to transition to a green and carbon-neutral economy will be a strategic priority for the country.

Investments in the transition to a green and carbon-neutral economy not only stimulate GDP growth, but also generate large benefits for the economy. Environmentally sustainable agricultural practices reduce GHG emissions while conserving water resources, reducing soil erosion, increasing crop yields, and additional income, increase production volumes and reduce the risk of damage from negative weather and climatic factors.

Investments in energy efficiency of buildings lead to energy savings and lower costs for households and businesses, reducing air pollution harmful and dangerous substances, increasing incomes of the population.

Reusing waste (circular economy) creates synergies in other sectors, reducing raw material costs. Investments in zero-carbon transport reduce noise pollution and atmospheric pollutants, and provide tangible benefits to households in the form of fuel cost savings.

According to the World Bank, the right investments now can deliver short-term benefits - jobs and economic growth - and long-term benefits, including decarbonization and increased resilience. Low-carbon development incentive programs can create new jobs that are sustainable, inclusive and help reduce inequality, improve infrastructure resilience - benefits for the economy.

Kazakhstan is well positioned for international climate finance and is able to attract investment through a variety of channels, taking into account corporate projects, ETS, green finance schemes, public finance and international financial institutions. However, the investment resources needed for low-carbon development and achieving carbon neutrality require increased funding. Therefore there will be

a vision has been formed for financing the transition to carbon neutrality with a detailed study of financing elements by type of source, tariff policy, and the phasing of involvement of financing elements.

Close cooperation between the public and private sectors, active participation in international project financing schemes, including the sustainable development mechanism of the Paris Agreement, and the use of innovative digital technologies will accelerate the processes of green transformation and actions to reduce GHG emissions and adapt to the effects of climate change.

In order to attract additional resources necessary for low-carbon development and the transition to carbon neutrality, the regulatory legal and institutional framework will be improved, as well as the conditions for the development of innovative tools and standards for green financing, taxonomies of green projects will be updated, taking into account international experience in developing such taxonomies and investor expectations.

To stimulate private investment in low- and zero-carbon technologies, pricing schemes in a number of sectors must be reviewed, in particular for electricity and heat, waste collection and sorting.

Economically optimal policies would allow markets to set prices that take into account all capital, operating and environmental costs, motivate sustainable use of resources, and encourage private investment in energy efficiency and alternative fuels. In addition, GHG emissions pricing internalizes the environmental costs of carbon-intensive products and encourages investment in renewable energy sources and low-carbon production technologies. At the same time, a meaningful price on GHG emissions will generate government revenues that can be redistributed to support decarbonization and provide preferences for green projects.

Thus, of great importance is the creation of a "carbon" (carbon) fund, which will accumulate funds from the sale of carbon units and a carbon tax, from which projects to reduce emissions and increase the absorption of GHGs will be further financed.

Improving framework conditions and sending clear signals about future policies will reduce the uncertainty and risks perceived by domestic and international investors, and thus reduce the investment costs associated with decarbonization. This can be strengthened by active engagement with the international community (e.g. development banks, governments and international organizations) to ensure support for green investments.

To increase investment attractiveness, we will introduce international standards, including in the field of "green" construction, "green"

transport, energy efficiency of buildings and residential premises and environmental management.

To increase incentives for the adoption of low- and zero-carbon technologies Fiscal incentives should be available to domestic businesses.

Policies to stimulate green investments should be complemented by measures to improve the overall business environment and investment climate in Kazakhstan, taking into account transparent criteria for green investments - ESG criteria. The taxonomy of “green” projects should clearly define, taking into account international approaches, the corresponding indicators of “environmental friendliness” of enterprises’ activities, such as increasing energy efficiency and energy saving, reducing GHG emissions, and adapting to climate change.

In order to determine the possibility of using new technologies decarbonization in the conditions of Kazakhstan, pilot projects will be implemented.

In this regard, decarbonization opportunities in various sectors will be tested in a pilot project to further decide on scaling up such technology and developing changes to legislation to provide government support in the form of fiscal incentives, financial and non-financial measures.

Technologies that currently have not yet become widespread in Kazakhstan will be tested taking into account various aspects: climatic features, the architecture of the energy system of Kazakhstan, the structure of consumption of fuel and energy resources, the way of life of households, etc.

3.3.2.3. Research, development and education

Research and development, innovation and education are essential for low-carbon development and the transition to carbon neutrality and adaptation to consequences of climate change.

Transformation of the economic structure of Kazakhstan within the framework of a low-carbon development and transition to carbon neutrality will require scientific, technological and professional staffing.

In addition, the pace of decarbonization and energy transition requires today, advanced scientific support, organizing targeted fundamental and applied research in various sectors and areas of the economy, studying labor markets and creating new jobs.

To form and develop our own low-carbon infrastructure in the production sector and reduce dependence on foreign technologies and the best available techniques, the training of domestic specialists, including within the framework of public-private partnerships.

The volume of funding for science will be increased, taking into account modern processes of technological modernization based on the principles of decarbonization, while paying attention to

attention to the development of scientific research in the field of low-carbon development, circular economy and alternative energy.

Research will be actively supported in areas of priority for the transition to low-carbon development (RES, energy efficiency, biogas, nuclear and hydrogen energy, energy efficiency, energy saving, etc.), where Kazakhstan can achieve comparative advantage in international markets.

Research programs will be organically linked to the development of new industries, stimulate the launch of low-carbon projects and support collaboration between researchers and business stakeholders.

To enhance the integration of domestic scientists with the foreign research community in strategic innovation areas and promote the development of high-quality scientific research relevant to Kazakhstan, as well as the commercialization of new technologies, grants will be provided for entrepreneurs and startups.

As part of the implementation of measures to decarbonize economic sectors and further low-carbon development of the country, measures will be taken to ensure staffing and training of specialists in such areas as climate policy, green energy, environmental economics, sustainable design, digitalization, etc. Innovative methods will be introduced, solutions and tools in

domestic education system. Technological changes will increase skill requirements in sectors adopting new technologies. Digital competencies will become a mandatory element of all professional standards.

As one of the priority measures, access to modern knowledge and data in the field of climate change and low-carbon development will be expanded and ensured for all stakeholders (decision makers, expert community, business, etc.) through increased investment and expansion

scientific and technical potential.

Active involvement of citizens, representatives of non-governmental organizations and other social groups into decarbonization processes through education programs, scientific research and the creation of innovative developments is an important step towards low-carbon development of Kazakhstan.

3.3.2.4. Changing public consciousness

The transition to a low-carbon economy will require society to significantly change its attitude towards the challenges of green development, lifestyle and consumption in the medium and long term. These changes must take place on the basis of sustainable development values that will be promoted

consistently - from mass education and information to increasing interest and awareness, involvement, and practical participation of civil society in the implementation of the objectives of the Strategy.

A policy will be pursued to promote a "low carbon" culture and image life.

Thus, sustainable development issues, especially related to climate change, energy transition and reduction of GHG emissions, will be included in the educational programs of primary, secondary and higher educational institutions.

Climate change awareness campaigns will be launched, highlighting the health and environmental benefits of low-carbon policies.

Creating and promoting a low-carbon culture among government agencies is important, in particular through the development of energy management systems, policies of openness and public participation. It seems effective to organize on an ongoing basis national and regional days on climate and energy topics for government and budgetary organizations.

Interest will be increased among the younger generation through the involvement of youth and volunteer organizations to participate in large-scale environmental projects.

The state will support the activity of citizens in the transition to low carbon development through:

- encouraging the population to rationally consume goods;
- development and dissemination of digital tools allowing citizens calculate their own climate impact and propose personalized actions to reduce emissions based on individual lifestyles;

- promoting and communicating the importance and benefits of good governance waste (separate collection, recycling, etc.).

Effective implementation of the Strategy is impossible without ensuring maximum transparency and feedback. All interested parties will have the opportunity to track the progress of implementation of the Strategy projects. It is important to constantly collect public proposals for new draft Strategy projects and conduct a discussion on the problems of low-carbon development on a national scale.

Effective feedback will be provided through sociological research in the development and implementation of public policy in the field of decarbonization and regular public consultations at various dialogues and expert platforms.

3.3.2.5. The international cooperation

In order to achieve its goals, Kazakhstan needs financial and institutional support from the international community to

ensuring a smoother energy transition for all sectors. In this regard, Kazakhstan will implement projects under the sustainable development mechanism of the Paris Agreement.

Kazakhstan will continue to interact with the UN Climate Technology Center and Network and the Green Climate Fund. Subject requests will be formulated and specific projects will be initiated with appropriate appeal to

organization data.

An important area will be the attraction of technology as part of the commitments made by some developed countries. Developed countries support developing countries in building capacity in emissions measurement, reporting and verification, blue carbon, national emissions inventory and accounting systems, carbon capture and storage, and others.

Kazakhstan will cooperate with the international community in the field of innovation for involvement in international research programs and projects.

Improving the skills of policymakers will be an important element of international cooperation. Such programs include technical assistance, for example, in the areas of energy security and clean technologies, development of technology standards (in construction, energy efficiency, etc.), integrating climate change issues into national development policies, updating NDCs and incorporating adaptation measures.

Kazakhstan will continue to actively develop international cooperation in the field of energy security and clean technologies, and the development of technological standards. This will facilitate the exchange of best practices and the transfer of carbon-free technologies, bring together scientific achievements and expertise from different countries and potentially improve the quality, speed and efficiency of research and development.

It is planned to conduct joint research, including programs for macroeconomic assessment of climate policy, management assessment climate-sensitive public investment and environmentally sensitive public financial management.

Procedures for attracting international investment will be simplified, as well as import of technologies and highly qualified personnel.

Cooperation with international financial organizations will continue - the UN Development Program, the International Monetary Fund, the Organization for Economic Cooperation and Development, the World Bank, the European Bank for Reconstruction and Development, the Asian Development Bank, the German Society for International Cooperation, the Eurasian Development Bank and other organizations. This will attract international

mechanisms to promote “green” growth of national economies with a high carbon footprint (tools for accelerated decarbonization of the energy industry, energy transition mechanisms, write-off of sovereign (corporate) debt to international financial institutions in exchange for green growth” and others).

Kazakhstan will continue to build strategic relationships with partners who share similar climate ambitions, build knowledge sharing across global supply chains, and accelerate the joint development and deployment of low-emission technologies. This will advance the country's technology-based approach to reducing emissions by strengthening global cooperation in the development and deployment of low-carbon technologies.

3.3.2.6. Adaptation to climate change

Restructuring the national economy for low-carbon development and achieving carbon neutrality must take into account the risks associated with the effects of climate change in all sectors of the economy. This will make decarbonization measures more resilient to climate change. An integral part of climate action, along with Kazakhstan's efforts to reduce GHG emissions, should be the adaptation of the economy and society to the transition to a low-carbon economy.

development.

It has been empirically proven that adaptation measures have a significant positive impact on the economic development of the country.

Thus, investments in improving irrigation infrastructure significantly reduce crop losses during droughts, increase the export potential of agricultural products and create additional jobs.

In the infrastructure sector, investing in climate-resilient roads reduces damage from extreme rainfall and flooding, and reducing travel times through improved road conditions

will reduce transportation costs.

When planning the development of industries and territories, the authorized central executive body and local executive bodies must ensure the implementation of all stages of the process of adaptation to climate change, as well as close intersectoral and interdepartmental interaction.

The most vulnerable sectors should be prioritized for adaptation measures economy.

For the purposes of low-carbon development in the field of adaptation to the consequences of climate change, processes for planning and implementing measures for adaptation to climate change will be institutionalized, including expanding the scope of

responsibilities of government organizations and the creation of mechanisms for financing adaptation measures within the framework of national planning and budgeting processes.

The system for collecting and providing relevant and accessible information will be improved. climate data, including data on physical and economic damage from the effects of climate change. The data collection system will allow for the assessment of risks and vulnerabilities in various sectors, as well as to support decision-making at various levels.

Of great importance is the development and improvement of methodologies for assessing climate risks and vulnerability to the effects of climate change, monitoring the effectiveness of adaptation measures, as well as economic assessment and modeling of the consequences of climate change and adaptation measures; and ensuring a holistic approach to climate action in Kazakhstan, taking into account the close link between adaptation and mitigation measures.

3.3.2.7. Carbon regulation system

Carbon regulation provides a powerful impetus for the development of low-carbon technologies. The development of a sustainable carbon regulation system in the country will allow solving a whole range of pressing problems: reducing the carbon footprint of goods, environmental damage, saving resources, motivating domestic technological re-equipment.

To implement the Strategy, a sustainable Carbon Management System (hereinafter referred to as the RMS) will be created, which will consist of the following main elements:

- monitoring, reporting and verification system;
- national quota system and ETS;
- carbon taxation of installations (processes, goods and services), emissions which are not regulated under the national ETS;
- climate finance system, including carbon fund, taxonomy of projects, bank of ready-to-implement low-carbon projects, green financing, green procurement;
- interaction with BAT;
- unified digital ecosystem for carbon regulation.

The key element of the RMS will be the ETS, the importance of the effective functioning of which has increased taking into account Kazakhstan's national obligations to reduce GHG emissions under the Paris Agreement, as well as plans to introduce the MTSD mechanism.

The main priority for improving the ETS will be the phased introduction paid distribution of quotas by reducing carbon quotas for GHG emissions.

The coverage of carbon pricing instruments will be expanded, the approved specific emission factors will be revised towards their tightening in order to encourage quota subjects to improve their individual GHG emissions per unit of production.

Control over the verification of reporting by quota subjects on the inventory of GHG emissions and the activities of validation and verification bodies will also be strengthened. Methodologies for calculating GHG emissions will be improved by using enterprises' own source data.

4. Conclusion

To participate in the efforts of the international community to address the problem of climate change, the Republic of Kazakhstan decided to develop its Strategy for Achieving Carbon Neutrality.

Strengthening international climate policy means that investments poured into energy- and resource-intensive projects could very soon turn into locked-out assets. Removing the carbon price from carbon-intensive goods on border of importing countries, if it is not paid in the country of origin of the goods, will lead to a decrease in investor income.

A gradual global reduction in the need for fossil fuels will inevitably lead to a reduction in foreign exchange earnings of exporters and, accordingly, a drop in state budget revenues, which can significantly limit the ability to finance education, health care, and social security systems, reducing the potential for creating new jobs and economic growth.

As a major exporter of fossil raw materials, Kazakhstan needs to decarbonize its economy and build a sustainable low-carbon economic development model to create new growth drivers.

Low carbon development and achieving carbon neutrality by 2060 for a country as large and sparsely populated as Kazakhstan requires careful planning of follow-up actions over four decades.

This Strategy is the foundation of such large-scale transformations.

The strategy aims to achieve low-carbon development and achieve carbon neutrality by 2060 by building an effective low-carbon model development.

Achieving ambitious climate goals is a huge challenge for Kazakhstan. Reducing GHG emissions will require fundamental changes in production and consumption patterns, a rapid and effective transition from unfriendly combustion of fossil energy resources to carbon-free technologies, large-scale technological modernization, and attraction of "green" investments in all sectors of the national economy, including regions, cities and various business sectors.

Low carbon development and achieving carbon neutrality will occur in three main directions.

1. Decarbonization of energy-related industries and processes.

This direction covers large-scale measures to transform energy sectors, in particular, a shift towards more sustainable energy sources through the gradual reduction of fossil fuels,

transition to the use of electricity and heat instead of direct combustion of fossil fuels, increased use of natural gas in the intermediate transition period, as well as alternative energy sources and renewable energy sources.

Today, in the production of electricity and heat, coal generation retains dominant position, but for low-carbon development and achieving carbon neutrality by 2060, a gradual systematic reduction in the share of coal generation will be provided.

The development of renewable energy sources will be a key condition for successful decarbonization. So, wind, given its quality and availability in the country, will become the main resource for development at earlier stages, while solar energy will become a key technology at a later stage, when the cost of investment in solar power plants is noticeable will decrease.

In the long term, the use of renewable energy sources will be accompanied by systems energy conservation, which will allow regulating electricity supply and better integrating renewable energy sources into the energy system.

An important point is the technological modernization of industry and, above all, its basic sectors, taking into account the principles of energy saving and energy intensity. Energy saving principles will also be are also common in other sectors of the economy.

One of the key elements of decarbonizing emissions from energy production and use is large-scale electrification.

The use of biofuels and hydrogen is expected in those modes of transport that are difficult or impossible to fully electrify (for example, in water and air transport).

2. Decarbonization of non-energy industries and processes.

As part of this direction, it is expected to increase carbon efficiency - the use of methods with low or zero emissions in industrial processes, the development of sustainable agriculture and management waste.

Agriculture will undergo a transition to sustainable practices agriculture and livestock farming.

Further development of industry should be associated with updating equipment and modernizing production in such a way as to separate

production processes or allow equipment to be easily upgraded from low-carbon to zero-carbon processes.

The reduction in total GHG emissions from the waste sector will be achieved through gradual elimination of open waste disposal, increasing the share of recycled and compostable waste, accelerated implementation of full coverage of collection and sorting.

3. Acquisition and compensation projects.

As part of this direction, it is expected to increase the ability to accumulate carbon in forests and soils, and to actively use technologies for capturing, using and storing carbon from the moment their economic feasibility increases.

The implementation of sustainable forest management and reforestation will cover 2060 GHG emissions from agricultural production and partly from others sectors.

The active use of carbon capture and storage in economic sectors is expected precisely when the technologies become economically feasible

The described directions will allow for effective transformation of sectors economy and reduce GHG emissions. But the decarbonization process will be accompanied by certain difficulties and risks that require the right approaches to their leveling.

The most important priorities for low-carbon development must be a just transition and job creation. To ensure a just transition, additional legislative, policy and economic measures will be taken to ensure that the burdens and benefits of climate action are shared in a fair and acceptable manner among different

social groups, create new opportunities in industries and regions affected by decarbonization policies and adaptation to climate change.

In this regard, fossil fuel workers exposed to job loss during the energy transition should be protected by social protection measures, retraining and retraining programs, and the creation of new jobs in low-emission industries. For this category of people, programs will be developed that offer alternative employment and retraining in order to carry out activities in new “green” areas.

The process of transition to low-carbon development will require mobilization large investment resources in clean energy and additional low-carbon technologies. Kazakhstan needs to redirect current carbon-intensive investments towards these low-emission solutions while simultaneously improving market conditions that will incentivize entry into

a market for private domestic and foreign entities capable of accelerating the energy transition.

The process of decarbonization at the country level requires systematic work and the adoption of appropriate investment, regulatory and institutional reforms both in the field of public administration and in planning the development of the national economy and its basic industries. Due to the intersectoral nature of low-carbon development areas and their importance for ensuring the country's energy security, large-scale coordination work will be ensured among all interested bodies.

The strategy for achieving carbon neutrality of the Republic of Kazakhstan until 2060, being a strategy for economic diversification and its technological breakthrough, should become a new long-term strategic document during the period of updating the country's socio-economic policy.