Approved
by the resolution of “Samruk-Energy” JSC
Board of Directors
dated “18” November 2024
(Minutes No. 16/24)

“Samruk-Energy” JSC
Energy Transition Program
until 2060
Public version

Document owner	GR and Legislative Initiatives Department
Edition 2	2
Year	2024

Astana c.

Contents

1. Terms and definitions

Terms and abbreviations	Definition
CBAM	Carbon Border Adjustment Mechanism
CCUS	Carbon Capture, Use & Storage
ESG	Environmental, Social and Governance
ESG-Rating	Assessment of the alignment between the company's internal policies and activities with the principles of sustainable development.
Net Zero Emissions/NZE	Net-zero emissions ("net zero") refer to a state where anthropogenic residual greenhouse gas (GHG) emissions are balanced by anthropogenic absorption. "Net zero" represents one of the scenarios for achieving the Paris Agreement goals, aiming to limit global warming to 1.5°C above pre-industrial levels. The NZE scenario assumes that economically developed countries will achieve net-zero emissions by 2050.
SWOT-analysis	Analysis of the positive and negative impacts of external and internal environmental factors
The Announced Pledges Scenario/APS	Average- a scenario of declared commitments, which assumes that all climate commitments made by governments will be fully and timely fulfilled (note: in Kazakhstan, this refers to achieving carbon neutrality by 2060).
The Stated Policies Scenario/STEPS	Moderate - a policy-driven scenario that models future economic and energy trends, based on the assumption that governments will follow conservative strategies and not all climate targets will be achieved by 2050.
ADB	Asian Development Bank
APP	"Almaty Power Plants" JSC
BK	"Bogatyr Komir" LLP
GDP	Gross domestic product
RES	Renewable energy sources
WPP	Wind power plant
PSH	Pumped storage hydropower plant
GeoTPP	Geothermal power plant
SDPP	State District Power Plant
HPP	Hydropower plant
Decarbonization	The process of reducing carbon emissions into the atmosphere
SA	Subsidiaries and affiliates of Samruk-Energy JSC
EBRD	European Bank for Reconstruction and Development
EU	European Union
LULUCF	Land Use, Land-Use Change, and Forestry sector
kWh	Kilowatt-hour, a unit of electricity generation measurement
IFCA	International financial center "Astana"
BAT	Best Available Technology
Company	"Samruk-Energy" JSC

GHG	Greenhouse gases
CCGT unit	Combined cycle gas turbine unit
Energy transition program/program	"Samruk-Energy" JSC Energy Transition Program until 2060 (Second edition)
RK	The Republic of Kazakhstan
BoD	"Samruk-Energy" JSC Board of Directors
ESDPP-2 plant/SDPP-2	"Ekibastuz SDPP-2 plant" JSC
Traditional generation	Electricity generation using fossil fuels
TPP	Thermal power plant
CHP	Combined heat and power plant
Carbon offset	Reduction of greenhouse gas emissions and/or increase in greenhouse gas absorption achieved as a result of activities or types of activities in any sectors of the economy in the Republic of Kazakhstan aimed at reducing greenhouse gas emissions and/or increasing greenhouse gas absorption.
Fund	"Sovereign Wealth Fund "Samruk-Kazyna" JSC
e/e or electricity	Electricity
ESDPP-1/SDPP-1	"Ekibastuz SDPP-1 named after B.Nurzhanov" LLP
Energy transition	A global structural transformation in the energy system, involving the shift from fossil fuels to renewable energy sources and low-carbon emission technologies.
EPO	Energy producing organizations

2. Introduction

The energy sector is the primary source of anthropogenic greenhouse gas emissions, predominantly carbon dioxide, generated through the combustion of fossil fuels. Despite international agreements and national strategies aimed at reducing greenhouse gas emissions, global CO_2 emissions continue to rise, significantly exceeding permissible levels required to limit global warming to within 1.5°C.

The Republic of Kazakhstan is among the major contributors to anthropogenic greenhouse gas emissions in the global energy sector. According to international rankings, the country is among the top 30 emitters, ranking 11th in carbon intensity of GDP and 13th in CO_2 emissions per capita[1].

However, the Republic of Kazakhstan demonstrates consistent commitment to combating climate change. The country joined the United Nations Framework Convention on Climate Change (UNFCCC) in 1995, ratified the Kyoto Protocol in 2009, and the Paris Agreement in 2016. Under the Paris Agreement, Kazakhstan pledged to reduce greenhouse gas emissions by 15% below 1990 levels by 2030 as an unconditional target, and by 25% contingent on receiving additional international assistance (conditional target).

Additionally, during the Climate Ambition Summit in December 2020, the President of the Republic of Kazakhstan, Kassym-Jomart Tokayev, announced the strategic initiative for the country to achieve carbon neutrality by 2060.

[1] https://www.iea.org/countries/kazakhstan/emissions

In today's context, decarbonization is seen not only as an environmental necessity but also as a strategic tool for ensuring long-term economic resilience and competitiveness.

Taking into account global and national trends in climate policy, "Samruk-Energy" JSC has developed a long-term Energy Transition Program. The first edition of Samruk-Energy JSC's Energy Transition Program for 2022–2060 was approved by the company's Board of Directors on April 1, 2022 (Minutes No. 03/22). Revisions to the Program were made in 2022 (Board of Directors Minutes No. 13/22 dated October 28, 2022).

To further advance sustainable development in accordance with the SDGs and to align existing goals with the specific objectives of the Paris Agreement—namely the 2°C and 1.5°C scenarios—as well as to reflect current trends and operational performance, "Samruk-Energy" JSC has developed the new (second) edition of its Energy Transition Program up to 2060.

The key drivers of the energy transition have been global trends in combating climate change, including:

1) The Paris Agreement, adopted in December 2015 at the 21st Conference of the Parties to the UNFCCC, which aims to encourage nations worldwide to reduce greenhouse gas emissions and contribute to limiting the rise in global atmospheric temperature to no more than 2°C.
2) International carbon regulation and the introduction of the Carbon Border Adjustment Mechanism (CBAM) in the EU under the European Green Deal. This mechanism will have significant implications for the EU's trading partners, including Kazakhstan. The CBAM regulation was adopted by the European Commission on August 17, 2023, came into effect on October 1, 2023, and will operate with a two-year transitional period until December 31, 2025. Following the transition period, starting January 1, 2026, importers to the European Union will be required to purchase CBAM certificates.
3) Commitment to the UN's 17 Sustainable Development Goals, including those aimed at combating climate change and protecting the environment.
4) Tightening of Kazakhstan's Environmental Code, effective from July 1, 2021, which strengthened requirements for greenhouse gas emissions and introduced a national emissions trading system.
5) The annual Address to the People of Kazakhstan delivered on September 1, 2023, where President Kassym-Jomart Tokayev emphasized the importance of transitioning to carbon neutrality and implementing targeted measures in line with the Paris Agreement.
6) Kazakhstan's commitment to the Global Methane Pledge, as announced by the Head of State at the COP28 World Climate Summit in Dubai in December 2023.

This Program serves as a document that:

- defines the key directions, goals, and objectives for the Company's energy transition;
- describes scenario analysis for contributing to the limitation of the average global temperature increase to significantly below 1.5°C and achieving carbon neutrality by 2060;
- consolidates the assessment of physical and transitional climate risks;
- establishes time horizons for climate-related risks and opportunities;
- sets short-, medium-, and long-term target indicators.

2.1. "Samruk-Energy" JSC and decarbonization: global context and local initiatives

In 2021, the largest global sources of CO_2 emissions were China, the United States, the 27 EU member states, India, and Japan, collectively accounting for 67.7% of global CO_2 emissions from fossil fuels. All of these countries increased their CO_2 emissions from fossil fuels in 2021 compared to 2020, with India and Russia showing the highest relative growth rates (10.5% and 8.1%, respectively). Aggregate global CO_2 emissions are illustrated in Graph 1.

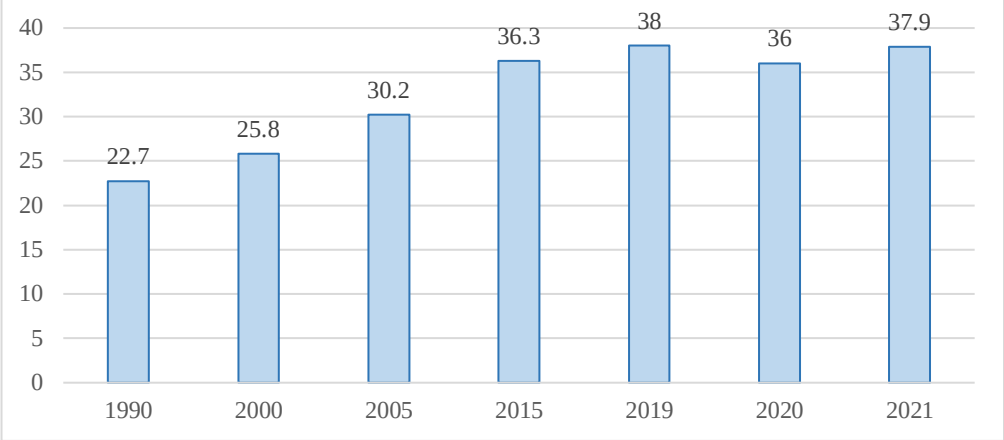


Chart
1. Aggregate global CO_2 emissions, in gigatons [2]

Forecasts for the development of global energy over the coming decades vary, reflecting a wide range of possible future scenarios. However, 2023 studies show common trends towards 2050-2060: a reduction in coal consumption, an increase in demand for liquid fuels, and rapid growth in wind and solar energy (see Graph 2). Nevertheless, the exact pace and scale of these changes vary significantly depending on assumptions regarding policies, technologies, and other factors.

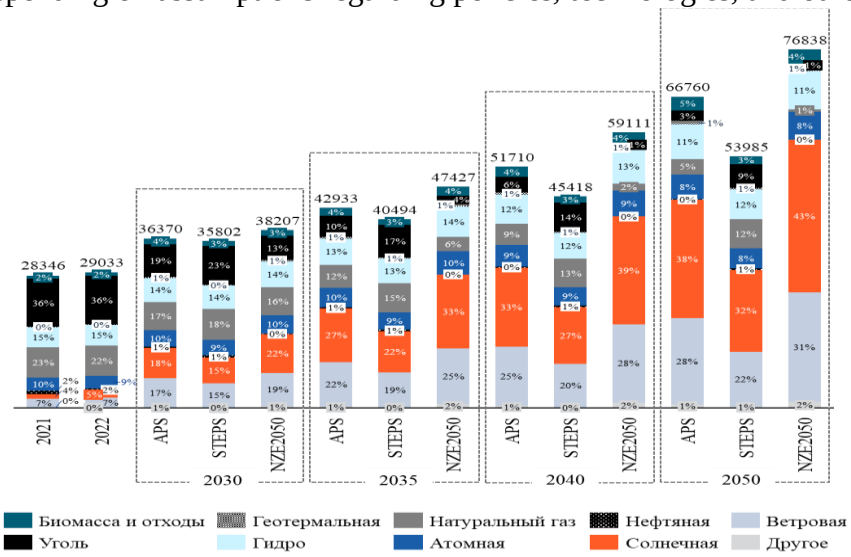


Chart 2. Forecasts for global electricity generation by energy source from 2021 to 2050, in TWh [3]

[2] https://ranking.kz/digest/industries-digest/vybrosy-parnikovyh-gazov-v-mire-obzor-situacii.html
3 KPMG_SE_Strategy_Results of 1 and 2 stages, paragraph 1.1.1. "Review of global statistic and forecasts"

The NZE, APS, and STEPS scenarios present different visions for the future of energy. NZE reflects the ambitious goal of achieving net-zero emissions by 2050. APS illustrates the potential outcomes based on the current commitments of countries, while STEPS shows the projected developments under the continuation of existing policies. A comparison of the NZE, APS, and

STEPS scenarios helps assess the ambitions and actual actions of countries in the climate field (see Graph 3).

In all of these scenarios, technological development plays a key role in addressing climate change. The majority of CO_2 emissions reductions in the near term will be achieved through existing technologies. However, to meet long-term climate goals, it will be necessary to accelerate the development and deployment of innovative solutions that can further reduce emissions.

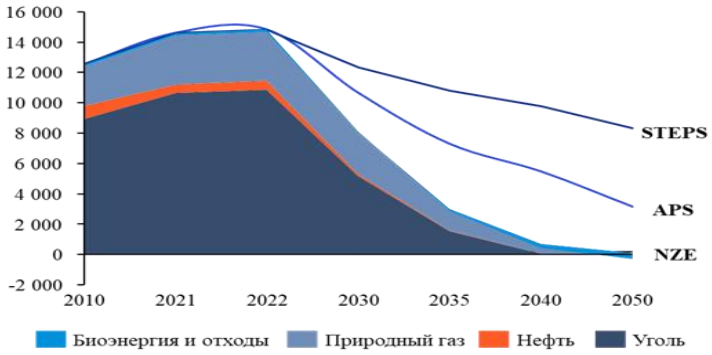


Chart 3. Carbon Dioxide (CO_2) Emissions in the energy sector across three scenarios, Gt

Kazakhstan, like many other countries, faces the acute challenge of the energy trilemma. The need to ensure reliable and affordable energy supply in the context of harsh climatic conditions and growing demand is complicated by outdated energy infrastructure and the limited potential of renewable energy sources (RES). The existing imbalance between price, reliability, and environmental sustainability of energy supply requires finding new solutions.

Currently, primary energy in Kazakhstan is primarily supplied through coal mining, crude oil, and natural gas extraction. The largest share of greenhouse gas emissions from primary energy supply comes from coal, both due to methane release from coal seams during extraction and emissions from combustion. Therefore, reducing and eventually phasing out coal extraction and combustion, or implementing CCUS technology, will be crucial for any efforts to decarbonize Kazakhstan's economy. The dynamics of national greenhouse gas emissions are shown in Graph 4.

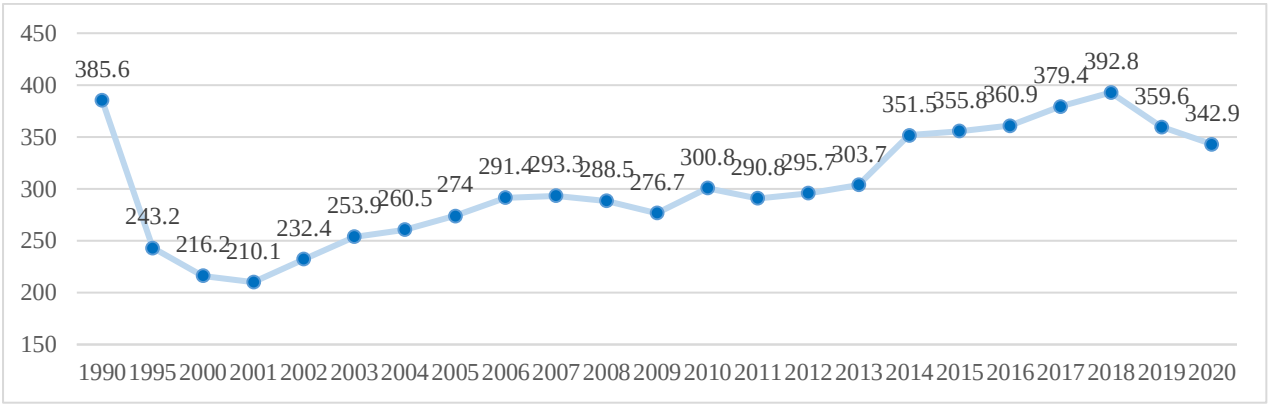


Chart 4. Dynamics of national GHG emissions in the Republic of Kazakhstan excluding LULUCF.

"Samruk-Energy" JSC, as a key player in Kazakhstan's energy market, faces the challenge of balancing short-term energy security goals with long-term energy transition objectives. Given that the energy sector is the largest source of emissions in Kazakhstan, accounting for around 80% of the country's total greenhouse gas emissions, and that "Samruk-Energy" JSC contributes 9% of these emissions, addressing the decarbonization of the company's assets is a complex task. "Samruk-Energy" JSC includes major emitters such as three large energy production facilities—ESDPP-1, ESDPP-2 Plant, and APP JSC—which

generate electricity from traditional fuels (gas, coal), as well as one of the world's largest open-pit coal mining companies, Bogatyr Komir LLP.

The challenges associated with the low cost of traditional energy resources and outdated infrastructure hinder the decarbonization process. At the same time, growing demand and climate change necessitate an accelerated transition to cleaner and more sustainable energy sources. The company plans to focus on the proactive development of renewable energy, infrastructure modernization, and improving energy efficiency.

For the successful development and implementation of the Program, large-scale research into promising technologies, the assessment of ecosystem capabilities for absorbing greenhouse gases, and ensuring the reliability of data will be required. This will necessitate expanding the expertise of relevant ministries and the expert community in coordinating and justifying long-term state environmental policy decisions. The energy transition program holds significant importance, not only domestically but also internationally.

Looking ahead, the Program should be supported by numerous specific decisions and actions. Currently, the main development directions have been outlined, taking into account various scenarios. However, technological advancements, emerging environmental trends, and updates to legislation (such as carbon offset calculations, cross-border carbon taxes, taxonomy, etc.) will contribute to the ongoing adaptation and updating of the Program.

3. Area of operations and carbon footprint of the Company

The current operations of "Samruk-Energy" JSC encompass coal mining, electricity and heat generation, including coal- and gas-fired stations, hydropower generation, and renewable energy facilities, as well as distribution and supply companies[2].

As of 2023, the company holds a 31.3% share of the domestic electricity market, generating more than 35.3 billion kWh. Approximately 91% of the company's generating capacity is traditional generation, with around 8% derived from renewable energy and hydropower, and 1% from gas generation.

The company's carbon footprint is primarily comprised of direct greenhouse gas emissions from electricity and heat production resulting from the combustion of fuels (coal, fuel oil, gas), as well as emissions associated with the coal mining process.

The majority of the company's greenhouse gas emissions consist of carbon dioxide[3] (graph 5).

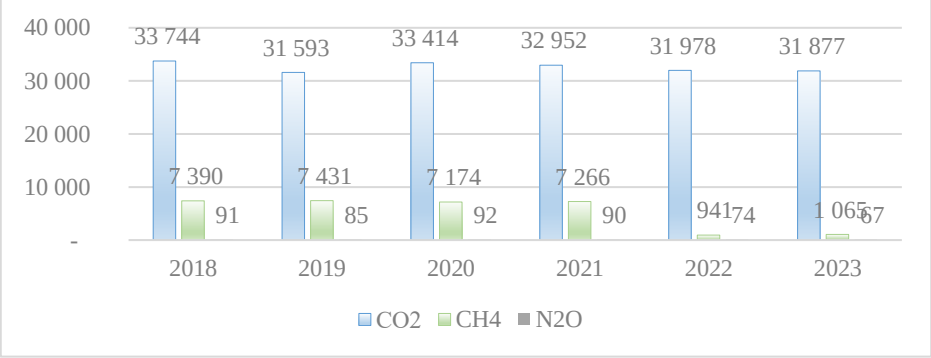


Chart 5. Structure of GHG emissions (Scope 1), thousand tonnes of CO_2

[4] *"Development Strategy of "Samruk-Energy" JSC for 2024-2033," Section 3.2.1.*

[5] *According to the Sustainability Reporting Standard on Emissions, GRI 305: Emissions 2016 Topic Standard, greenhouse gases include Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulfur Hexafluoride (SF_6), and Nitrogen Trifluoride (NF_3).*

The requirements of the legislation of the Republic of Kazakhstan, international standards, and agreements define the need for the disclosure of greenhouse gas emissions as follows:

1. **Scope 1** – direct greenhouse gas emissions from sources that are owned or controlled by the organization.
2. **Scope 2** – energy indirect greenhouse gas emissions occurring during the production of purchased electricity and heat energy.
3. **Scope 3** – other indirect greenhouse gas emissions not included in energy indirect emissions (Scope 2) that occur outside the organization. The Company is working on determining the boundaries of Scope 3 according to its specific activities.

When disclosing information, the Company adheres to the principles of consistency and comparability, continuously working to improve the completeness of the disclosed information and expand the reporting scope on indirect emissions of the second level (Scope 2). In 2023, the second-level indirect emissions amounted to 0.011 million tonnes of CO_2, including the consumption of electricity and heat from indirect sources purchased from third-party suppliers, which are not owned or controlled by the Company.
Given the specific nature of the Company's activities, the majority of emissions are attributed to Scope 1, which are a priority in reducing the carbon footprint (Chart 1).

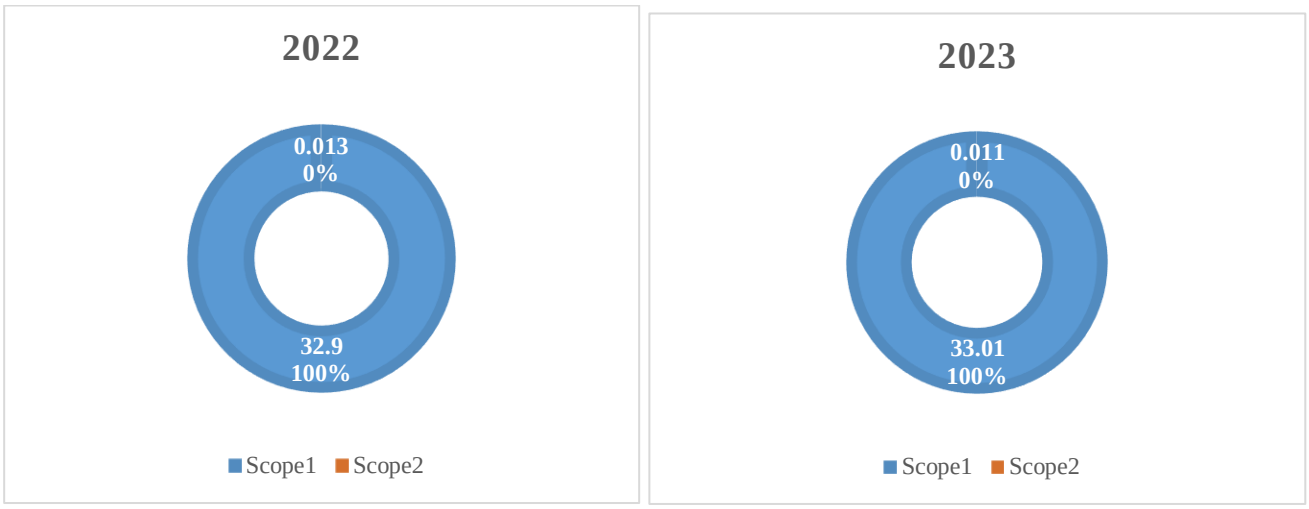


Diagram 1. Structure of direct and indirect emissions, million tonnes of CO_2 (CO_2 equivalent)

The calculation and public disclosure of indirect emissions under Scope 3, as well as the establishment of targets for Scope 3, enable companies to transparently demonstrate their responsibility for all sources of emissions, including the supply chain. This provides companies with a clearer understanding of their climate impact. The company recognizes the importance of disclosing information on Scope 3, and therefore, plans to address this in 2025-2026 [6] A phased approach for accounting and monitoring Scope 3 emissions is planned, following the approval of the categorization. 4.
To define the scope of the Program, all subsidiaries were analyzed and grouped according to the characteristics of their core activities into the following segments:

1. Traditional energy generation (SDPP-1,2, APP including planned projects for traditional generation);
2. Coal mining and processing (BK);
3. Renewable energy generation (WPP, HPP, PSPP, SPP, including planned projects).

[6] - *Setting targets for Scope 3, in cases where the relevant and mandatory Scope 3 emissions account for 40% or more of the total emissions from Scope 1, 2, and 3*

[7] *Scope 3 emissions, according to the GHG Protocol (Corporate Value Chain Scope 3 Standard), are divided into 15 categories covering various aspects of the supply chain: purchased goods and services, transportation, emissions from product use, investments, emissions related to end-of-life treatment, and other indirect emissions. The selection of a categorization suitable for the Company's operations is planned for 2026*

4. Program scenarios

In the pursuit of decarbonization goals, the Company faces both new opportunities and a range of external and internal challenges that define the main directions of the Program. Based on an analysis of the internal and external environment, a SWOT analysis of the Program has been prepared, as presented in Table 1.

Table 1. SWOT-analysis of Energy transition program

Strengths	Weaknesses
- Extensive expertise in implementing renewable energy projects; - A diversified portfolio of renewable energy assets; - Relatively low wear and tear of renewable energy facilities compared to the overall wear rate of energy assets in Kazakhstan; - Strong support from the government and the Fund; - Significant potential for the development and expansion of renewable energy projects in Kazakhstan, given the country's vast territory and varied climatic conditions.	- High levels of debt; - Social projects with insufficient return on invested capital; - Inadequate regulatory framework needed to stimulate renewable energy projects; - Instability in the supply of electricity from renewable energy sources; - The cost of electricity generated by traditional methods is still lower than that produced by renewable energy facilities; - Limited research and uncertainty around the costs of implementing carbon capture and storage technologies; - The need for significant financial investments.
Opportunities	**Threats**
- Expanding clean energy generation in collaboration with strategic partners; - Utilization of green financing tools for clean energy projects; - Growing trend of electrification across various sectors (such as transportation, automotive, and rail); - Expanding market share driven by rising demand, enhanced competitiveness, and potential market model changes; - Collaboration with international organizations to study and implement carbon capture, utilization, and storage (CCUS) technologies, among others.	- Global reduction in financing for projects that do not contribute to a greener economy; - Increasingly stringent international climate change policies; - Tighter environmental regulations in Kazakhstan, including higher carbon emission fees; - Geopolitical instability in neighboring countries; - Rising costs of major investment projects due to currency depreciation; - Potential job losses if traditional power generation volumes decrease.

Considering the conducted analysis and international green agenda, the Company sets goals and develops a long-term vision for low-carbon development by enhancing energy efficiency, adopting low-carbon technologies (available on the market), advancing renewable energy sources (RES), and utilizing offset mechanisms. Given the significance of global trends in mitigating climate change and the risks associated with activities based on traditional power generation, Samruk-Energy JSC aims to minimize its negative impact on the environment by 2060, in alignment with its Strategic **Mission:**

"We ensure the country's energy security and contribute to the accelerated energy transition, adhering to the principles of sustainable development and effective resource management."

One of the Company's strategic goals is to proactively develop renewable energy sources and reduce environmental impact.

The Program's objective is to reduce the Company's net carbon footprint by 2060.

4.1. Defining the Program's directions and target indicators.

Taking into account the strengths and weaknesses, the key directions for achieving carbon neutrality have been identified within the scenarios outlined in Table 2.

Table 2. Key directions

Direction and tasks	Comments/description

1. **Alternative energy** 1.1. wind and hydropower 1.2. solar energy 1.3. geothermal energy 1.4. hydrogen energy 1.5. international cooperation	1.1. **Wind and hydropower** In recent years, the company has gained significant experience in implementing renewable energy projects and their subsequent operational management. A key and large-scale task of the energy transition is the construction of new wind and hydroelectric power plants. In terms of increasing capacity by generation type, wind projects will make the largest contribution, accounting for a 5.2 GW increase in installed capacity within the strategy horizon. For hydropower development, plans include both constructing new plants and expanding or modernizing existing assets, adding a total of 1.6 GW of new capacity. 1.2. **Solar energy** The development of solar energy is also becoming a key factor in the transition to green energy and sustainable development. A 20% reduction in solar energy production costs from 2018 to 2023 has made this technology more competitive, encouraging a shift toward renewable energy sources. The company plans to implement solar power plants with a total capacity of up to 1 GW within the strategy horizon. 1.3. **Geothermal energy** In the long term, the company is considering geothermal power plant projects. Geothermal energy offers significant advantages, including full environmental safety, minimal CO_2 emissions, inexhaustible resources, and independence from external conditions and time of day. By 2060, the company plans to launch a pilot geothermal power plant project with a capacity of 20 MW, capable of producing an annual electricity output of over 0.044 billion kWh. 1.4. **Hydrogen energy** Hydrogen in electricity generation, particularly as a backup fuel source for energy storage and additional generation capacity, offers substantial environmental and accessibility benefits. In Kazakhstan, special attention is being paid to pilot projects involving hydrogen use at thermal power plants. These projects present opportunities for the company to explore hydrogen applications for decarbonization following feasibility studies. 1.5. **International cooperation** The implementation of large-scale renewable energy projects involves expanding international cooperation and collaboration. Opportunities for participating in intergovernmental projects focus on renewable energy development to meet green energy goals and expand base capacities to reliably meet the growing demand for electricity. For instance, in 2023, Samruk-Energy JSC signed an agreement with Power China Resources Ltd to jointly develop a project increasing the capacity of a wind farm in Shelek Corridor of Almaty region to 810 MW. Agreements were also signed for a 1 GW wind farm project with Abu Dhabi Future Energy Company (Masdar), W Solar Investment LLC, and the Kazakhstan Investment Development Fund, among others.

	Additionally, within the "Deep Decarbonization" scenario, a long-term additional renewable energy volume has been calculated to achieve carbon neutrality, including wind farms and a pilot geothermal power plant with a total capacity of 3,000 MW.
2) Conventional energy 2.1. Reducing CO_2 emissions through coal-fired power plant gasification	2.1. Considering the practical impossibility of completely phasing out coal within the next 20–30 years, the company is implementing gasification projects in Almaty to reduce environmental emissions, as directed by the President of Kazakhstan, Kassym-Jomart Tokayev, in his Address to the Nation on September 1, 2021. 1)Expansion of Almaty CHP-1 (80 MW): This project will enhance the reliability of heating and electricity supply for Almaty. 2)Modernization of Almaty CHP-2 (37 MW): Aimed at reducing the negative environmental impact of the power station on Almaty city and Almaty region. 3)Reconstruction of Almaty CHP-3 (371 MW) with the construction of a combined cycle gas turbine (CCGT): In addition to transitioning to gas, CHPP-3 will operate in a flexible mode to cover peak consumption loads in Almaty city and Almaty region. The transition of Almaty CHP-2 and CHP-3 to gas is expected to reduce greenhouse gas emissions from "APP" JSC by 30%.
3) Grid infrastructure and regulation 3.1. Modernization of grids and implementation of smart grid technologies**;** 3.2**.** Energy storage systems and flexible generation.	**3.1. Modernization of grids and implementation of smart grid technologies** Achieving the renewable energy targets outlined in the carbon neutrality commitments requires a comprehensive modernization of power grids and the integration of smart grid technologies and energy storage systems. These efforts aim to enhance grid capacity, flexibility, and efficiency to accommodate the growing share of renewable energy sources. **3.2. Energy storage systems and flexible generation** Energy storage and accumulation systems are essential for improving the reliability of electricity supply from renewable sources. They enable the storage of surplus electricity generated during periods of low demand for use during peak load periods. Current projects include the deployment of flexible capacities, ranging from traditional gas-fired power plants, such as the Kyzylorda combined-cycle gas turbine (CCGT) plant, to alternative forms of flexible generation like hydropower plants, pumped-storage hydropower plants, and energy storage systems. The company is committed to actively advancing initiatives in this area to enhance energy stability and efficiency.
4)Emissions management 4.1. Coal beneficiation and gasification 4.2. Carbon capture, utilization, and storage (CCUS) 4.3. Energy efficiency and resource conservation 4.4. Green transportation	**4.1. Coal beneficiation and gasification** The company continues to explore coal gasification and beneficiation technologies at coal pits. However, several equipment options were considered to assess the feasibility of dry coal beneficiation. After evaluating the technical and economic proposals, financial and economic model calculations showed that implementing a pilot project for the beneficiation of Ekibastuz coal at the "Severny" pit is economically unfeasible. The company will revisit this issue when technical and financial capabilities become available. **4.2. CCUS (Carbon Capture, Utilization, and Storage)**

4.5. Carbon farms and offsets	CCUS is considered a potential measure to mitigate the impacts of stabilizing atmospheric concentrations of greenhouse gases. The large-scale application of CCUS technology will depend on its technical maturity, cost, overall potential, distribution, and ability to be implemented on traditional assets, as well as regulatory, environmental, and other factors. Currently, the company is studying CCUS technology and its applicability to the company's major power plants. **4.3. Energy efficiency and resource conservation** Considering the high energy intensity of production, the company places great emphasis on improving energy efficiency. The company implements advanced technologies and utilizes natural resources efficiently. Special attention will be given to the rational use of resources[9]. Energy efficiency management is based on an energy management system in compliance with the international standard ISO 50001:2018 **4.4 Green transport**. The company considers "green" transportation as one of the possible measures to reduce greenhouse gas emissions under Scope 3. However, due to the lack of developed necessary infrastructure and sufficient financial incentives, this type of transport has low competitiveness compared to vehicles powered by traditional fuels. For the company, the development of the electric vehicle industry is possible in the following directions: • Use of renewable energy at electric vehicle charging stations (EVCS). • Partial transition of the company's transport fleet to gas and electric vehicles. Specific decisions regarding this direction will be made after the approval of the Scope 3 categorization in line with the company's activities. 4.5. **Carbon farms and offsets**. A carbon offset is a way to compensate for greenhouse gas emissions by supporting projects that reduce their levels. Due to stricter environmental regulations and the reduction of free quotas, the company is considering the possibility of intra-group implementation of renewable energy (RE) offset units to compensate for the missing volume of greenhouse gases at traditional stations. However, according to the Procurement Procedure of Samruk-Kazyna JSC, there is currently no possibility to purchase offsets within the Samruk-Energo group. This issue requires detailed consideration and support from the Fund.
5) Supporting measures 5.1. Carbon accounting and digitization 5.2. Changes in the regulatory environment 5.3. Green financing 5.4. Compliance with ESG criteria	**5.1. Carbon accounting and digitization** Accurate and effective measurement of greenhouse gas emissions and carbon dioxide absorption is a key requirement for integration into internationally recognized emissions trading systems and carbon units. In this regard, to conduct a comprehensive analysis and assessment of the current situation regarding direct and indirect greenhouse gas emissions, using a unified methodological approach to emissions calculations, the Company will develop reporting practices under the CDP climate program. The technological process in the energy sector is shifting towards

[9] See the Development Strategy of "Samruk-Energy" JSC for 2024-2033, Strategic Direction - Efficiency."

5.5. Localization of production.	increasing the share of renewable energy sources (RES), as well as digitalizing infrastructure. Modernizing energy infrastructure will focus on reducing the wear and tear of generating capacities, as well as enhancing equipment with modern metering systems, which will reduce overall losses and system failures, thus aligning with sustainable development goals. The implementation of intelligent technologies will significantly increase the reliability and quality of energy supply, improve the efficiency of primary energy use, reduce production process costs and environmental impact, and ensure compliance with advanced corporate governance practices in terms of information disclosure and data validation and verification tools. **5.2. Changes in the regulatory environment** The decarbonization process requires studying and developing proposals to improve Kazakhstan's regulatory framework. Proposals to enhance the regulatory environment should address issues such as tariff regulation, support measures for RES, improvement of quota distribution mechanisms, stimulation of electricity consumption reduction, creation of an effective offset unit trading system, and more. **5.3. Green financing** The trend towards investments in green projects (green financing) offers new opportunities for attracting additional funding sources for RES projects. The main tools for green financing include green bonds, green preferential loans, and subsidies for green projects. On November 25, 2021, "Samruk-Energy" JSC held its debut green bond issuance through a public subscription on the Astana International Exchange (AIX) stock exchange, totaling 18.4 billion tenge with a coupon rate of 11.4% per annum and a maturity period of 6.5 years. **5.4. Compliance with ESG criteria** Today, the Company actively integrates sustainable development principles into its operations. "Samruk-Energy" JSC publishes annual reports on sustainable development, and most of the Company's operations are certified according to international ISO standards. In 2023, the ESG risk rating of "Samruk-Energy" JSC was 24.1 points, corresponding to the Medium risk level according to Sustainalytics. Implementing a strategy for the continuous improvement of the ESG rating will help the Company enhance its image among potential investors and expand the scope of modern ESG practices (offset carbon projects, climate projects, etc.). To maintain and improve the ESG rating, the Company has developed a Roadmap for improving the sustainable development management system at "Samruk-Energy" JSC. For monitoring and reporting purposes, the Company has an Instruction on calculating greenhouse gases and offset units across Samruk-Energy Group (according to the Methodology for calculating greenhouse gas emissions and absorption), which defines the main approaches to calculating greenhouse gases and offset units. 5.5. **Localization of production** A high level of import substitution in the energy sector exposes the industry to risks due to disruptions in global supply chains. Shifting the production of key components to the domestic market will reduce costs,

	enhance the country's energy security, and stimulate the development of local manufacturing. The Company regularly conducts activities to increase domestic value in accordance with the Program for increasing domestic value in the overall procurement of goods, works, and services at "Samruk-Energy" JSC, including the implementation of investment projects to establish new production capacities for subsidiaries: -Organizing the production of components (blades, gondolas, and towers) for wind power plants in partnership with partners; -Organizing the production of special equipment in Kazakhstan: localization of a factory with large-scale assembly technology (SKD) transitioning to small-scale assembly (CKD) in collaboration with partners.

As part of the current Program and in light of the chosen directions, the Company models three possible development scenarios: two ambitious ones involving active changes and one baseline scenario reflecting the inertial development of the existing business model:

1) **Business as usual (BAU)** – The baseline scenario models the development of the Company in the absence of significant technological breakthroughs and new climate policies. It is based on the extrapolation of historical data and reflects the inertial development path of the energy sector.
2) **Decarbonization** – A scenario of moderate decarbonization, implying a phased reduction of the carbon footprint. This is the unconditional target scenario and the optimal course of events.
3) **Deep decarbonization** – An ambitious plan to achieve carbon neutrality in the shortest possible time. It is a conditional target and can be implemented under additional conditions.

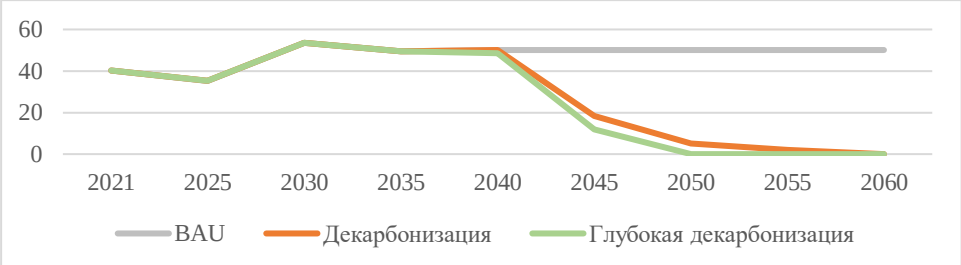
Considering Kazakhstan's climate policy, global trends, and its own goals, the Company sets the following objectives in the decarbonization scenario:

- Achieving carbon neutrality by 2060 (primary objective);
- Reducing specific greenhouse gas emissions from the Company's activities by ≥40% by 2030, ≥45% by 2040, ≥70% by 2050, and ≥95% by 2060 relative to the baseline year (monitoring objective).

Given the uncertainties of global and local decarbonization processes, the Company adopts the ambitious deep decarbonization scenario with the following target indicators:

- Achieving carbon neutrality by 2050 (primary objective);
- Reducing specific greenhouse gas emissions from the Company's activities by ≥40% by 2030, ≥45% by 2040, ≥80% by 2050, and ≥100% by 2060 relative to the baseline year (monitoring objective).

The summary dynamics for greenhouse gas reduction across the three scenarios are presented in Graph 6.



Note:Grey line – BAU, orange line- Decarbonization, green line – deep decarbonization

Graph 6. Dynamics of geenhouse gas (GHG) reduction (in absolute terms, million tons) across three scenarios.

Selection of the base year and calculation methodology

In compliance with the protocol instructions of "Samruk-Kazyna" JSC dated May 24, 2021, No. 47-r, and April 20, 2021, No. 32-r, titled "Develop the energy transition plan within strategic planning" and considering the tightening of the Environmental Code of the Republic of Kazakhstan in 2021, **the base year for Scope 1 is set as 2021.** Additionally, the base year (2021) is established in accordance with the approved Concept of Low-Carbon Development of "Samruk-Kazyna" JSC until 2060 (Section 3, "Goals of low-carbon development" of CLCD). For the analysis and assessment of the boundaries of Scope 2, the base year for Scope 2 coverage is set as 2022.

The following are used for the calculation of greenhouse gas (GHG) emissions, as well as for the scenario analysis of future emissions:

1) The approved methodology for the calculation of GHG emissions and absorption, Order No. 9 of the Minister of Ecology and Natural Resources of the Republic of Kazakhstan dated January 17, 2023.
2) The approved Order No. 260 of the Acting Minister of Ecology, Geology, and Natural Resources of the Republic of Kazakhstan, dated July 19, 2021, "List of benchmarks in regulated sectors of the economy."
3) The approved internal guideline on GHG and offset units' calculation for "Samruk-Energy" JSC Group of Companies, approved by the Company's Management Board decision (Minutes No. 09, dated April 10, 2024).

4.2. Business as usual scenario

The **Baseline** scenario, which assumes the absence of significant technological changes or political measures aimed at achieving carbon neutrality, is considered a reference for comparing the results of other scenarios. This scenario envisions the continued development of all types of generation (renewable energy, alternative energy, traditional generation) and extrapolates the historical trends observed in Kazakhstan into the future.

This scenario is modeled based on the STEP (The Stated Policies Scenario) conditions, which allow the assessment of potential energy sector development trajectories under the assumption that existing and planned political measures are maintained without additional policy actions. The model does not assume that governments or companies will achieve all of their stated goals.

This scenario is adopted as a comparison model and is not a target scenario. Carbon neutrality is not achieved. The net carbon footprint by 2060, compared to the baseline year (2021), is projected to be +25%.

4.3. Decarbonization scenario

The **Decarbonization** scenario envisages a moderate reduction in greenhouse gas emissions. This scenario incorporates the conditions set out in the APS (The Announced Pledges Scenario), which outlines potential pathways for the development of the energy system through the adoption of advanced energy technologies. This approach enables the company to assess the maximum potential impact of the country's existing climate commitments, understand how ambitious these pledges are, and determine whether they can help achieve global climate goals in the company's operations. The scenario also identifies areas where intensified climate action is needed to meet more ambitious targets (the target indicators for this scenario are consolidated in Table 3).

The Decarbonization scenario envisions the expansion of wind energy capacity and other alternative energy sources, the implementation of carbon capture, utilization, and storage (CCUS) technologies at coal-fired power plants, the execution of offset projects, and the gradual decommissioning of coal-based generation.

The net carbon footprint by 2060, compared to the baseline year (2021), is projected to be -100%.

Table 3. Target indicators for Program (under the Decarbonization scenario).

No.	Title of target indicator	Measurement unit	2021**	2030	2040	2050	2060
1	Net carbon footprint*	mln.tons	40,31	54	31,4	7	0
2	Reduction in net carbon footprint by 2021	%	-	+33	-22	-87	-100
3	Reduction in specific GHG emissions	%		≥40	≥45	≥70	≥95
*Including carbon offsets and ongoing initiatives. ** actual							

Conditions for achieving target indicators:

1) Financial support: Investments from the parent company, the government, and stakeholders.
2) Technological readiness: Maturity of carbon capture technologies.
3) RES project implementation: Strict adherence to the renewable energy construction plan.
4) Government support: Active involvement of the government and the Fund in implementing emission compensation mechanisms and improving the legal and regulatory framework.

4.4. Deep decarbonisation scenario

The **Deep decarbonisation (Ambitious)** scenario foresees a significant increase in the share of renewable energy within the Company through promising future projects, alongside the adoption of existing low-carbon technologies. This scenario aligns with the key principles of the Net Zero Emissions (NZE50) scenario. The NZE scenario anticipates that countries will achieve net-zero emissions by 2050. It incorporates the weaker aspects of the Decarbonisation scenario and increases the ambitions for decommissioning traditional blocks and expanding the required additional renewable energy capacity. Emission trajectories under the Deep decarbonisation scenario are in line with a 50% probability of limiting global warming to 1.5°C without exceeding the maximum temperature threshold. The target indicators for this scenario are presented in Table 4.

Carbon neutrality is achieved by 2050.

Table 4. Target Indicators of the Programme (under the Deep Decarbonisation scenario).

№	Title of target indicator	Measurement unit	2021**	2030	2040	2050	2060
1	Net carbon footprint*	mln.tons	40,31	54	31,4	0	0
2	Reduction in net carbon footprint by 2021	%	-	+33	-30	-100	-100
3	Reduction in specific GHG emissions			≥40	≥45	≥80	≥100
*Including carbon offsets and ongoing initiatives. ** actual							

The implementation of this scenario will depend on a variety of factors, including technological breakthroughs, political decisions, and social changes.

Conditions for achieving target indicators:

1) Financial support: Investments from the parent company, the government, and stakeholders.
2) Technological readiness: The maturity of carbon capture technologies.

3) Energy Security assurance with Government support.
4) Implementation of Renewable Energy Projects.
5) Government support: Active involvement of the government and the Fund in implementing emission compensation mechanisms and enhancing the regulatory framework.

The implementation of this scenario requires a detailed examination of socio-economic prospects, including ensuring a stable electricity supply for the region, affordable tariffs, and the retraining and employment of workers currently engaged in traditional power generation.

5. Funding sources

The Company faces the need to secure significant investments to implement the Programme. Given the limitations of current financial resources, the Company is considering the option of raising debt financing and increasing its share capital through the Shareholder (the Fund).

To enhance investment attractiveness and optimize the asset portfolio, a corporate restructuring option should be considered. In particular, assets related to renewable energy and hydropower should be transferred to the balance sheet of PLC "Qazaq Green Power." This decision would enable the creation of a more flexible and investor-friendly structure focused on the development of "green" energy. Attracting strategic investors to the projects of PLC "Qazaq Green Power" will be a crucial step in securing funding for the Program and ensuring the Company's further development.

It is worth noting that global trends aimed at expanding renewable energy and reducing greenhouse gas emissions create favorable conditions for implementing investment projects in this sector. International financial institutions and their support programs actively back such projects, offering long-term financing on favourable terms. Meanwhile, the largest investment funds and banks (e.g., EBRD, ADB, World Bank, Bank of China, ING, and others) are scaling back investments in high-emission assets, including coal-based projects, and redirecting funds to the construction of new renewable energy capacity. Key partners in financing renewable energy projects could include international financial institutions such as the World Bank, EBRD, ADB, Asian Infrastructure Investment Bank, as well as Kazakhstan's Development Bank. These organizations are actively supporting the development of renewable energy in the country and the region.

The government is also providing comprehensive support for the development of "green" energy. The development and implementation of a state program for transitioning to a "green" economy, the creation of a favorable regulatory framework, and the establishment of a green finance market are creating attractive investment conditions.

6. Assessment of climate risks

6.1. General information

The Company places a strong emphasis on managing climate risks to ensure a reasonable level of assurance in achieving its strategic goals. "Samruk-Energy" JSC implements a comprehensive set of measures to address climate risks. Climate change risk assessments are integral to the development of the Company's strategy, the evaluation of investment projects, and the formulation of both annual and medium-term plans. The financial implications of these risks, before mitigation measures are applied, include penalties for non-compliance with legislative requirements and the potential increase in tax rates on greenhouse gas emissions.

As part of the Program's scenario analysis, the Company has identified key physical climate risks, along with transitional climate risks. Environmental risks, however, are not included within the scope of this Program.

6.2. Physical climate risks

These risks are associated with changes in weather and climate conditions, as well as other environmental factors that could impact equipment reliability and human health (including risks related to natural disasters). To manage these risks, the Company conducts assessments of the potential impacts of climate changes during the operation, design, and construction of facilities, as well as environmental monitoring across key parameters, to ensure timely decision-making and necessary actions.

The analysis identified the following categories of significant physical climate risks:

For wind energy:
- Low wind speed: Reduces electricity generation.

For solar energy:
- **Cloud cover and precipitation**: Decrease the efficiency of solar panels.

For hydropower:
- **Precipitation:** Uneven rainfall leads to fluctuations in reservoir levels, potentially reducing electricity generation.
- **Temperature:** Low temperatures may freeze water bodies, while high temperatures increase evaporation.
- **Wind:** Enhances water evaporation from reservoirs.

For conventional energy (TPP):
- **Temperature:** High temperatures risk equipment overheating, while low temperatures increase the demand for heat.

For coal mining:
- **Temperature:** Low temperatures complicate coal extraction and transportation.

For overall energy infrastructure:
- **Precipitation:** Damages power lines, roads, and other infrastructure. Extreme weather events (hurricanes, floods, severe frosts) may damage transmission lines, substations, and other infrastructure elements.

Impact on the Program:
1) Electricity generation instability
2) Cost escalation
3) Increased risk of accidents
4) Reduced energy system efficiency

To mitigate the negative effects of climate change, adaptation measures should be developed and implemented, such as creating backup energy sources, modernizing energy equipment, and enhancing forecasting and disaster prevention systems.

6.3. Climate transition risks

6.3.1. Political, legal, and regulatory risks:

1) Tightening of international climate policies:

The implementation of CBAM provides for the sale of certificates by a specially designated authorized body for imported carbon-intensive goods to the EU, based on an established list. The EU's cross-border carbon tax will be introduced gradually: starting in 2023, producers will be required to report the carbon footprint of their products, and from 2026, they will be required tTi pay the carbon tax.

2)Tightening of environmental legislation:

Under the Paris Agreement, Kazakhstan has committed to reducing greenhouse gas emissions by 15%

by December 2030, compared to 1990 levels. The Environmental Code of Kazakhstan mandates stricter emissions reduction requirements, the adoption of Best Available Techniques (BAT), and a phased increase in emission tax rates (by a factor of 2x, 4x, or 8x) for non-compliance with BAT.

In response, the Company plans to implement advanced technologies at its Category 1 facilities, including the installation of gas-cleaning systems, modernization of existing plants, and a transition from coal to gas as the primary fuel source.

3) Carbon pricing:

The carbon price significantly impacts the Company's costs and asset profitability. To reduce expenses and enhance competitiveness, investments in environmentally friendly technologies and projects are necessary.

6.3.2. Reputational risks.

Reputational risks arise from stakeholder perceptions of the Company's involvement (or lack thereof) in the transition to a low-carbon economy.

The Company regularly discloses information on its climate management and greenhouse gas emissions, addressing stakeholder concerns. A decline in sustainability ratings poses a reputational risk. To mitigate this, Samruk-Energy prioritizes transparency as part of a broader sustainability strategy, fostering stronger relationships with all stakeholders.

6.3.3. Ongoing and prospective investment projects in the framework of the Program implementation

The untimely or poor execution of investment projects and programs within subsidiaries due to a lack of funding or currency fluctuations can result in a decrease in the operational efficiency of existing capacities and failure to achieve planned benefits due to equipment becoming obsolete.

There is a risk of project implementation delays and/or cost escalations, which may be influenced by a range of factors, including high project costs, insufficient internal funds for financing, limited borrowing capacity, the lack of thorough research on CCUS technologies, and uncertainties regarding their applicability to the Company's TPPs, among other considerations.

To minimize this risk, it is necessary to conduct a comprehensive study of new technologies with the involvement of research institutes and international organizations, attract a strategic investor within the framework of these projects, carry out public awareness campaigns, and ensure strict oversight of project implementation (both from a technical standpoint and in terms of safety compliance).

6.3.4. Technological risks

These risks are associated with the acceleration of the global economy's transition to a low-carbon path, driven by the development and increasing efficiency of low-carbon technologies.

Measures to minimize these risks may include: ongoing monitoring of technological advancements; development of proprietary solutions in energy efficiency; improving energy efficiency in production through energy conservation, energy management, and streamlining industrial processes.

6.3.5 Threat to the country's energy security

The Company's current assets, operating on traditional fuels, form the backbone of the country's energy system, providing stable, reliable, and affordable electricity to the economy and population. The

tightening of CO_2 emissions reduction requirements and the increase in the share of renewable energy sources (RES) in the country's generation mix brings energy system stabilization to the forefront. Given the instability of RES and the complex climatic conditions of the country, the development of RES and the transition to their full use is not feasible without supporting base generation.

Measures to mitigate this risk include implementation of RES development projects; development of energy storage technologies; implementation of energy security plans that take into account the need for the development of base generation to support RES; construction of coal power plants equipped with modern, environmentally friendly technology.

6.3.6. Growth of electricity consumption by 2060

Electricity consumption in the country shows a steady annual increase. Currently, electricity consumption stands at around 100 billion kWh, with an annual growth rate of approximately 1%. Factors influencing consumption growth include the energy intensity of industries, the trend towards electrification, the adoption of digital technologies, population growth, and the expansion of mining.

To meet the growing demand for electricity in the future, the Company is continuously working to improve energy efficiency and reduce energy intensity in its operations, while also commissioning new generation capacities. The development of energy-saving and energy efficiency programs at the state level also yields positive effects.

6.3.7. Limitation of energy resources

The vast territory of Kazakhstan has a wide variety of climate zones and significant potential for utilizing energy from water, sunlight, wind, and geothermal sources. The growing demand for electricity and the decommissioning of traditional power plants will require the construction of a large number of new capacities. While maintaining the share of RES generation within the framework of deep decarbonization scenarios, there is a possibility that RES sources may not be sufficient to meet the demand.

In this context, research and the implementation of alternative energy projects may help maintain a balance between the use of clean energy and ensuring the reliable supply of electricity to meet the growing demand.

6.3.8. Social

The decommissioning of conventional TPPs and the transition of CHPs to natural gas may result in the displacement of a portion of the workforce.

The implementation of Energy Transition Program projects at enterprises vital to local economic stability may have significant social implications

To enhance social stability, a comprehensive set of measures is necessary, including addressing the potential retraining of workers to facilitate their employment at new facilities and cooperating with local authorities to jointly develop regional development programs.

6.3.9. Currency

RES projects require significant capital investments, and most of these projects are financed through borrowed funds in US dollars. Given the consistent trend in exchange rate fluctuations and the high level of dependency on the cost of imported equipment (which constitutes a large portion of project costs), there is a high currency risk that could substantially increase costs and jeopardize the implementation of current and future projects.

To mitigate this risk, measures include avoiding the attraction of loans in foreign currency and conducting regular monitoring with timely adjustments to the Program.

7. Regulatory references

No.	Document title
1	Strategy for achieving carbon neutrality in Kazakhstan by 2060 (Decree of the President of the Republic of Kazakhstan No. 121, dated 02.02.2023)
2	Concept of Low-Carbon Development of Samruk-Kazyna JSC (Minutes of "Samruk-Kazyna" JSC Board of Directors meeting No. 200, dated August 25, 2022)
3	Development Strategy of "Samruk-Energy" JSC for 2024-2033 (Minutes of the Board of Directors meeting No. 09/24, dated 19.07.2024)
4	Legislation of the Republic of Kazakhstan in climate and environmental development