Approved
by the decision of the Management Board
JSC «NC «QazaqGaz»
Minutes of meeting No. __ dated «___»
_____ 2025

CLIMATE RISK MANAGEMENT PROGRAM
FOR THE GROUP OF COMPANIES JSC «NC «QAZAQGAZ»

Astana 2025

Content

1. Purpose and scope of application

1.1. This Program on climate risk management for the group of companies of JSC NC QazaqGaz (hereinafter - the Program) establishes unified principles, requirements and recommendations for environmental management in the process of activity of JSC NC QazaqGaz (hereinafter - the Company) and subsidiaries, dependent legal entities (hereinafter - SACs).

1.2. This Program shall apply to all technological, business and social processes of the Company.

2. Regulatory references

2.1. The following national and international standards and internal regulatory documents of the Company are referenced in this Program:

ISO 14001:2015	International Standard. Environmental Management Systems. Requirements and guidelines for application.
FCCC/CP/2013/10/Add.3	Framework Convention on Climate Change
IFRS S2	IFRS S2 Climate Disclosure
IPCC	Fifth IPCC Evaluation Report
ISO 14001:2016	Environmental Management Systems. Requirements and guidelines for application
No. 400-VI LRK of January 2, 2021	Environmental Code of the Republic of Kazakhstan
P-04-22	Environmental policy
DP-01-23	General requirements for the development, design and presentation of internal regulatory documents of JSC NC QazaqGaz
DP-02-23	Document management
DP-10-23	Identification of environmental aspects of JSC NC QazaqGaz
PR-27-23	Rules of training and development of employees of JSC NC QazaqGaz
PO-12-23	Procedure for Conducting Audits and Inspections in the Areas of OHS, FS, and EP at Production Sites of JSC NC QazaqGaz
No. 34 dated 04/15/2022.	Regulation of HSE Service approved by the Order of the Chairman of the Management Board of NC QazaqGaz JSC

3. Terms and definitions

3.1. This Program uses terms and their respective definitions in accordance with ISO 14001:2016, the Environmental Code of the Republic of Kazakhstan and Table 1.

Table 1. Terms and definitions

No.	Terms and definitions	Term Description
1	**Favorable environment**	The environment is considered favorable for human life and health if its quality ensures ecological safety and natural balance of the natural environment, including sustainable functioning of ecological systems, natural and natural-anthropogenic objects and natural complexes, as well as preservation of biodiversity
2	**Internal audit**	A systematic, independent and documented process of obtaining evidence of verification and assessing it objectively to establish the extent to which agreed verification criteria are met.
3	**Environmental impact**	Any change in the environment, positive or negative, fully or partially resulting from the impact of environmental aspects of the Company's structural units.
4	**Decarbonization**	The process of removing carbon from an alloy or other material
5	**Stakeholder**	An individual or a group of individuals interested in or affected by the results of the Company's environmental activities.
6	**Control**	A procedure for assessing conformity by observation and judgment accompanied by appropriate measurement, testing or calibration.
7	**Corrective Action**	An action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent its recurrence.
8	**Climate risks**	Potential risks that may arise from climate change (physical risks) or mitigation measures (transition risks).
9	**Inconsistency**	Failure to fulfill an established requirement within the management system, which will adversely affect the quality of the Company's products, environmental management system.
10	**Environment**	The environment is recognized as the totality of conditions, substances and objects of the material world surrounding a person, including the natural environment and the anthropogenic environment.
11	**Environmental protection**	A system of measures implemented by the state, individuals and legal entities aimed at preservation and restoration of the natural environment, prevention of environmental pollution and damage in any form, minimization of negative anthropogenic impact on the environment and elimination of its consequences, ensuring other environmental foundations for sustainable development of the Republic of Kazakhstan.
12	**Greenhouse gases**	Gases with high transparency in the visible range and high absorption in the mid- and far-infrared.
13	**Policy in the field of environmental protection**	Intentions and directions of the Company's activities related to the environmental performance of the Company's operations, formed by the Company's management.
14	**Preventive action**	An action taken to eliminate the causes of a potential nonconformity, defect, or other undesirable situation in order to prevent its occurrence.
15	**Management of the Company**	Management Board, Chairman of the Management Board and Deputy Chairmen of the Management Board of the Company.
16	**Management of subsidiaries and affiliates**	General directors of subsidiaries and affiliates.
17	**Compliance**	Fulfillment of established requirements.
18	**Status**	A product condition determined on the basis of inspection and test results.

19	**Sustainable development**	A process of economic and social change in which natural resources, investment direction, scientific and technological development orientation, personal development and institutional changes are harmonized and enhance current and future capacity to meet human needs and aspirations.
20	**Energy efficiency**	Efficient (rational) use of energy resources.

4. Abbreviations and designations

4.1. Abbreviations and designations are applied in this Program in accordance with Table 2.

Table 2. Abbreviations and designations

No.	Abbreviations and notations	Full name of the given designations and abbreviations
1	APS	Announced Pledges Scenario
2	CDP	Carbon Disclosure Project - Carbon Accountability Project
3	CCUS	Carbon capture, storage and transportation system
4	CMIP-6	Coupled Model Intercomparison Project Phase 6
5	EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization - earnings before interest, taxes, depreciation and amortization
6	ENVID	Environmental impact and risk assessment
7	GGCS	Green Gas Certification Scheme
8	GMI	Global Methane Initiative - Global Methane Initiative
9	HSE	Health Safety and Environment - Health, Safety and Environment
10	IFRS	International Financial Reporting Standards - International Financial Reporting Standards, IFRS
11	I-REC	A certificate that confirms that a certain amount of electricity is generated through the application of renewable energy sources
12	LNG	Liquefied natural gas - Liquefied natural gas
13	NZE	Net Zero Emissions
14	SPI	Standardized Precipitation Index
15	SSP	Shared Socioeconomic Pathways - Shared Socioeconomic Pathways
16	TCFD	Task Force on Climate-related Financial Disclosures - standards for maintaining records that disclose information on the potential impact of climate change on the global economy
17	RES	Renewable energy sources
18	WMO	World Meteorological Organization
19	BSGP	Beineu-Shymkent gas pipeline
20	SUBSIDIARIES AND AFFILIATES	Subsidiary and dependent company
21	ICA	Intergas Central Asia
22	CRMS	Corporate Risk Management System
23	QGA	QazaqGaz Aimaq
24	IPCC	Intergovernmental Panel on Climate Change - A set of possible future climate change trajectories based on different levels of greenhouse gas emissions and other factors
25	CM	Coalbed methane
26	IEA	International Energy Agency
27	BAT	Best available technology

28	UN	United Nations
29	GG	Greenhouse gas
30	LCDP	Low Carbon Development Programs
31	FCCC	UN Framework Convention on Climate Change
32	CO2-eq.	The industry unit by which greenhouse gas emissions are measured in relation to their impact on the climate
33	SDGS	Sustainable Development Goals

5. Responsibility

5.1 Responsibility for the development of this Program shall rest with the HSE.

5.2 The responsibility for managing this Program in accordance with the requirements of the documented Program DP-02 'Document Management' lies with the ISP ISM.

5.3 The Strategy and Sustainable Development Department of JSC NC QazaqGaz is responsible for coordination of sustainable development management issues at the operational level.

5.4 The heads of structural subdivisions of JSC NC QazaqGaz - HSE Service and Production and Technical Department are responsible for certain aspects of implementation of programs and activities in the field of climate change.

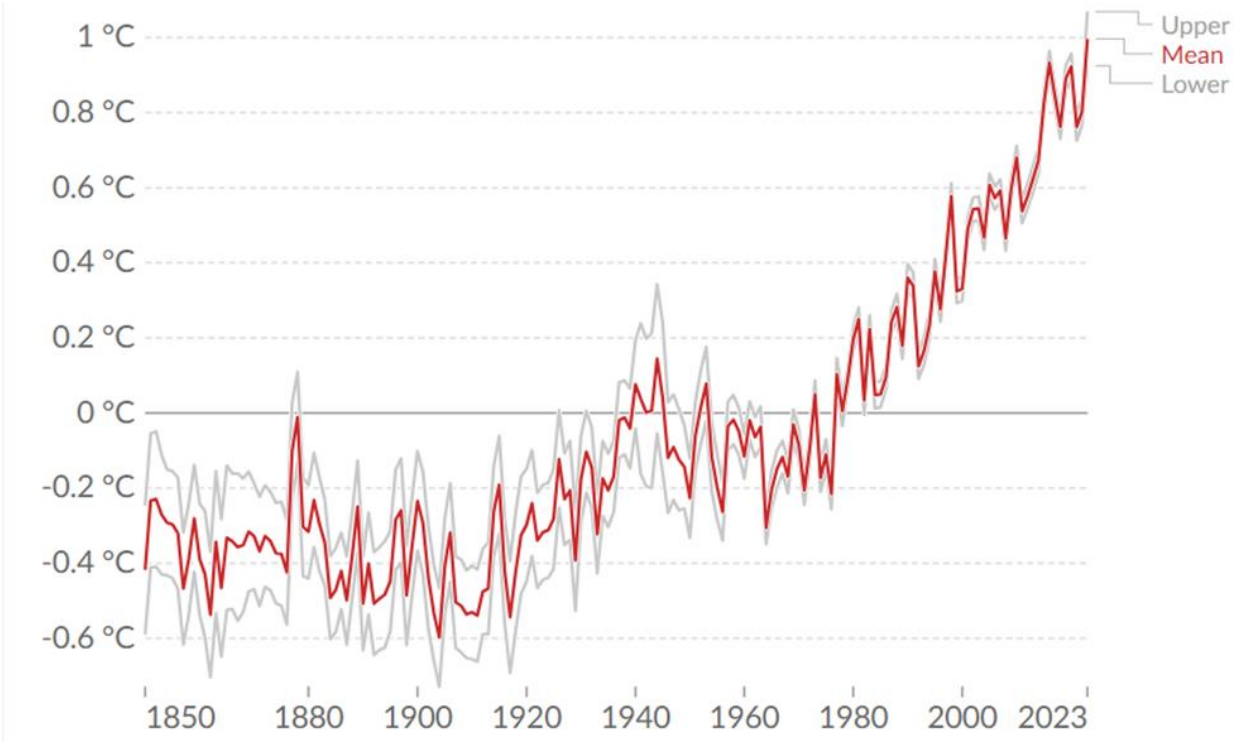
6. Main part

6.1 Growing importance of the climate agenda

International context for the development of the climate agenda climate change is one of the most serious and urgent challenges for humanity in the xxi century. it threatens the security, health, well-being and development of billions of people, as well as the biodiversity and ecosystems of our planet. combating climate change therefore requires coordinated and joint efforts of all countries, sectors, organizations and citizens.

The rise in global average temperature from 1850 to today is the most obvious and measurable indicator of climate change. According to the World Meteorological Organization (WMO), the global average temperature in 2020 was about 14.9 °C, 1.2 (±0.1) °C above pre-industrial (1850-1900) levels. On a decadal scale, temperatures have been higher in each decade since 1850 than in any previous decade. Humans have been responsible for a 1.1 °C increase in global average temperature since 1800.

Figure 1. Global anomaly of mean land-sea temperature relative to the 1961-1990 mean temperature.

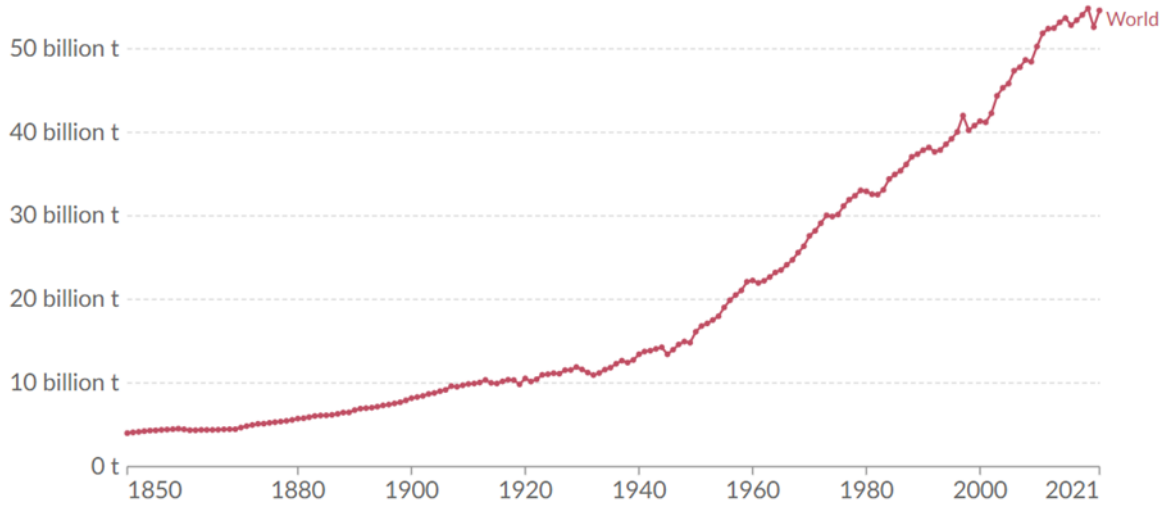


Source: [Average temperature anomaly, Global (ourworldindata.org)]

Rising temperatures are leading to increased and more frequent extreme weather events such as heat waves, droughts, floods, storms, fires and melting ice. These events have widespread and devastating impacts on natural and socio-economic systems, including agriculture, water resources, health, energy, transportation, tourism, infrastructure and security. According to the UN, there is alarming evidence that thresholds have already been exceeded, leading to irreversible changes in our planet's ecosystems and climate system.

Emissions of greenhouse gases such as carbon dioxide, methane, nitrous oxide and others are a major cause of anthropogenic climate change. These gases absorb infrared radiation emitted by the Earth and trap it in the atmosphere, creating a greenhouse effect that raises surface and lower atmosphere temperatures.

Figure 2. Annual greenhouse gas emissions, 1850-2021.



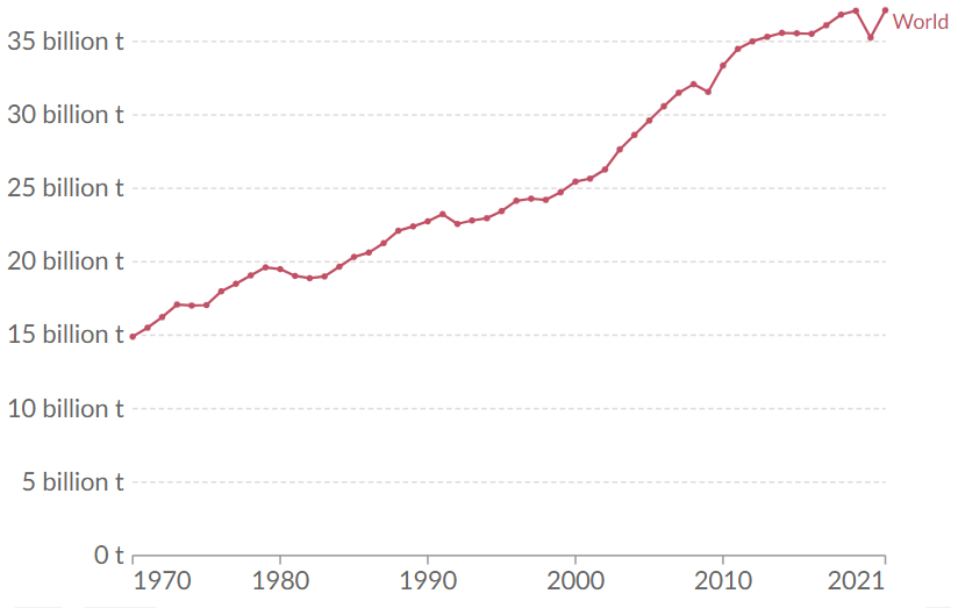
Source: [Greenhouse gas emissions - Our World in Data]

According to the Global Carbon Budget report, total CO_2 emissions, including emissions from fossil fuel combustion and land use change, have stabilized over the past decade and are projected to reach 41.6 billion tons of CO_2 in 2024. The period of stability from 2014 to 2023 followed a decade of significant growth in aggregate emissions, averaging 2% per year between 2004 and 2013. In addition, methane concentrations reached a record high of 1934 ± 2 ppb in 2023, equivalent to a 265% increase compared to pre-industrial levels.

According to the Intergovernmental Panel on Climate Change (IPCC), global greenhouse gas emissions rose by 90% between 1970 and 2018, while carbon dioxide emissions rose by 78%. Most of this increase has occurred since 2000, when greenhouse gas emissions rose by 43% and carbon dioxide emissions by 47%. According to the latest EDGAR database, global greenhouse gas emissions (excluding land use, land use change, and forestry - LULUCF) reached 53.0 billion tons of CO_2 equivalent in 2023. This is the highest level ever recorded, 1.9% or 994 million tons of CO_2 equivalent higher than the 2022 level.

In this regard, the international community has adopted a number of documents and agreements aimed at reducing greenhouse gas emissions, adapting to climate change and supporting the most vulnerable countries and populations. Among them, the most important are the UN Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and the Paris Agreement.

Figure 3Annual CO2 emissions, 1970-2021.



Source: [CO2 emissions - Our World in Data]

In order to combat climate change and its negative impacts, countries adopted the Paris Agreement on December 12, 2015. This agreement aims to substantially reduce global greenhouse gas emissions and limit the increase in global temperatures this century to 2 degrees Celsius, while finding means to further limit the increase to 1.5 degrees.

In the same year, the Sustainable Development Goals (SDGs) were adopted by the UN as a blueprint for achieving a better and more sustainable future for all. Among the seventeen Sustainable Development Goals adopted, SDG 13 focuses on taking urgent action to combat climate change and its impacts, calls for reducing greenhouse gas emissions, increasing adaptation to climate change and promoting sustainable development in a changing climate. SDG 13 emphasizes the urgency of taking action to mitigate climate change and adapt to its impacts, such as sea level rise, extreme weather events and other aspects related to climate change.

According to the World Meteorological Organization (WMO), it is likely that we will feel the effects of global climate change within the next five years. In order to prevent irreversible changes, we need to accelerate the reduction of greenhouse gas emissions.

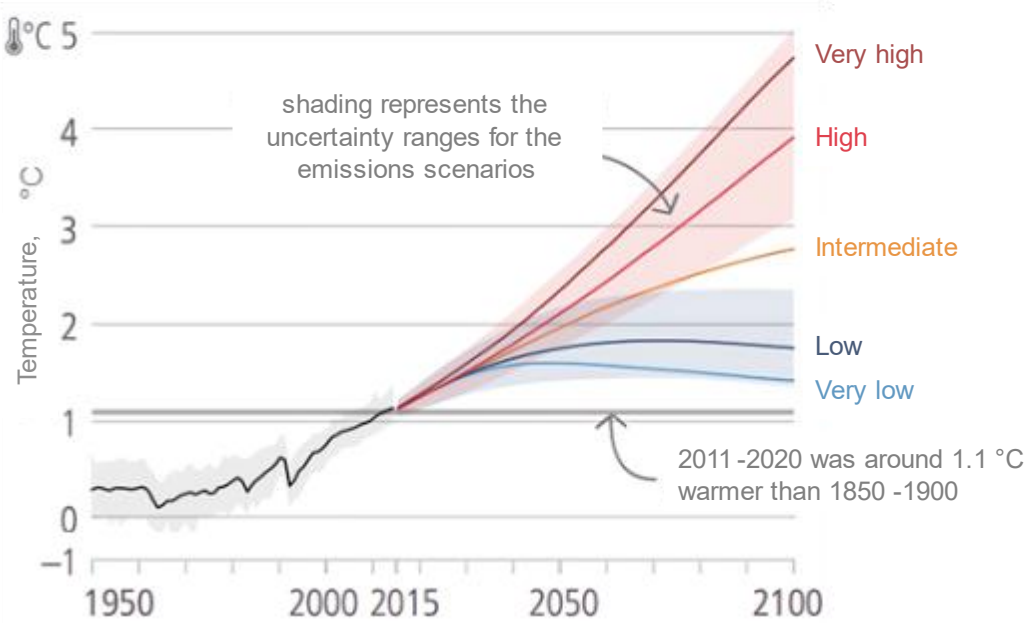
According to the IPCC, the likely magnitude of further temperature increases over the 21st century based on climate models is 0.8-2.4 °C for the minimum greenhouse gas emission scenario and 2.0-4.9 °C for the maximum emission scenario. The IPCC climate scenarios are a set of possible future climate change trajectories based on different levels of greenhouse gas emissions and other factors. They include five main scenarios, called SSPs (Shared Socioeconomic Pathways), which describe different pathways for socioeconomic development and climate change in the 21st century. These scenarios have different degrees of ambition in achieving the goals of the Paris Agreement on climate change, as well as different implications for nature, the economy and people's lives.

SSP1-2.6 describes a world in which there is a shift toward sustainable development, reduced inequality, increased prosperity and education, and a rapid transition to clean energy. This scenario is consistent with the goal of limiting global warming to 1.5°C.

SSP2-4.5 represents a medium pathway in which the world follows current development trends without making significant efforts to reduce greenhouse gas emissions or adapt to climate change. Under this scenario, the Earth's surface temperature could increase by 2.6 °C by the end of the century.

SSP5-8.5 describes a world dominated by material prosperity, individualism and consumption, and intensive use of resources and energy. This scenario leads to very high greenhouse gas emissions and climate change exceeding 4°C.

Figure 4. Scenarios of global changes in the Earth's average temperature, relative to 1850-1900, IPCC



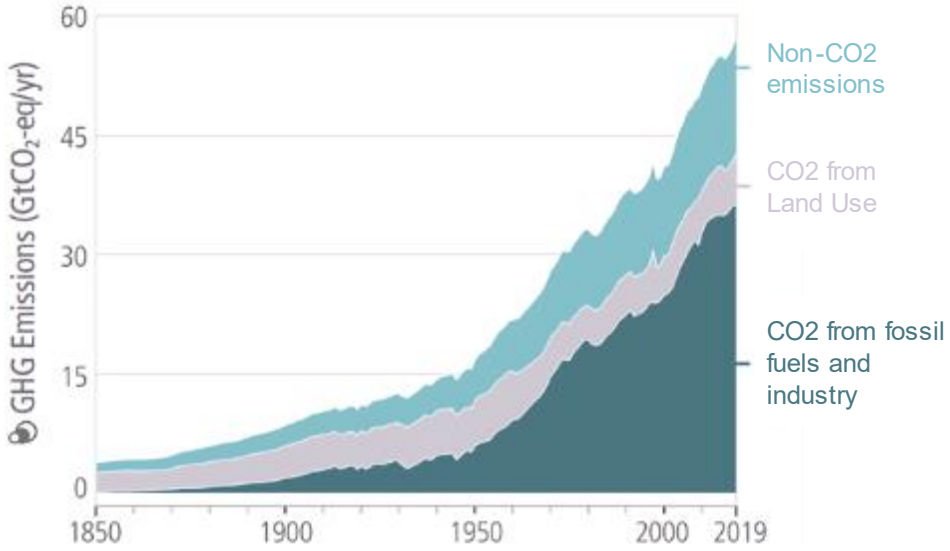
Source: AR6 МГЭИК

In this context, JSC NC QazaqGaz as one of the largest producers and suppliers of natural gas in Kazakhstan and the Central Asian region, has a great responsibility to comply with international and national commitments to combat climate change. Therefore, the Company has developed a Climate Risk Management and Decarbonization Program, which defines goals, principles, directions and activities to reduce climate impact, adapt to climate change and increase business resilience. The Climate Risk Management and Decarbonization Program is part of the Company's overall development strategy and is based on its mission, vision and values. The Climate Risk Management and Decarbonization Program also takes into account the interests and expectations of stakeholders, including shareholders, customers, partners, employees, regulators, the public and non-governmental organizations. The Climate Risk Management and Decarbonization Program is a dynamic document that will be periodically reviewed and adjusted in accordance with changes in the external and internal environment.

6.1.1 Relevance of climate change issues for JSC NC QazaqGaz

Today, the oil and gas sector accounts for about 15% of all energy-related emissions (40 billion tons of CO2-eq.), equivalent to 5.1 billion tons of global greenhouse gas emissions. The oil and gas sector is a major source of greenhouse gas emissions, which trap heat in the atmosphere and cause global warming and climate change. According to the UN, fossil fuels - coal, oil and gas - account for more than 75% of global greenhouse gas emissions and nearly 90% of all carbon dioxide emissions. The most common greenhouse gases emitted by the oil and gas sector are carbon dioxide and methane. These gases have long-lasting effects on the climate because they can persist in the atmosphere for decades or even centuries.

Figure 5. GHG emissions, 1850-2019.

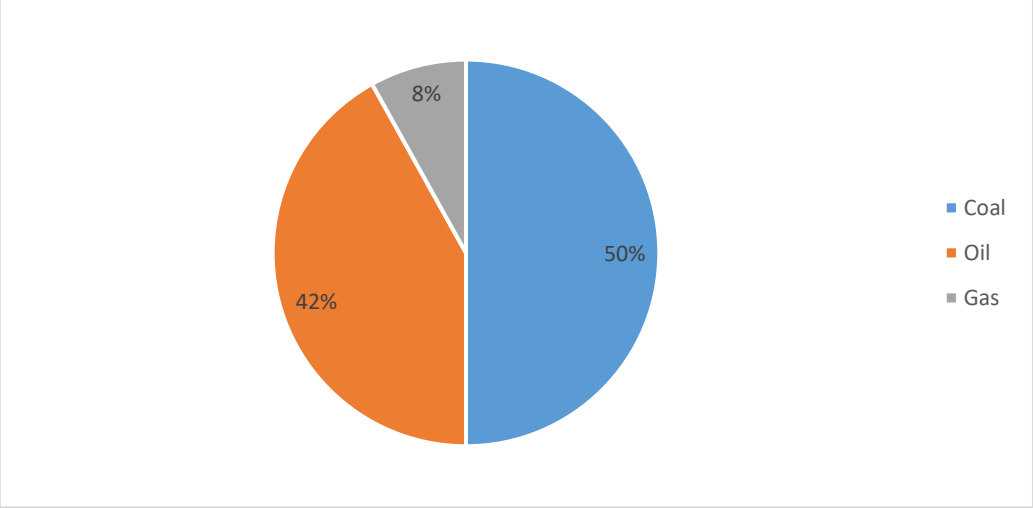


Source: AR6 МГЭИК

The gas production and transportation sector is part of the oil and gas sector, which is a major source of GHG emissions that contributes to GHG emissions and temperature rise in several ways.

When natural gas is extracted from underground reservoirs, it releases methane, a powerful greenhouse gas that traps more heat than carbon dioxide. Methane leaks can occur from wells, pipelines, storage facilities and processing plants. The oil and gas sector plays a disproportionately large role in the growth of global methane emissions. It is the second largest source of anthropogenic methane emissions in the world after agriculture. According to estimates by the International Energy Agency (IEA), the oil and gas industry accounts for approximately 23% of global methane emissions (Figure 6).

Figure 6. GHG emissions by fuel types for 2023 (MtCO2-eq.)

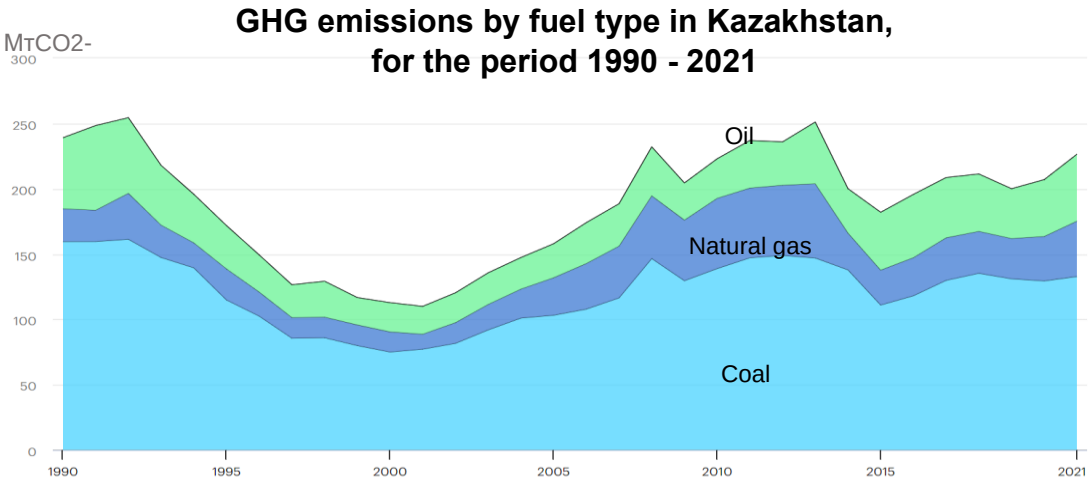


Source: [CO_2 emissions by fuel - Our World in Data]

Sources of GHG emissions from natural gas transportation include compressor stations, production units, and leaks. The U.S. Environmental Protection Agency estimates that approximately 61.8 million metric tons of carbon dioxide equivalent were emitted from natural gas pipeline transportation in 2018. Thus, the natural gas production and transportation sector plays a significant role in emissions and temperature rise, and faces various challenges and opportunities related to climate change.

Kazakhstan, one of the leading producers and exporters of energy resources, is facing significant GHG emissions. By signing the Paris Agreement in 2016, Kazakhstan has committed to reducing GHG emissions by 15% by 2030 compared to 1990 levels and achieving carbon neutrality by 2060.

Figure 7. GHG emissions by fuel type in Kazakhstan, for the period 1990-2021.

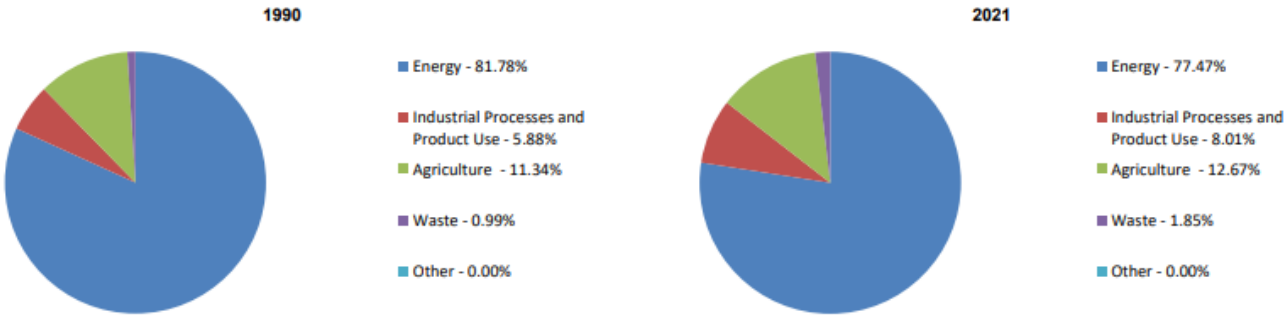


Source: [Greenhouse Gas Emissions from Energy Data Explorer]

Important steps in reducing GHG emissions are related to the transition to alternative and renewable energy sources, energy efficiency, electrification, and the application of carbon capture and storage technologies.

As a major fossil exporter, it is important for Kazakhstan to decarbonize its economy and develop a sustainable low-carbon model for new sources of growth.

Figure 8. Greenhouse gas emissions in Kazakhstan by sector, 1990-2021.



Source: United Nations, Framework Convention on Climate Change

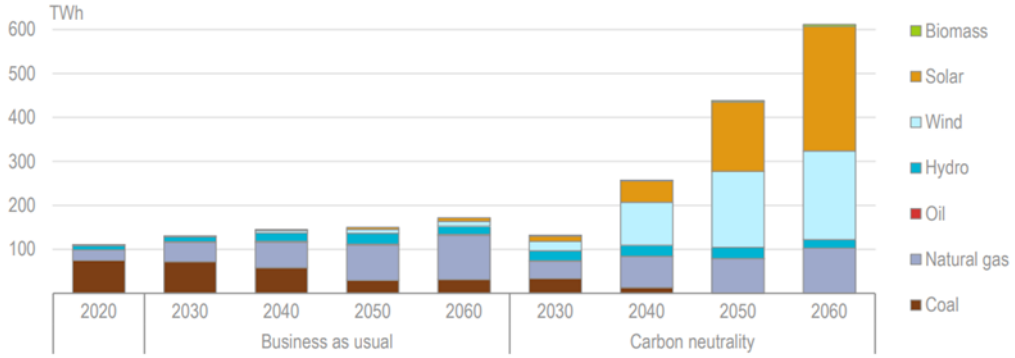
JSC NC QazaqGaz plays a key role in the realization of Kazakhstan's ambitious climate goals. In the context of efforts to reduce greenhouse gas emissions and achieve carbon neutrality, the Company has the opportunity to make a significant contribution.

JSC NC QazaqGaz is the main gas company of Kazakhstan, representing the interests of the state in the domestic and foreign gas market. The Company operates an extensive network of gas pipelines, gas distribution stations, underground gas storage and compressor stations, providing gas supply to 11.7 million people and supplying gas to 3.6 thousand industrial enterprises. JSC NC QazaqGaz also exports gas to China, Russia and other countries.

Gas is a relatively clean fossil fuel and its use has been recognized as one of the most viable options in the transition to cleaner energy sources. It generates much lower carbon dioxide emissions than coal and oil, making it an important component of a greenhouse gas reduction strategy.

Natural gas is critical in the transition to low-carbon energy sources. According to Kazakhstan's Carbon Neutral Strategy, gas will remain the only fossil energy source in Kazakhstan from 2050. All coal-fired thermal power plants will either be completely suspended or switched to gas. According to the projections made during the preparation of the national carbon neutrality strategy, both in the baseline "business as usual" scenario (a scenario in which no additional decarbonization measures are taken) and in the carbon neutrality scenario (a scenario in which all national decarbonization targets are met), natural gas is the key energy source in Kazakhstan.

Figure 9. Forecasts of electricity generation by scenarios, 2030-2060.



Source: Doctrine (strategy) for achieving carbon neutrality of the Republic of Kazakhstan until 2060

Application of advanced technologies and support of innovations aimed at reducing GHG emissions can also become a key contribution of JSC NC QazaqGaz to the achievement of climate goals of Kazakhstan. All these efforts of the Company may prove to be a significant factor in the overall picture of reducing gas emissions and in the implementation of the country's sustainable development strategy.

JSC NC QazaqGaz plays an important role in the oil and gas sector as it develops gas fields, participates in liquefied natural gas (LNG) projects, cooperates with international gas partners, and implements innovation and sustainability standards. JSC NC QazaqGaz is committed to improving Kazakhstan's energy security and efficiency, as well as participating in the Energy Silk Road.

6.1.2 Assessment of the current level of development of the climate agenda in JSC NC QazaqGaz

JSC NC QazaqGaz recognizes that climate change and environmental problems are the main challenge of our time. Within the framework of the climate agenda, annual activities are carried out to achieve best practices. To date, the Company annually conducts an inventory of GHG emissions of Scope 1 and 2 according to the national (On Approval of Methods for calculation of emissions and absorption of greenhouse gases. Order of the Minister of Ecology and Natural Resources of the Republic of Kazakhstan No. 9 dated January 17, 2023) and international methodology (IPCC dated 2006), calculation of specific greenhouse gas emissions (carbon intensity) in relation to revenue, according to GRI principles.

One of the significant steps in ensuring the Company's sustainability in the area of climate aspects is the assignment of responsibility at the level of the Board of Directors. Such an initiative at the management level demonstrates a high level of priority to addressing climate issues and implementing sustainable practices in the Company's operations.

In 2022, the Company began tracking energy consumption, including fuel consumption from renewable and non-renewable sources, as well as total energy consumption.

For 2024-2025, JSC NC QazaqGaz has done a lot of work in the field of management of climate change related issues, which include the following aspects:

1. Filling in the CDP Climate Change questionnaire

   In 2023, the Company participated in the CDP Climate Change international disclosure system for the first time and received a D rating. In 2024, as a result of systematic work to improve emissions management and climate risk processes, the Company's rating was upgraded to B.

2. Identification and assessment of climate risks

   Since the beginning of this year, the QazaqGaz has been actively engaged in climate risk management. This work includes:

   - developing a methodological approach to identifying and assessing climate risks;
   - quantitative assessment of climate risks based on scenario analysis has been carried out.
   - integration of climate risks into the corporate risk management system has begun.

3. Estimation of indirect non-energy GHG emissions (Scope 3)

   For the first time, non-energy indirect GHG emissions were assessed for categories 1, 6, 7, and 11 (in accordance with the GHG Protocol methodology). The company identified the relevant categories and adapted the assessment methodology to its specific operations.

4. Setting targets to reduce GHG emissions and energy consumption

In 2025, a Low Carbon Development Program was developed for the period up to 2033, which includes:

- targets for reducing specific greenhouse gas emissions;
- measures to improve energy efficiency;
- plans for electrification and modernization of production processes.

5. Double materiality assessment

The Company conducted a comprehensive double materiality assessment, which identified:

- the most significant impacts on the environment and society (impact materiality);
- financially significant climate and ESG factors (financial materiality) that could potentially affect the company's business.

6.2 Management of climate change matters

JSC NC QazaqGaz gives top priority to the management of climate change related issues, having built responsible attitude to the environment into its corporate strategy. Realizing the importance of global climate challenges, the Company not only actively develops and implements measures to mitigate the impact of business on the climate situation, but also strives to manage issues related to climate change. The Company's senior management, as key figures in corporate governance, are responsible for integrating climate change issues into strategic planning and decision-making, contributing to the Company's sustainable and responsible development.

6.2.1 Double materiality assessment

In 2024, QazaqGaz JSC conducted a comprehensive Double Materiality Assessment (DMA), which was a crucial step towards integrating sustainable development into its strategic management, disclosure, and risk assessment systems. The assessment was conducted in accordance with the provisions of the CSRD Directive, European Sustainability Reporting Standards (ESRS), and EFRAG recommendations, taking into account international practices of GRI, SASB, as well as rating agencies MSCI and Sustainalytics.

The assessment of double materiality covers two complementary aspects:

- Financial materiality: Refers to issues that have or may have a significant financial impact on the company (on its revenues, expenses, assets, liabilities, cash flows, access to capital, or cost of capital).
- Impact materiality: Refers to issues where the Company’s activities have or may have a significant impact on the economy, society, and the environment, regardless of the direct financial impact on the company itself.

The DMA was conducted using a multi-stage methodology, including:

- value chain mapping;
- identification and prioritization of sustainability topics;
- identification and structuring of IRO (Impacts, Risks & Opportunities);

- segmentation and surveying of stakeholders;
- assessment of significance using probability and impact scales;
- construction of double materiality matrix;
- consolidation of results and validation with relevant departments and management.

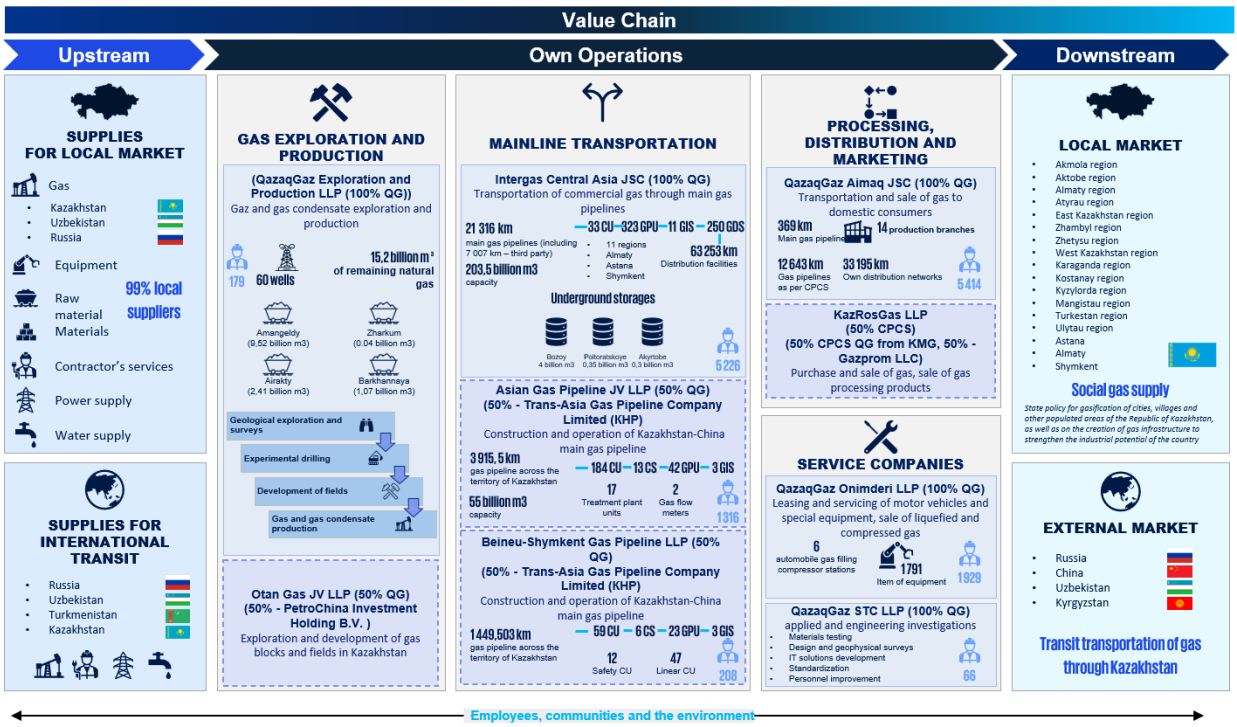
1. Value chain mapping

The first step for DMA was to build a value chain map covering:

- upstream-segment: equipment suppliers, contractors, service companies;
- midstream: production processes at QazaqGaz (extraction, transportation, storage);
- downstream: sales, customer relations, local communities, and regulators.

The mapping results formed the basis for identifying potential ESG impact points at each stage of the product life cycle and business process. The Company's dependencies on natural and social resources were also identified.

Figure 10. Value chain for QazaqGaz Group of Companies



2. Identifying relevant ESG topics

Based on mapping, internal context, analysis of industry practices and standards (GRI 11: Oil and Gas, SASB, ESRS AR16), a long list of 17 topics was formed, grouped into categories:

- Ecology: climate change, emissions, water, biodiversity, waste.

• Social aspects: occupational safety, human rights, local communities, employment.

• Governance: ethics, anti-corruption, compliance, product quality

The topics were ranked according to their relevance to the Company and the industry.

Figure 11. List of material topics for the QazaqGaz Group of Companies

2024 Integrated Annual Report Material Topics
Greenhouse gas emissions
Environmental strategy
Emissions into the atmosphere
Biological diversity
Waste management
Water and wastewater management
Land reclamation
Asset security and critical incident management
Occupational health and safety
Employment practice
Anti-discrimination and equal opportunities
Forced labor
Freedom of association
Economic efficiency
Local communities
Land and resource rights
Conflicts and safety
Competitive barriers
Countering corruption
Payments to government agencies
Development of human capital
Corporate ethics
Compliance with legal requirements
Emergency Management

Final List of Potentially Significant Topics
Greenhouse gas emissions
Environmental strategy
Emissions into the atmosphere
Biological diversity
Waste management
Greenhouse gas emissions
Occupational health and safety
Employment practice
Anti-discrimination and equal opportunities
Economic efficiency
Local communities
Competitive barriers
Countering corruption
Development of human capital
Corporate ethics
Interaction with stakeholders
Quality control/Products safety

3. Identification of impacts, risks, and opportunities (IROs)

For each topic, the following were defined:

• Actual and potential impacts (e.g., GHG emissions, pollution, social conflicts)

• Financial risks and opportunities.

A total of 75 IROs were identified, distributed across 17 priority topics.

- 52% — impacts,
- 29% — risks,
- 19% — opportunities.

The highest density of IROs was observed in the following topics:

- climate strategy (12%),
- corporate ethics (11%),
- anti-corruption compliance (11%).

Aspect	Essential Topics	Impact, Risk, or Opportunity Name (IRO)	Category (Risk/Opportunity/Impact)	IRO definition	Description
Ecological	Climate strategy	Energy efficiency	Financial opportunities	Investments in energy efficiency can reduce operational and service costs, reduce GHG emissions, gain access to green financing, government subsidies and incentives. It also improves a company's reputation and its competitiveness in international markets.	Improving energy efficiency allows QazaqGaz to reduce operating costs, increase asset profitability and extend the service life of process equipment. In addition, it opens up access to international grants and green bonds, especially within the framework of projects to modernize gas transportation infrastructure. Energy-efficient projects can be integrated into the emission compensation system and also contribute to compliance with Kazakhstan's climate commitments, strengthening the company's market position in foreign markets.
Ecological	Greenhouse gas emissions	GHG emissions	Financial risk	High levels of GHG emissions increase a company's vulnerability to increased climate regulation: carbon taxes, reduction of quotas, rising prices for emissions, new reporting requirements. This can lead to additional costs, reduced margins, deterioration of investment attractiveness, and restrictions on entering international markets.	QazaqGaz is one of the largest emitters of GHG in the gas industry of Kazakhstan, primarily due to methane emissions from compressor stations, leaks in gas transmission systems and flaring. Tightening regulations on GHG emissions, a decrease in the country's carbon budget (-1.5% per year until 2030), as well as the potential introduction of CBAM and tightening requirements in international markets create risks of a significant increase in costs for the purchase of quotas, payment of environmental fees and technical modernization. In addition, high emissions may affect the ESG rating and reduce the interest of international investors.
Ecological	Water and wastewater management	Access to water	Impact (Negative)	Excessive water extraction or pollution of sources in arid regions impairs access to water for populations and ecosystems, reduces groundwater levels, and impacts agricultural production and biodiversity. This increases social tensions and environmental vulnerability of the region.	Although the company claims that it does not have a significant negative impact on water bodies, the volume of consumption (more than 900 million liters per year) and discharges (about 317 million liters) can cause local stress in ecosystems, especially in areas where competition for water is high. Excessive consumption or discharges, even if treated to standard standards, can reduce access to quality water for local populations and farmland, especially in arid areas.

Ecological	Biodiversity	Impact of industrial facilities on protected natural areas	Impact	The construction and operation of facilities near protected natural areas disrupts the integrity of ecosystems, fragments animal habitats, leads to soil degradation, water pollution, and noise pollution. This weakens the natural functions of biosphere areas and threatens the extinction of rare species.	Gas transportation and geological exploration work of QazaqGaz may affect steppe, desert and wetland ecosystems, including the habitat of rare and endemic species. In case of placement of objects protected natural areas, the integrity of natural territories may be violated, soils may be degraded, animal migration routes may be disrupted and the environment may be polluted (during accidents, discharges or noise impact). This worsens the state of local biodiversity, increases pressure on ecosystems and may cause protest sentiments in the regions of presence.
Ecological	Waste management	Waste (including hazardous and non-hazardous)	Impact	Waste, especially if stored or placed incorrectly, can pollute soils, water bodies, the atmosphere and negatively affect human health and flora/fauna. Hazardous waste increases the toxic load on ecosystems, and the accumulation of solid household and construction waste without recycling leads to land degradation.	Storage and disposal of hazardous waste (oils, filters, oil sludge, etc.) without proper control contributes to soil and groundwater contamination, which threatens ecosystems and potentially the health of workers and nearby residents. Even with waste transferred to licensed recycling, accounting errors or delays in disposal can lead to waste accumulation on sites and secondary contamination. Widespread failures in waste management practices at gas facilities are a growing concern.
Governance	Anti-corruption	Fight against corruption	Financial risk	Corruption offences – bribery, collusion, misappropriation of funds and abuse of power – can result in direct financial losses, contract termination, fines, bans on tenders and serious reputational damage, particularly in the public sector.	As a national company, QazaqGaz is subject to high scrutiny from the state, society and international partners, especially in the run-up to the IPO. Any cases of corruption can not only lead to criminal prosecution and millions of tenge in losses, but also threaten the license to operate and access to sustainable financing. Maintaining an anti-corruption policy, internal audit and anonymous notification channels is critical to reducing these risks and strengthening corporate ethics.
Governance	Economic efficiency	Payment practices	Financial risk	Failure to pay suppliers on time may result in deterioration of relations with counterparties, disruptions in supply chains, contractual penalties, and a decrease in trust from small and medium-sized partners.	QazaqGaz is a systemically important company, whose timely payment discipline directly affects the sustainability of supply chains and the financial stability of contractors, especially in the regions. Violations of payment schedules can destabilize contractors, lead to an increase in compensation costs and a deterioration in the company's reputation profile.

Governance	Quality control / product safety	Supply chain traceability	Impact (Positive)	A high degree of supply chain traceability increases transparency, reduces operational and reputational risks, and ensures compliance with quality, environmental and ethical standards at all stages of supply. This builds trust with investors, customers and regulators, and promotes sustainable and responsible business practices.	For QazaqGaz , development of supply chain management systems (including through the Samruk Procurement platform) improves quality control, reduces dependence on unstable suppliers and supports the group's strategic sustainability.
Social	Anti-discrimination and equal opportunities	Diversity and Inclusion	Financial opportunities	Diverse and inclusive teams improve the quality of management decisions, stimulate innovation, help attract a wide range of talent, and strengthen a company's reputation in the marketplace as a socially responsible employer.	By creating an inclusive corporate culture and equal opportunities policy, QazaqGaz can expand its talent pool to include women, youth and workers with special needs. This reduces recruitment and training costs, especially in technical and remote departments.
Social	Occupational health and safety	Health and Safety	Financial risk	Insufficient attention to occupational health and safety can lead to accidents, production shutdowns, fines from regulatory authorities, lawsuits, and increased costs for compensation and medical care.	Failure to comply with HSE (Health, Safety & Environment) standards, especially in remote and manufacturing branches, can lead to accidents, incidents, fines from regulatory authorities, and increased compensation and downtime costs. For example, without a dedicated HSE department and regular inspections, the risk of a repeat incident increases, which can have serious operational consequences.
Social	Development of human capital	Training and development	Financial opportunities	Investments in employee training improve their skills, productivity and management potential, which in the long term reduces the costs of hiring external specialists, contributes to the internal talent pool and supports the sustainability of business processes.	QazaqGaz systematically develops personnel competencies through the ESG Academy, digital learning platforms and industry internships, including in scientific and international centers. In 2024, the company introduced individual development trajectories for engineering and management personnel, which helps prepare a sustainable talent pool for long-term infrastructure projects. This strengthens the corporate culture, reduces dependence on the external labor market and increases innovative potential.

Social	Employment practice	Social integration	Impact	Involving socially vulnerable groups — youth, veterans, people with disabilities — in work activities contributes to the formation of an inclusive and fair society. This strengthens social sustainability and the company's corporate reputation as a responsible employer.	Through cooperation with trade unions and collective agreements, QazaqGaz supports the involvement of different groups of employees and guarantees them equal working conditions, payments and social benefits. This helps to strengthen a cohesive team and maintains social balance in the company environment.
Social	Local communities	Dialogue and community engagement	Financial risk	Insufficient dialogue with local communities can lead to social tensions, protests, blocking of infrastructure projects, construction delays, additional compensation and reputational losses. Such situations can seriously affect the timing of projects and increase unexpected costs.	If the company does not actively involve local communities in the implementation of gasification and infrastructure projects (construction of main gas pipelines and gas processing plants), delays, protests or compensation costs are possible - all this leads to disruption of schedules and significant additional costs. For example, the construction of the Sarsha gas pipeline required investments of 31 billion tenge in 2024 and was accompanied by public discussions confirming the need for consultations.
Social	Interaction with stakeholders	Public consultations and participation in legislative initiatives	Financial opportunities	The company's active participation in public consultations and specialized legislative initiatives allows it to influence the formation of the regulatory environment, achieve consideration of industry interests and reduce the regulatory burden, which can reduce future costs, increase investment predictability and simplify access to sustainable financing.	Participation in formal initiatives through its Rules for Proactive Information and engagement in specialized meetings and forums allows the company to influence legislation, adapting regulations to the realities of the gas industry and reducing future regulatory costs

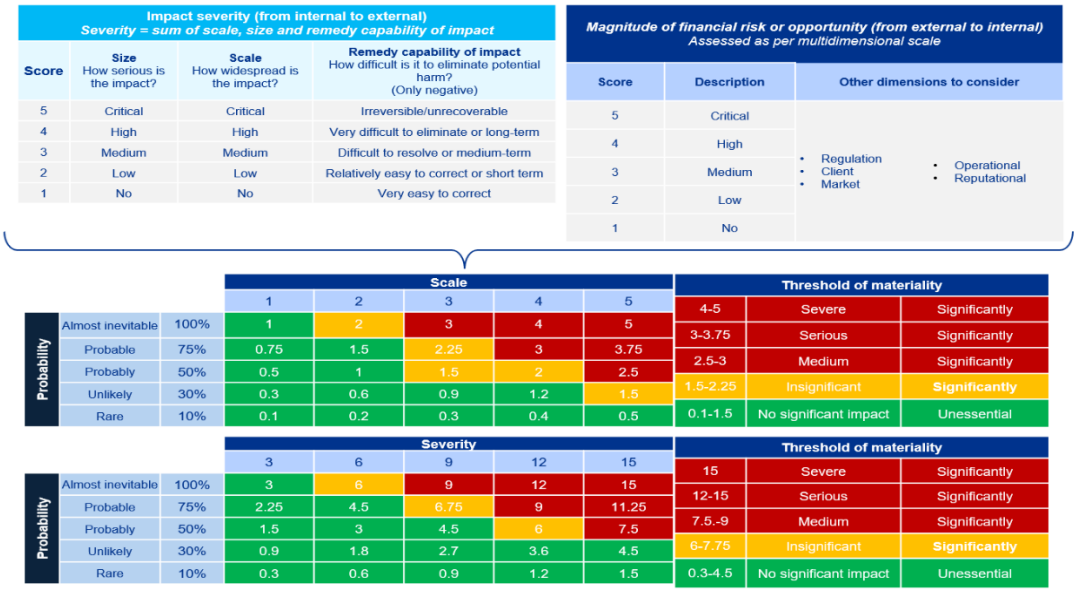
4. Assessment of double materiality of topics

Each topic and its associated set of IROs were evaluated along two axes:

- Impact on the external environment (impact materiality) — scale, scope, irreversibility;
- Financial significance (financial materiality) — probability and level of impact on financial metrics.

The assessment was based on an expert survey, industry data, and the ESRS methodology. As a result, a double materiality matrix was constructed, which included 17 topics with the highest integral values on both axes.

Figure 12. Double materiality assessment matrix



Impact severity (from internal to external)
Severity = sum of scale, size and remedy capability of impact

Score	Size How serious is the impact?	Scale How widespread is the impact?	Remedy capability of impact How difficult is it to eliminate potential harm? (Only negative)
5	Critical	Critical	Irreversible/unrecoverable
4	High	High	Very difficult to eliminate or long-term
3	Medium	Medium	Difficult to resolve or medium-term
2	Low	Low	Relatively easy to correct or short term
1	No	No	Very easy to correct

Magnitude of financial risk or opportunity (from external to internal)
Assessed as per multidimensional scale

Score	Description	Other dimensions to consider
5	Critical	• Regulation • Client • Market • Operational • Reputational
4	High	
3	Medium	
2	Low	
1	No	

Probability			Scale 1	2	3	4	5	Threshold of materiality		
	Almost inevitable	100%	1	2	3	4	5	4-5	Severe	Significantly
	Probable	75%	0.75	1.5	2.25	3	3.75	3-3.75	Serious	Significantly
	Probably	50%	0.5	1	1.5	2	2.5	2.5-3	Medium	Significantly
	Unlikely	30%	0.3	0.6	0.9	1.2	1.5	1.5-2.25	Insignificant	Significantly
	Rare	10%	0.1	0.2	0.3	0.4	0.5	0.1-1.5	No significant impact	Unessential

Probability			Severity 3	6	9	12	15	Threshold of materiality		
	Almost inevitable	100%	3	6	9	12	15	15	Severe	Significantly
	Probable	75%	2.25	4.5	6.75	9	11.25	12-15	Serious	Significantly
	Probably	50%	1.5	3	4.5	6	7.5	7.5.-9	Medium	Significantly
	Unlikely	30%	0.9	1.8	2.7	3.6	4.5	6-7.75	Insignificant	Significantly
	Rare	10%	0.3	0.6	0.9	1.2	1.5	0.3-4.5	No significant impact	Unessential

5. Stakeholder engagement

The DMA was accompanied by active involvement of internal and external stakeholders:

- An anonymous expert survey was conducted among more than 20 representatives of various departments (environment, finance, HR, strategy, procurement, etc.).
- “Influence-interest” matrix was used for categorization of stakeholders.

Figure 13. Categorization of internal and external stakeholders of the Company

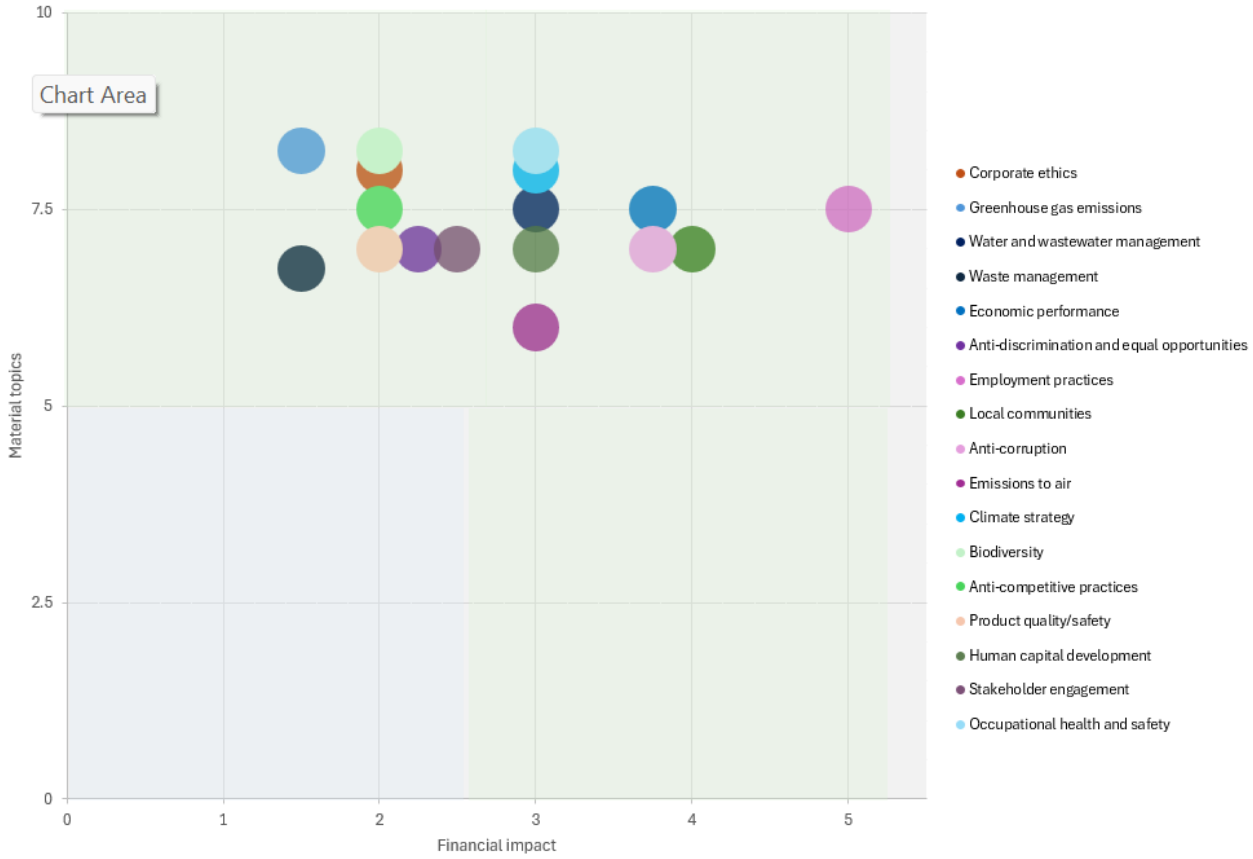
6. Analysis of climate issues

QazaqGaz is already actively managing climate risks and opportunities by developing relevant policies and programs. The company identifies various categories of climate risks. Climate issues are recognized as the most critical:

- 12 significant IROs related to climate and GHG emissions have been identified;
- Physical risks (heat, water scarcity), transition risks (carbon regulation, investor expectations), and opportunities (energy efficiency, CCS, decarbonization of logistics) are covered;
- The reputational and financial consequences of lack of progress in the area of GHG have been analyzed separately.

Conducting a double materiality assessment will enable QazaqGaz to integrate these two aspects more systematically, ensuring that climate risk management strategies and actions take into account both direct financial implications and broader social and environmental impacts that may also lead to financial implications in the long term. This reinforces the Climate Risk Management Program, which has already been approved and implemented by the Company, and complies with international standards such as IFRS S2 (TCFD). At the same time, with the entry into force of ISSB standards – primarily IFRS S1 and S2 – the approach to disclosure has undergone significant changes. The new standards focus on financial materiality – the ability of climate and other ESG factors to have a significant impact on the financial position, performance, and sustainability of the business.

Figure 14. Double materiality matrix for the QazaqGaz JSC group of companies



Recognizing the need to transition to a new disclosure model, the Company decided not to abandon the results of its long-standing impact materiality practice, but to combine the two approaches into a single analytical process by conducting a double materiality assessment (DMA). This allowed for continuity in impact assessment, while also reflecting potential financial risks and opportunities.

6.2.2 Defining the role of the highest governance body for climate change

The Board of Directors of JSC NC QazaqGaz is the supreme governing body responsible for managing climate issues and controlling the functioning of the climate risk management system. The responsibilities of the Board of Directors include control over setting corporate goals, reviewing and guiding the risk management process, including risks related to climate change. On an annual basis, meetings of the Board of Directors, as well as committees under the Board of Directors are scheduled to consider topical issues of strategic nature, including issues related to climate change. The Board of Directors of JSC NC QazaqGaz approves policies and strategies covering climate change issues - Environmental Policy, Policy on Sustainable Development, Development Strategy of JSC NC QazaqGaz for 2023-2032, a comprehensive plan to improve the ESG system of JSC NC QazaqGaz for 2022-2025.

The Strategy and Sustainable Development Committee functions under the Board of Directors, which is an advisory and consultative body of the Board of Directors on strategic planning. The Committee monitors the implementation of the Strategy of JSC NC QazaqGaz within the framework of revision of short-term and long-term key performance indicators (KPIs) on sustainable development and climate change. In addition, internal documents, annual non-financial reporting and other issues in the field of sustainable development and climate change are reviewed by the

Committee before the stage of their approval at the meetings of the Board of Directors of JSC NC QazaqGaz.

At the managerial level, the Management Board of JSC NC QazaqGaz controls and monitors activities on the implementation of measures, programs, monitors the implementation of strategic objectives and implementation of KPIs on issues related to climate change. The responsibilities of the Chairman of the Management Board of the Company include management of organization and coordination of work on environmental protection, including climate change in the structural units of the Company, as well as internal control over compliance of employees with the requirements of regulatory documents on occupational health and safety and the environment. In case of his absence, the responsibility is assigned to the First Deputy Chairman of the Management Board of JSC NC QazaqGaz.

Execution, organization and participation in monitoring, coordination and control of operational activities in the field of occupational health and safety and environment, including climate change issues is carried out by the main structural unit of JSC NC QazaqGaz, HSE (Health, Safety & Environment) service. The HSE service also coordinates the work of the Committee on Industrial Safety, Occupational Safety, and Environmental Protection, which includes the heads of the Company's subsidiaries and affiliates. The Committee oversees issues related to climate change.

6.2.3 Sustainable development and climate change governance structure

Sustainable development management of JSC NC QazaqGaz is based on a systematic approach. The key documents regulating the Company's activities in the field of sustainable development and climate change are:

- JSC NC QazaqGaz Climate Change Policy;
- Ecology Policy;
- Climate change policy of QazaqGaz JSC;
- Sustainable development policy;
- Development strategy of QazaqGaz for 2023-2032;
- Development Strategy of JSC NC QazaqGaz for 2023-2032;
- Comprehensive plan on improvement of ESG system of NC QazaqGaz JSC for 2022-2025;
- Low-carbon development program of QazaqGaz JSC for period 2025-2033.

In accordance with the Code of Corporate Governance of JSC "National Welfare Fund "Samruk-Kazyna", the Board of Directors of JSC NC QazaqGaz within its competence ensures the formation of an appropriate system in the field of sustainable development and its implementation at all levels. On an annual basis, the Company issues report to disclose achievements in the field of sustainable development on environmental, including climate change, social and economic indicators. In accordance with the Development Strategy of JSC NC QazaqGaz for 2023-2032, the Company declares its commitment to strategic goals and objectives within the framework of improving sustainable development practices in the gas transportation industry to ensure clarity and transparency of its activities for stakeholders.

Committees under the Board of Directors play an important role:

- Audit Committee;
- Strategy and Sustainable Development Committee;

- Nomination and Remuneration Committee.

A special role is played by the Strategy and Sustainable Development Committee of JSC NC QazaqGaz, the purpose of which is to assist the Board of Directors in determining strategic objectives, priority development areas and setting the main guidelines for the Company's activities, including areas of sustainable development and climate change. for the medium and long term.

The Management Board of JSC NC QazaqGaz provides management control and monitoring of the implementation of programs and activities to increase the level of maturity of the sustainable development system, including the climate agenda in the Company. For deeper elaboration of these issues at the level of the Management Board a project office on ESG was formed for the purpose of implementation, control and execution of measures of JSC NC QazaqGaz on implementation of the Company's strategy in the field of sustainable development, including the development of the Low Carbon Development Program. The Chairman of the Project Office is the Deputy Chairman of the Management Board for Strategy and Investments. The Project Office includes employees of JSC NC QazaqGaz and subsidiaries and affiliates.

The Strategy and Sustainable Development Department of JSC NC QazaqGaz is responsible for coordination of sustainable development management issues at the operational level. This body regularly analyzes internal regulations, practices and internal control system, and promotes the implementation of practices and compliance with the principles of sustainable development of the Company. Based on the document "Rules for Formation of Integrated Annual Report of JSC NC QazaqGaz annually, the Strategy and Sustainable Development Department is responsible for the preparation of non-financial reporting in accordance with the international standards of non-financial information disclosure GRI Standards and International Integrated Reporting Framework (IIRC).

The heads of structural subdivisions of JSC NC QazaqGaz - HSE Service and Production and Technical Department are responsible for certain aspects of implementation of programs and activities in the field of climate change. The responsibilities of these divisions include development of proposals on the plan of implementation of strategic objectives in the field of climate change, ensuring the availability of financial and other resources, and identification of climate risks.

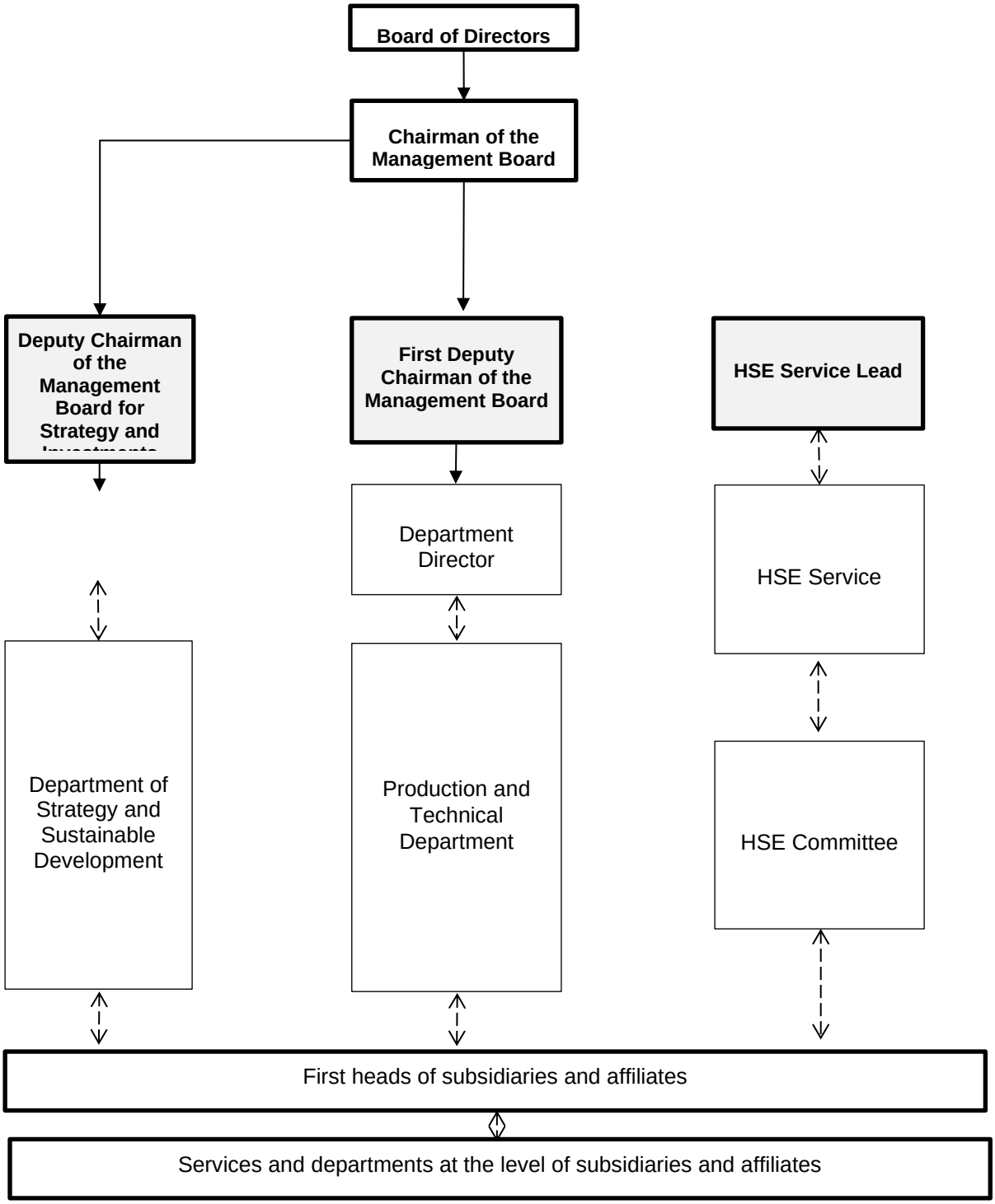
The HSE Service oversees general HSE issues. As part of its work in the area of climate change, this structural unit is responsible for carbon reporting in the Company, including:

- Calculation of GHG emissions;
- Conducting verification of GHG emissions;
- Disclosure of carbon information as part of the global CDP initiative.

The Production and Technical Department of JSC NC QazaqGaz is responsible for issues in the field of energy management. In order to adapt to climate change, the department is authorized to carry out works in the field of energy saving and energy efficiency. Plans of activities in this direction are carried out annually.

In turn, each of the Company’s subsidiaries and affiliates is also represented by the HSE Service and Production and Technical Department, which report directly to the head office of JSC NC QazaqGaz. Within the framework of their job descriptions, each structural subdivision plays a significant role in coordinating the management of sustainable development and climate change practices, as well as in implementing the Company's contribution to the UN Sustainable Development Goals and the global climate agenda.

Figure 15. Organizational structure of sustainable development and climate change management



Source: JSC NC QazaqGaz. JSC NC QazaqGaz - Sustainable development; QazaqGaz 2022 Integrated Annual Report

6.2.4 Integration of issues related to climate change into the general risk management system of JSC NC QazaqGaz

JSC NC QazaqGaz has a corporate risk management system (CRMS), the purpose of which is the prompt identification, assessment and monitoring of significant risks with the subsequent adoption of measures to mitigate them. The Board of Directors of JSC NC QazaqGaz is responsible for ensuring the effective functioning of the CRMS, including compliance with risk management and internal control policies and procedures, which are constantly being improved in accordance with changing internal and external conditions. The Company is currently exposed to the following significant risk factors:

- Changes in taxation;
- Changes in asset structure;
- Impact of exchange rate fluctuations;
- Geopolitical changes;
- Changes in corporate governance structure;
- Increase in the number of accidents at facilities;
- Increase in the number of intermediary schemes.

According to the QazaqGaz CRMS Regulations, risk assessment is conducted on an annual basis. The Board of Directors is responsible for implementing an effective risk management system within the Company.

Under the QazaqGaz, climate change issues are integrated into the process of describing, identifying, and assessing operational risks at QazaqGaz JSC.

Table 3. Types of risks that take into account climate issues in JSC NC QazaqGaz

Risks	Relevance and inclusiveness	Description
Regulatory	Relevant, always included in the system	The Company constantly analyzes changes in legislation and takes measures to mitigate possible negative consequences of changes. A relevant regulatory risk for the Company is the imposition of fines for incorrect reporting of data on greenhouse gas emissions.
Developing regulatory	Relevant, always included in the system	The Company systematically assesses and responds to changes in legislation in order to minimize possible negative consequences. Climate initiatives, both internationally and locally, may impose restrictions on the company's operations and require additional operating costs.
Technological	Relevant, always included in the system	The company invests annually in equipment upgrades to reduce energy consumption and is considering expanding R&D in green projects and renewable energy.
Market	Relevant, always included in the system	Market risks are associated with the global trend towards low carbon fuels and therefore the Company considers factors such as the increasing cost of electricity and associated operating costs.
Acute physical	Relevant, always included in the system	Temperature changes entail an increase in unfavorable climatic events in Kazakhstan. Most of Kazakhstan is experiencing an increase in the frequency of climatic anomalies, such as higher air temperatures and intense precipitation, as well as extreme weather events. Climate change also impacts water resources, food security and other aspects. The Company continuously monitors and mitigates the impact of such weather events on its operations.
Permanent physical	Relevant, always included in the system	Temperature changes entail an increase in unfavorable climatic events in Kazakhstan. Most of Kazakhstan is experiencing an increase in the frequency of climatic anomalies, such as higher air temperatures and intense

		precipitation, as well as extreme weather events. Climate change also impacts water resources, food security and other aspects. The Company continuously monitors and mitigates the impact of such weather events on its operations.

The process of climate risk management is in line with the current Risk Assessment Program of JSC NC QazaqGaz. Tracking and management of climate risks is supposed to be carried out by the Department of Internal Control and Risk Management. In order to effectively respond to a variety of climate risks, it is necessary to delegate responsibility for their identification to various departments.

Physical climate risks identified at the level of individual subsidiaries, taking into account the specifics of production processes, should fall under the responsibility of the production and technical department of each subsidiary and affiliates. In turn, risks related to energy supply should be controlled by the energy departments of the respective subsidiaries and affiliates.

As for the transitional climate risks, their identification is carried out at the level of the whole Company, without division into separate subsidiaries, as they are related to global changes, such as tightening of carbon regulation, changes in taxation, etc. Since identification of transition risks requires understanding of the climate agenda, the JSC NC QazaqGaz HSE service is responsible for this, but for successful identification requires close interaction with representatives of other departments (see section 3.3.2.2.)

The effectiveness of the CRMS of JSC NC QazaqGaz is annually confirmed by independent assessments conducted by internal and external auditors or independent experts, as well as recognized by shareholders, members of the Board of Directors of the Company, rating agencies, investors, creditors and other stakeholders.

In 2023 in JSC NC QazaqGaz was analytical work on assessment of climate risks. As part of the work carried out, the processes of management and identification of climate risks are at the stage of integration into the CRMS. Based on the assessment of climatic risks, the horizons of risk management planning periods in subsidiaries and affiliates of JSC NC QazaqGaz were allocated:

1) Near term - short term horizon (through 2040);

2) Medium term - medium term horizon (2041-2060);

3) Long term - long term horizon (2081-2100).

According to the results of the assessment of climatic risks it was possible to identify categories of climatic risks in accordance with the international classification TCFD and IFRS S2. Within the framework of the assessment of business directions of activity of JSC NC QazaqGaz the most significant climatic risks were identified. A detailed description of the process of identification and assessment of climate risks is presented in section “3.3. Management of risks and opportunities associated with climate change”.

6.3 Main directions of the climate agenda for JSC NC QazaqGaz

6.3.1 Reduction of greenhouse gas emissions (Scope 1, 2). Reduction of energy consumption and energy efficiency

6.3.1.1 Analysis of current greenhouse gas emissions Scope 1, 2.

The Environmental Code of the Republic of Kazakhstan provides for mandatory monitoring, reporting and verification of greenhouse gas emissions. The National Carbon Allocation Plan sets limits on carbon dioxide emissions of quota subjects, with a threshold of 20 thousand tons of CO2-eq. per year.

In accordance with Article 289 of the Environmental Code of the Republic of Kazakhstan, installations of certain subsidiaries and affiliates of JSC NC QazaqGaz are subjects of carbon quotas, data on their emissions are recorded in the state carbon cadastre for further disclosure in the annual reporting of the Republic, which is part of the country's obligations under international agreements. As part of the program on climate risk management and decarbonization, the analysis of calculation of greenhouse gas emissions of JSC NC QazaqGaz was carried out for the main areas of the Company's activities (mainline transportation, exploration, production and gas distribution), which are represented by the following subsidiaries and affiliates: Intergas Central Asia JSC, Asian Gas Pipeline LLP, Beineu-Shymkent Gas Pipeline LLP, «QazaqQaz Aimaq» JSC, QazaqGaz Exploration and Production LLP.

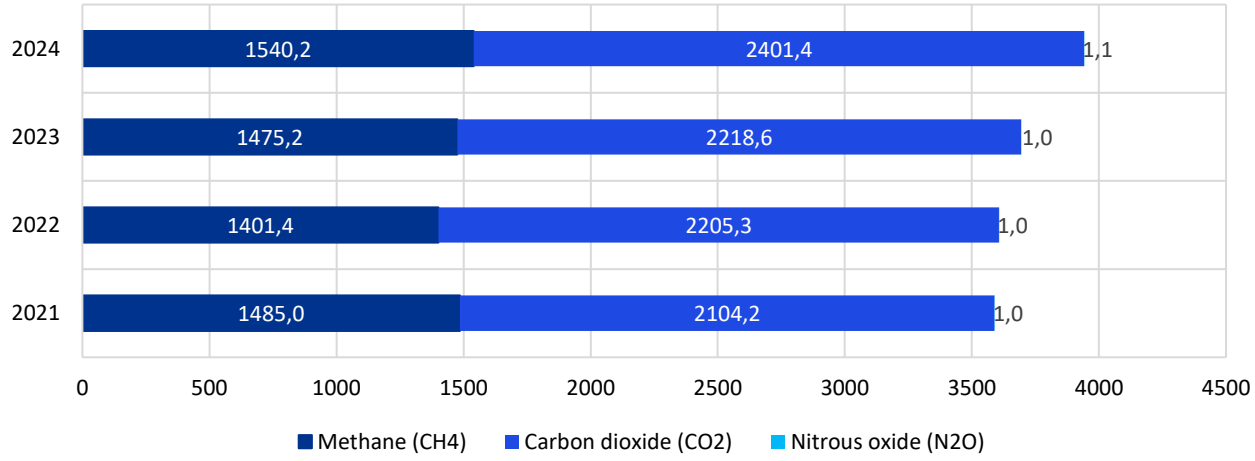
Information on greenhouse gas emissions of the Company is registered in the state carbon cadastre of the Republic of Kazakhstan. Emissions of the Company's operations are monitored using approved methodologies, in particular, the balance method. In accordance with the Environmental Code of the Republic of Kazakhstan, the Company annually develops and approves greenhouse gas inventory report (Scope 1), as well as conducts calculations of indirect energy emissions (Scope 2).

1) Greenhouse gas emissions by type of emission

JSC NC QazaqGaz carries out operational activities on gas production and transportation, which which inevitably results in greenhouse gas emissions. Due to the specifics of the Company's activities, the largest share of direct greenhouse gas emissions is methane.

Between 2021 and 2024, the QazaqGaz group of companies' total greenhouse gas emissions (Scope 1 and Scope 2) showed a steady upward trend, reflecting an increase in gas transportation volumes, growth in technological losses, and infrastructure expansion. At the end of 2024, gross emissions amounted to 3 994 421 t CO_2-eq, of which Scope 1 accounted for 3 942 768 t CO_2-eq. (98.7%), and Scope 2 accounted for 51 653 tons of CO_2 eq. (1.3%). Figure 11 shows the volume of direct greenhouse gas emissions for 2021–2024 for QazaqGaz.

Figure 16. Total direct greenhouse gas emissions by type of greenhouse gas for 2020-2022, thousand tons CO2-eq



Below are the S&As that contribute significantly to direct greenhouse gas emissions:

Methane (CH4): Direct methane emissions from QazaqGaz for 2024 amount to 1 540 232.67 t CO_2-eq. The largest share of methane emissions, 32.2%, comes from ICA subsidiary, which accounts for 496 677.04 tons of CO_2 equivalent.

Carbon dioxide (CO_2): Direct carbon dioxide emissions from QazaqGaz JSC for 2024 amount to 2 401 419.53 tons of CO_2 equivalent. The largest share of CO_2 emissions, 46.9%, comes from AGP, which amounts to 1 125 689.35 tons of CO_2 equivalent.

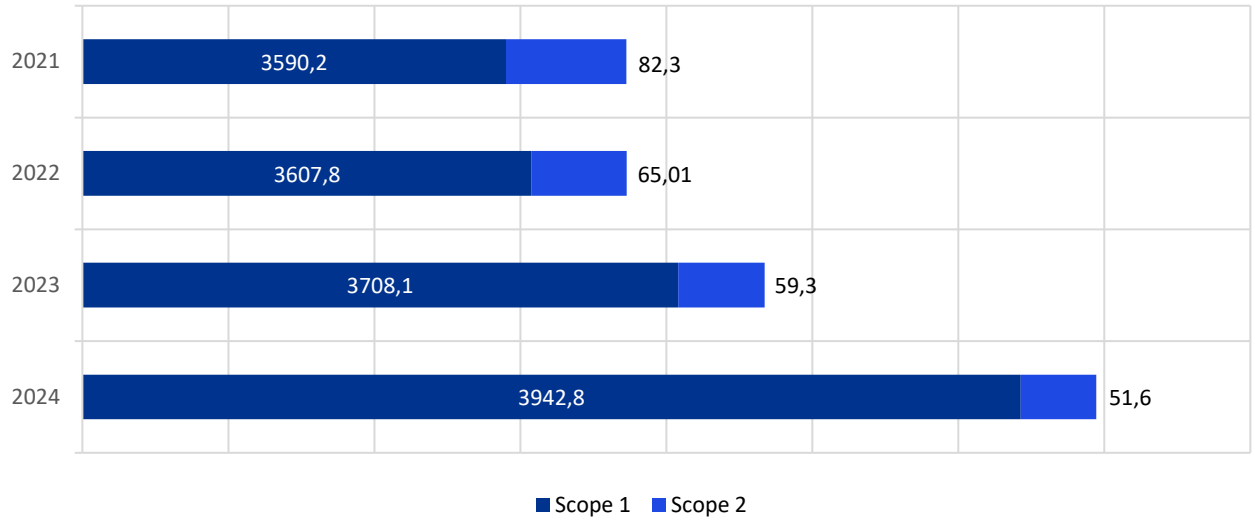
Nitrous oxide (N_2O): Direct nitrous oxide emissions from QazaqGaz for 2024 amount to 1 121.55 t CO_2 eq. The largest share of nitrous oxide emissions - 47.7% - comes from AGP, which amounts to 535.48 tons of CO_2 equivalent.

In 2024, the total direct greenhouse gas emissions of QazaqGaz JSC amounted to 3 942 773.75 tonnes of CO_2 equivalent, including emissions of methane (CH4), carbon dioxide (CO2), and nitrous oxide (N2O). From 2021 to 2024, there is a trend towards an increase in total direct GHG emissions, primarily due to an increase in carbon dioxide volumes. At the same time, the structure of emissions has shifted towards a predominance of CO_2, which is associated with an increase in stationary fuel combustion volumes. At the same time, QazaqGaz continues to implement measures to reduce methane emissions, including systematic monitoring and diagnosis of leaks using remote methods (laser detection from the air, motor vehicles, and on-foot inspections).

2) Greenhouse gas emissions by coverage

In the course of operating activities of JSC NC QazaqGaz, the total volume of direct and indirect greenhouse gas emissions in 2024 amounted to 5 199.1 thousand tons of CO2-eq, which is 30% less compared to 2023. This is due to a change in the approach to calculating methane emissions following changes in emission factors in the national methodological guidelines for calculating greenhouse gas emissions. When converting the values of methane and nitrous oxide to t CO2-eq, the current values of global emission factors (methane - 25, nitrous oxide - 298), adopted in accordance with Annex III to Conference of the Parties Decision 24/CP.19 of November 10, 2013, sent to the Company by the Ministry of Ecology and Natural Resources by official letter, were used.

Figure 17. Volume of greenhouse gas emissions for 2021-2024, thousand tons CO2-eq.



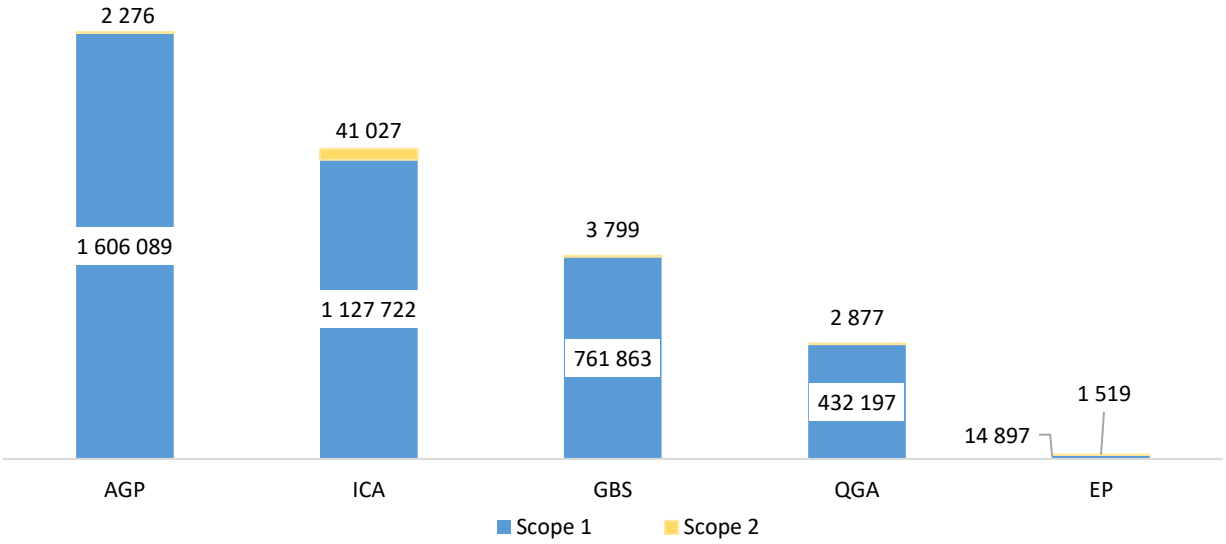
In 2024, the volume of direct greenhouse gas emissions (Scope 1) of QazaqGaz JSC amounted to 3,942.8 thousand tonnes of CO_2 equivalent, which is 6.3% higher than in 2023 (3 708.1 thousand tonnes). Indirect emissions (Scope 2) in 2024 amounted to 51.6 thousand tons of CO_2 equivalent, which is 13% lower than in the previous year (59.3 thousand tons).

The high proportion of direct greenhouse gas emissions (Scope 1), accounting for 98.8% of the Company's total emissions, is due to limited consumption of purchased electricity. The energy needs of JSC NC QazaqGaz are mainly covered by its own natural gas used in technological processes. A significant amount of Scope 1 emissions is due to the presence of a large number of stationary emission sources, including boiler units, compressor stations, gas turbine units, as well as fugitive emissions of natural gas.

3) Greenhouse gas emissions by subsidiaries and affiliates

In 2024, the main contributor to the total direct greenhouse gas emissions of the QazaqGaz Group was Asian Gas Pipeline LLP, which accounted for 40.7% of the total Scope 1 emissions. The high emission levels are explained by the long length of two key pipelines – the Western and Southern pipeline networks, which operate 28 compressor stations and 305 gas pumping units, as well as numerous gas turbine units. A significant share of emissions comes from leaks, purges, gas venting, and fuel combustion at compressor stations.

Figure 18. Volume of greenhouse gas emissions for 2024, thousand tons CO2-eq.



Intergas Central Asia JSC ranks second in terms of emissions volume, accounting for 28.6%, where significant emissions are also recorded at 13 compressor stations and 6 gas distribution stations along the Kazakhstan-China main gas pipeline. In 2024, compared to previous years, there was a moderate decrease in emissions due to a reduction in gas transportation and fuel consumption.

The Beyneu-Shymkent Gas Pipeline LLP accounted for 19.3% of total Scope 1 emissions. The increase in emissions compared to 2021 was 84.3%, which is associated with the transfer of the Karaozek compressor station from ICA, as well as a significant increase in the volume of natural gas transportation via the Beineu-Bozoy-Shymkent pipeline.

QazaqGaz Aimaq JSC contributed 11.0% to the total volume of direct emissions. Emissions in 2024 increased by 20.2% compared to 2021 due to increased technological gas losses in distribution networks, including fugitive emissions, which indicates the need to optimize operating modes and improve network tightness.

The overall analysis showed that the bulk of emissions fall under Scope 1, which is due to the use of own gas as fuel for production needs. The increase in emissions in 2024 for individual subsidiaries is associated with an increase in gas transportation volumes, asset transfers, and the operation of new compressor stations.

4) Specific indicators of greenhouse gas emissions

In the pursuit of environmental sustainability and responsible resource management, measuring specific greenhouse gas emissions is becoming a great tool for assessing and comparing the impacts of different production and energy processes. Specific indicators provide an opportunity to rethink the contribution of each source to total emissions, leading to more effective and strategic climate risk management.

Table 4. Carbon intensity indicators for gas distribution (for QGA) and transportation (for ICA, AGP, and BSG) for 2021–2024, tCO2-eq/billion m3*km (direct emissions)

Affiliate	2021	2022	2023	2024
QazaqGaz Aimaq	2,49	2,51	2,49	2,49
Asian Gas Pipeline	28,44	28,40	28,07	29,67
Intergas Central Asia	0,78	0,88	0,92	0,84
Beineu-Shymkent Gaspipeline	22,08	28,01	31,63	32,57

Table 5. Carbon intensity indicators for 2021–2024, tCO2-eq/TJ (direct emissions)

Affiliate	2021	2022	2023	2024
QazaqGaz Exploration and Production	0,507	0,508	0,441	0,484
QazaqGaz Aimaq	3,101	3,266	3,307	3,834
Asian Gaspipeline	0,069	0,069	0,073	0,069
Intergas Central Asia	0,055	0,088	0,080	0,084
Beineu-Shymkent Gaspipeline	0,068	0,064	0,065	0,065
Total	*0,071*	*0,082*	*0,082*	*0,082*

The assessment of the carbon intensity of the QazaqGaz group of companies' production processes for the period 2021-2024 (calculated in tCO_2 eq/TJ) shows varying dynamics across business areas and subsidiaries. In the gas distribution segment, QGA recorded a 23.6% increase in carbon intensity compared to 2021. In the AGP, which transports gas, the carbon intensity indicator remained at the 2021 level. At the same time, the ICA saw a significant increase in carbon intensity - by 54% - while in the BSG, this indicator decreased by 4.3%. In terms of gas production, Exploration and Production has seen a 4.5% reduction in carbon intensity. This trend is linked to changes in production volumes and a decline in the energy efficiency of technological equipment at certain sites.

Overall, for the QazaqGaz group of companies, carbon intensity of production processes increased by 15.4% during the period in question. This indicator is significantly influenced by the operating modes of the main production equipment, its utilization rate, and the volume of technological losses, including leaks and gas venting during operation.

5) Sources of greenhouse gas emissions

The main sources of greenhouse gas emissions of JSC NC QazaqGaz are operational activities (including fugitive emissions) and stationary combustion (including flaring). Examples of operational activity processes are the processes of operation of blower, turbo expander, separator, etc. Stationary combustion plants are gas turbines, furnaces, boilers and flares.

Table 6. Volume of direct greenhouse gas emissions by sources in the context of subsidiaries and affiliates, t CO2-eq.

Source of GHG emissions	ICA	QGA	EP	AGP	BSGP
Stationary combustion	630 987,19	5 874,96	1 333,34	1 126 790,59	637 724,71
Fugitive emissions	496 734,75	426 327,80	13 516,61	479 298,26	124 138,17
Solid waste disposal			47,37		

In 2024, direct greenhouse gas emissions from QazaqGaz subsidiaries were distributed among the main sources as follows. The largest volume of emissions from stationary combustion was recorded in AGP - 1 126 790.59 t CO_2-eq. followed by ICA – I 630 987.19 t CO_2 eq. and BSGP – 637 724.71 t CO_2 eq. Significantly lower values were recorded for QGA – 5 874.96 tons of CO_2 equivalent, and EP – 1 333.34 tons of CO_2 equivalent.

In terms of fugitive emissions, ICA and AGP are similarly in the lead, while BSGP, QGA, and EP showed significantly lower volumes – 124 138.17 tons, 426 327.80 tons, and 13 516.61 tons of CO_2 equivalent, respectively. Emissions from solid waste disposal were recorded in insignificant amounts only in EP; in other subsidiaries, this source is not observed or its contribution to total emissions is insignificant.

6.3.2 Identify decarbonization directions and areas for optimization and efficient energy consumption

According to the inventory for the base year 2021, more than 98.7% of the company's gross greenhouse gas emissions are direct emissions (Scope 1), the main sources of which are methane leaks and gas combustion at processing facilities. Therefore, the Low Carbon Development Program focused on the implementation of technical solutions aimed at reducing the carbon intensity of key processes in the gas transportation system, including the activities of subsidiaries and affiliates: Intergas Central Asia JSC, Beineu-Shymkent Gas Pipeline LLP, Asian Gas Pipeline LLP, and QazaqGaz Aimaq JSC.

Based on the emissions analysis, the following priority areas for decarbonization were identified (2021 was taken as the base year for calculations):

- Reduction of Scope 1 greenhouse gas emissions through improved energy efficiency, optimization of key production equipment operating modes, prompt repairs and maintenance, and other technical measures.
- Reduction of indirect greenhouse gas emissions under Scope 2 by increasing the share of electricity consumed from renewable sources, implementing energy-saving measures, and purchasing international I-REC certificates.

To achieve the targets for reducing greenhouse gas emissions for the period up to 2033, a separate Low Carbon Development Program was developed, providing for a systematic approach to decarbonization. Emissions reduction targets are differentiated among key subsidiaries, taking into account the scale of their operations and emissions structure. Progress monitoring and evaluation of

the effectiveness of the measures implemented will be carried out based on a system of key performance indicators (KPIs) under the Low-Carbon Development Program.

To assess and plan GHG emissions reductions, the company uses three decarbonization scenarios: “Business as usual,” “Green development,” and “Deep decarbonization.” This allows it to take into account technological and financial constraints and develop realistic trajectories for achieving climate goals.

6.3.2.1 GHG emission reduction targets Scope 1, 2 and key instruments for their achievement

To achieve these goals, measures will be implemented in three main areas:

- Technical measures - aimed at improving operational efficiency, modernizing equipment, introducing alternative technological solutions, and automating and digitizing production processes.
- Organizational measures - include improving management, planning, and emission control systems, training personnel, implementing monitoring solutions, and developing ESG management in subsidiaries.
- Offsetting measures - include the use of carbon offsets, the acquisition of international I-REC certificates, and the financing of external climate initiatives.

The production and technical department, the procurement department, and the health, safety, and environment (HSE) department have been assigned responsibility for implementing the measures.

The following assumptions were taken into account when developing the target indicators:

- Gas production segment is excluded from the calculations due to its insignificant contribution to total emissions (0.4%).
- Calculations only take into account trunk gas transportation, excluding distribution networks.
- Effect of measures covering several segments is distributed proportionally to the volume of emissions as of 2021.
- To calculate emissions from the consumption of imported electricity, a coefficient based on the location-based method is used, taking into account the average emissions from the production of electricity from various types of fossil fuels and the current generation structure in the Republic of Kazakhstan (as of mid-2023).
- Fugitive emissions of methane account for 39% of direct greenhouse gas emissions; calculations use a global warming potential (GWP) of 28 for methane.

The measures cover the period from 2025 to 2033 and are grouped according to their implementation timeframes:

- Short term (2026-2027) - implementation of technical and organizational measures already included in the budgets of subsidiaries and affiliated companies.
- Medium term (2027-2029) - assessment of the achieved effect of the implemented measures, adjustment of technical measures based on the results of energy audits, planning of budgets for the period after 2030.

- Long-term period (2030-2033) - introduction of new technological solutions, launch of climate instruments (e.g., offset projects), and assessment of the results of the measures implemented.

Table 7. Distribution of Scope 1 targets for QazaqGaz subsidiaries under the “Deep Decarbonization” scenario

Indicators	Basic year (2021)	Long-term goal: 10% reduction in GHG emissions (2033)
Reduction in Scope 1 GHG emissions for QazaqGaz, tCO2-eq/GJ	0,071	0,0635
Distribution of Scope 1 targets by subsidiaries and affiliated companies, tCO2-eq/GJ		
Intergas Central Asia	0,055	0,073
Beineu-Shymkent Gas Pipeline	0,068	0,053
Asian Gas Pipeline	0,069	0,049
QazaqGaz Aimaq	3,101	2,84

To achieve the target of 0.0635 tCO_2-eq/GJ by 2033, with projected energy consumption of 54.6 million GJ, direct GHG emissions must be reduced to 3.469 million tCO_2-eq (excluding subsidiaries and associated companies). This will ensure that the target of reducing specific emissions by 10% relative to 2021 levels is achieved.

6.3.2.1.1 Basic scenario - Business as Usual

The baseline scenario reflects the trajectory of JSC NC QazaqGaz's operations under conditions where current technological and operational parameters remain unchanged, without the introduction of additional climate initiatives or measures to reduce the carbon footprint. The approach is based on the “business as usual” principle and takes into account actual production capacities, historical carbon and energy intensity dynamics, as well as current industry and government policies without adjustments towards decarbonization.

Under the basic scenario:

- no new investment projects aimed at reducing greenhouse gas emissions are planned;
- current energy consumption structure with a high share of traditional energy sources remains unchanged.
- gas production, transportation, and processing volumes increase in line with projected economic and industry trends;
- there are no initiatives to transition to alternative energy sources (e.g., renewable energy sources) or large-scale equipment modernization projects.

Forecast production indicators

According to forecasts, if current approaches to equipment operation remain unchanged and no modernization takes place, greenhouse gas emissions will show steady growth by 2033. The main factors contributing to the increase in emissions will be growth in energy consumption, physical wear and tear of infrastructure, and expansion of operational activities.

The chart shows the projected volumes of gas production and transportation, taking into account the growth in fuel and energy consumption and the increase in operating load. The analysis shows different growth dynamics among subsidiaries:

- QazaqGaz Aimaq – the largest increase in volume is expected compared to the base year of 2021 (+43%), which is associated with the connection of new consumers and the expansion of the gas distribution network;
- Beineu-Shymkent gas pipeline will see an 18% increase, including the transfer of the CS-1A Ustyurt compressor station from ICA in 2026;
- Intergas Central Asia - growth will be around 7%;
- Asian gas pipeline and exploration and production segment - maintaining stable performance, with volumes increasing by 0.4% and 8% respectively.

Greenhouse gas emissions forecast

The increase in emissions is due to the natural aging of production equipment, increased energy consumption, and increased operating volumes. This scenario is used as a reference point for analysis and comparison with alternative decarbonization scenarios. According to calculations:

- The projected increase in GHG emissions by 2033 compared to 2021 will be 18.5%;
- The absolute volume of direct GHG emissions (Scope 1) by 2033 is expected to reach 4,253 thousand tCO_2eq, which means an increase of 663.7 thousand tCO_2eq compared to the baseline.

The growth is associated with both the expansion of technical infrastructure and an increase in gas transportation volumes, which leads to higher energy consumption by production equipment.

Figure 19. Forecast indicators for Scope 1 GHG emissions based on forecast energy consumption growth, tCO2-eq.

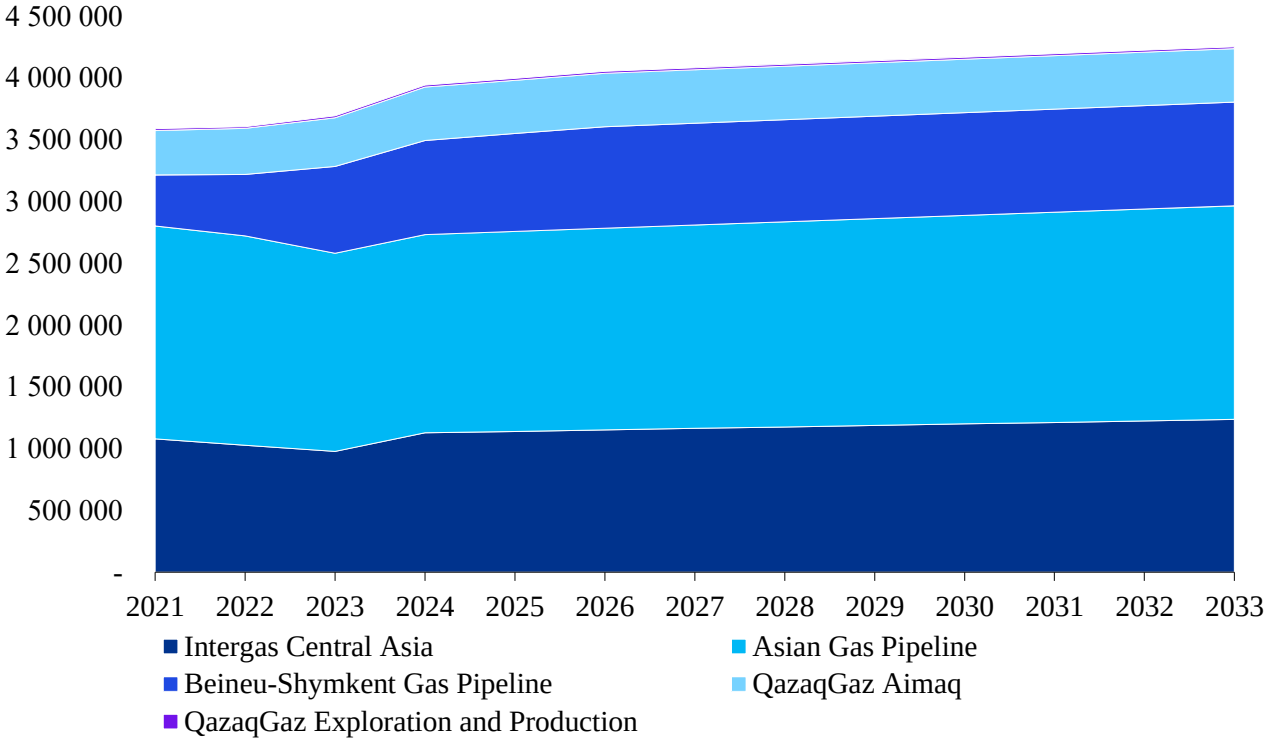


Table 8. Forecast indicators for specific Scope 1 emissions until 2033, tCO2-eq/GJ

Subsidiaries	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Intergas Central Asia	0.055	0.088	0.080	0.084	0.084	0.083	0.083	0.082	0.082	0.081	0.081	0.080	0.080
Asian gas pipeline	0.069	0.069	0.073	0.069	0.069	0.069	0.069	0.069	0.068	0.068	0.068	0.068	0.067
Beineu-Shymkent Gas Pipeline	0.068	0.064	0.065	0.065	0.065	0.062	0.060	0.061	0.061	0.061	0.062	0.062	0.063
QazaqGaz Aimaq	3.101	3.266	3.307	3.834	3.812	3.789	3.767	3.745	3.723	3.702	3.681	3.660	3.639
Exploration and Production	0.507	0.508	0.441	0.484	0.482	0.480	0.477	0.475	0.473	0.471	0.468	0.466	0.464
Total:	0.0705	0.082	0.082	0.082	0.081	0.080	0.079	0.079	0.078	0.078	0.078	0.078	0.078

If current approaches to energy consumption remain unchanged, QazaqGaz's specific GHG emissions are projected to increase by 10.43% - from 0.0705 to 0.07786 tCO_2-eq/GJ by 2033. Despite a local decrease in emissions intensity at individual subsidiaries, the overall level of emissions will increase, including a 401.9 thousand tCO_2-eq increase in Scope 1 emissions. Scope 2 emissions will remain stable (around 52 thousand tCO_2-eq.) due to an increase in the share of renewable energy sources in Kazakhstan's energy balance. The baseline scenario does not provide for climate measures and is used solely as a reference point.

6.3.2.1.2 Green development scenario

The green development scenario for QazaqGaz JSC is based on operational growth forecasts and aims to maintain specific direct greenhouse gas emissions (Scope 1) at the 2021 baseline level of

0.0705 tCO_2eq/GJ. Unlike the baseline scenario, this approach takes into account the implementation of a targeted package of technical and organizational measures aimed at improving energy efficiency and reducing the carbon intensity of production activities.

The key tools for achieving the targets of the “Decarbonization” scenario are presented in the table below.

Table 9. List of measures under the “green” development scenario

No.	Measures	GHG emissions category	Potential for reducing GHG emissions, tCO2-eq .	Relative reduction in GHG emissions from the target value, in %	Estimated capital costs, USD	Estimated operating costs, USD	Affiliates	Planned period for implementation of measures
Technical measures								
1	Major repairs of 19 GGS plants at compressor stations	Scope 1	1 088,4	0,14%	7 400 000	GGS operational maintenance is carried out by the Technical Services responsible for AGP operation	AGP	2025-2026
2	Replacement of power supply system for block valve units with solar panels (renewable energy sources)	Scope 1	123,7	0,02%	3 600 000	When servicing renewable energy sources, operating costs are estimated at approximately 5% of capital costs: USD 180 000 per year	AGP	2025-2026
3	Optimization of use of electricity generated by GGS at CS-6	Scope 1	1 223,6	0,16%	8 160 000	GGS operational maintenance is carried out by the Technical Services responsible for AGP operation	AGP	2025-2026
4	Installation of active harmonic filters for frequency converter GPA No. 1 of Turkestan CS	Scope 1	184.7	0,02%	3 705	By BSGP Technical Services	BSGP	2027
5	Optimization of equipment operating modes. Determination of the optimal operating mode of the GPA	Scope 1	28 058,1	3,63%	By BSGP Technical Services	By BSGP Technical Services	BSGP	2025–2033

	while maintaining the gas transport mode							
6	Adjustment works of existing reactive power compensation devices (RPCD) at Aral CS, Korkyt Ata CS, Turkestan CS	Scope 1	2.326	0,0003%	0	By BSGP Technical Services	BSGP	2026
7	Modernization of the energy supply system using renewable energy sources	Scope 2	374	1,38%	220 000	Operating costs for servicing a 1 MW solar power plant are estimated at average of USD 19 000 to USD 25 000 per year. Let us assume operating costs for servicing a solar power plant amounting to USD 20 000 per year	QGA	2030–2033
8	Use of system for washing the flow section of compressors	Scope 1	4 625,6	0,60%	0	By ICA Technical Services	ICA	2025
9	Using mobile compressor stations (MCS) to conserve natural gas during repairs on a single gas supply system	Scope 1	95 980,2	12,43%	774 610	By ICA Technical Services	ICA	до 2030
10	Improving the energy efficiency of a gas pumping unit during major repairs of a gas turbine engine	Scope 1	7 448,5	0,96%	712 381	By ICA Technical Services	ICA	2025
11	Replacing existing lamps with energy-efficient LED analogs	Scope 2	135,4	0,50%	207 314	By ICA Technical Services	ICA	2025

12	Replacing inefficient cathodic protection stations with new generation stations	Scope 2	602,8	2,22%	275 238	By ICA Technical Services	ICA	2025
13	Replacement of outdated domestic and drinking water supply pump units with energy-efficient automatic twin-pump stations with horizontal pumps	Scope 2	31,1	0,11%	994	By ICA Technical Services	ICA	2025
14	Modernization of the power supply system using renewable energy sources of autonomous hybrid power plant AGEU with a capacity of 172 kW	Scope 2	256	0,9%	743 640	By ICA Technical Services	ICA	2030–2033
15	Replacement of shut-off valves with diameters ranging from Ø800 mm to Ø1440 mm	Scope 1	4 840	0,63%	21 461 321	By ICA Technical Services	ICA	2025
16	Using low-emission fuel combustion technology in combustion chambers of the gas generator of the GPA fuel system	Scope 1	18 715	2,42%	400 000 per one DLE camera. To install 30 DLEs on the GPA, the costs are 12 000 000	110 000 per installation of one low-emission camera. Total 3 300 000	AGP	2025-2026 (15 GPA in 2025 and 15 GPA in 2026)
17	Use of dry gas seal systems on centrifugal compressors	Scope 1	188,7	0,02%	3 553 000	By AGP Technical Services	AGP	2025-2026
18	Maintaining the proper working order of key equipment	Scope 1	557	0,07%	0	By AGP Technical Services	AGP	2025-2026

19	Modernization of the existing power supply system for block valve units on the linear section of BBS MG, taking into account the introduction of renewable energy sources: Mangistau region, block valve unit CS No.1; - Aktobe region, block valve unit CS No.12; - Kyzylorda region, block valve unit CS No.32; - Turkestan region, block valve unit CS No.43.	Scope 1	279	0,036%	3 261 000	When servicing renewable energy sources, operating costs are estimated at approximately 5% of capital costs: USD 163 000 per year	BSGP	2026-2028
20	Implementation of renewable energy sources at 6 railway crossings	Scope 2	8	0,03%	361 700	Estimated at USD 18 000 per year	BSGP	2026-2027

Achieving the goals of the green development scenario relies on the implementation of 20 technical measures aimed at improving energy efficiency, introducing more efficient equipment, using renewable energy sources, and automating and digitizing processes. The implementation of these measures will curb the growth of projected specific greenhouse gas emissions from 10.43% to 10.04% by 2033 - from 0.07786 to 0.07758 tCO_2-eq/GJ. In absolute terms, this is equivalent to a reduction in direct emissions of 170.6 thousand tCO_2-eq.

However, in order to achieve the 2021 specific emissions level (0.0705 tCO_2-eq/GJ), it is necessary to reduce emissions by an additional 386,600 tCO_2-eq. This will require additional measures, including the electrification of key production equipment, a reduction in natural gas consumption, and the possible use of offset mechanisms during the period 2030-2033.

6.3.2.1.3 Deep decarbonization scenario

The Deep Decarbonization scenario represents the most ambitious path to reducing greenhouse gas emissions and is consistent with the target of limiting global warming to 1.5°C, as set out in the Paris Agreement. Unlike the “green development” scenario, which focuses primarily on equipment modernization and energy efficiency improvements, this scenario takes a comprehensive approach that includes technical, organizational, and compensatory measures in line with international best practices.

The scenario includes 22 measures aimed at achieving the following indicators by 2033:

- reduction of direct emissions (Scope 1) by 10% compared to the 2021 baseline;
- 33% reduction in indirect emissions (Scope 2), including through the replacement of imported electricity generated from fossil fuels with energy from renewable sources.

Achieving the targets set out in the Deep Decarbonization scenario is only possible if technical and organizational measures are implemented in a coordinated manner, internal management mechanisms are developed, and market-based carbon neutrality instruments are applied. This scenario reflects the Company's commitment to a more sustainable and climate-responsible development model.

The tools for achieving the targets of the Deep Decarbonization scenario are presented in the table below.

Table 10. List of measures under the Deep Decarbonization" scenario

No.	Measures	GHG emissions category	Potential for reducing GHG emissions, tCO2-eq .	Relative reduction in GHG emissions from the target value, in %	Estimated capital costs, USD	Estimated operating costs, USD	Affiliates	Planned period for implementation of measures
Technical measures								
1	Major repairs of 19 GGS plants at compressor stations	Scope 1	1 088,4	0,14%	7 400 000	GGS operational maintenance is carried out by the Technical Services responsible for AGP operation	AGP	2025-2026
2	Replacement of power supply system for block valve units with solar panels	Scope 1	123,7	0,02%	3 600 000	When servicing renewable energy sources, operating costs are estimated at approximately 5% of capital costs: USD 180 000 per year	AGP	2025-2026
3	Optimization of use of electricity generated by GGS at CS-6	Scope 1	1 223,6	0,16%	8 160 000	GGS operational maintenance is carried out by the Technical Services responsible for AGP operation	AGP	2025-2026
4	Installation of active harmonic filters for frequency converter GPA No. 1 of Turkestan CS	Scope 1	184.7	0,02%	3 705	By BSG Technical Services	BSGP	2027
5	Optimization of equipment operating modes. Determination of the optimal operating mode of the GPA	Scope 1	28 058,1	3,63%	By BSG Technical Services	By BSG Technical Services	BSGP	2025–2033

	while maintaining the gas transport mode							
6	Adjustment works of existing reactive power compensation devices (RPCD) at Aral CS, Korkyt Ata CS, Turkestan CS	Scope 1	2.326	0,0003%	0	By BSGP Technical Services	BSGP	2026
7	Modernization of the energy supply system using renewable energy sources	Scope 2	374	1,38%	220 000	Operating costs for servicing a 1 MW solar power plant are estimated at average of USD 19 000 to USD 25 000 per year. Let us assume operating costs for servicing a solar power plant amounting to USD 20 000 per year	QGA	2030–2033
8	Use of system for washing the flow section of compressors	Scope 1	4 625,6	0,60%	0	By ICA Technical Services	ICA	2025
9	Using mobile compressor stations (MCS) to conserve natural gas during repairs on a single gas supply system .	Scope 1	95 980,2	12,43%	774 610	By ICA Technical Services	ICA	до 2030
10	Improving the energy efficiency of a gas pumping unit during major repairs of a gas turbine engine	Scope 1	7 448,5	0,96%	712 381	By ICA Technical Services	ICA	2025
11	Replacing existing lamps with energy-efficient LED analogs	Scope 2	135,4	0,50%	207 314	By ICA Technical Services	ICA	2025
12	Replacing inefficient cathodic protection stations with new generation stations	Scope 2	602,8	2,22%	275 238	By ICA Technical Services	ICA	2025

13	Replacement of outdated domestic and drinking water supply pump units with energy-efficient automatic twin-pump stations with horizontal pumps	Scope 2	31,1	0,11%	994	By ICA Technical Services	ICA	2025
14	Modernization of the power supply system using renewable energy sources of autonomous hybrid power plant AGEU with a capacity of 172 kW	Scope 2	256	0,9%	743 640	By ICA Technical Services	ICA	2030–2033
15	Replacement of shut-off valves with diameters ranging from Ø800 mm to Ø1440 mm	Scope 1	4 840	0,63%	21 461 321	By ICA Technical Services	ICA	2025
16	Using low-emission fuel combustion technology in combustion chambers of the gas generator of the GPA fuel system	Scope 1	18 715	2,42%	400 000 per one DLE camera. To install 30 DLEs on the GPA, the costs are 12 000 000	110 000 per installation of one low-emission camera. Total 3 300 000	AGP	2025-2026 (15 GPA in 2025 and 15 GPA in 2026)
17	Use of dry gas seal systems on centrifugal compressors	Scope 1	188,7	0,02%	3 553 000	By AGP Technical Services	AGP	2025–2026
18	Поддержание исправного состояния основного оборудования	Scope 1	557	0,07%	0	By AGP Technical Services	AGP	2025–2026
19	Modernization of the existing power supply system for block valve units on the linear section of BBS MG, taking into account the introduction of renewable energy sources:	Scope 1	279	0,036%	3 261 000	When servicing renewable energy sources, operating costs are estimated at approximately 5% of capital costs: USD 163 000 per year	BSGP	2026-2028

	- Aktobe region, block valve unit CS No.12; - Kyzylorda region, block valve unit CS No.32; - Turkestan region, block valve unit CS No.43.							
20	Implementation of renewable energy sources at 6 railway crossings	Scope 2	8	0,03%	361 700	Estimated at USD 18 000 per year	BSGP	2026-2027
Organizational measures								
21	Implementation of policies on energy conservation, energy management, and organizational practices for personnel aimed at the careful use of energy resources.	Scope 1	14,09	0,001%	0	нет	QGA	2026-2028
			2 704,25	0,35%	0	нет	AGP	
			1 514,13	0,198%	0	нет	ICA	
			1 530,54	0,196%	0	нет	BSGP	
Additional measures								
22	Launch of the Green Office project for administrative buildings of subsidiaries and affiliated companies	Scope 2			0	Green Office project is being implemented by office staff and technical services of the subsidiary.	QGA, EP	2025–2033
23	Purchase of I-REC certificates to reduce indirect Scope 2 emissions	Scope 2	27 154	33%	68 700	no	ICA	2030–2033

24	Formation of portfolio of offset projects (climate, renewable energy sources)	Scope 1, 2				no	ICA, QGA, AGP, BSGP	2030–2033
25	Implementation of MIST-Methane Intensity Screening Tool	Scope 1				no	ICA	2030–2033
26	Joining the Oil and Gas Methane Partnership (OGMP) 2.0 initiative	Scope 1				no	ICA	2030–2033

Total reduction of direct GHG emissions by affiliates from planned measuresв

Affiliates	Relative reduction of GHG emissions from implementation of measures from the established contribution of Affiliates, %	Relative reduction of GHG emissions from QazaqGaz target indicators, %	Absolute reduction of direct GHG emissions from implementation of measures, tCO2-eq.
Total along ICA:	100.0%	14.8%	114 408
Total along AGP:	6.9%	3.2%	24 600
Total along BSGP:	21.3%	4.27%	31 585
Total along QGA:	0.01%	0.002%	14.09

6.3.3 Monitoring of greenhouse gas emissions Scope 3

Many international ESG standards and ratings increasingly focus on greenhouse gas (GHG) emissions disclosure. According to the updated version of CDP1, effective from 2022, companies must disclose at least 70% of emissions in each of the Scope 1 and 2 categories, as well as in at least one of the Scope 3 categories, to receive an “A” rating. In 2011, a unified methodological approach for calculating emissions under Scope 3 was adopted - the GHG Protocol “Corporate Value Chain”.

As required by the GHG Protocol, Scope 3 emissions cover all indirect emissions in a company's value chain, not including emissions from the production of purchased goods or services and from the production of energy purchased by the company, which are included in indirect energy emissions. Scope 3 has two streams - pre-product company emissions (upstream) and post-product company emissions (downstream). Scope 3 indirect emissions are divided into 15 emission categories, where each category has a specific boundary defining the type of activity to be accounted for in that category:

Table 11. Description of 15 GHG emission categories

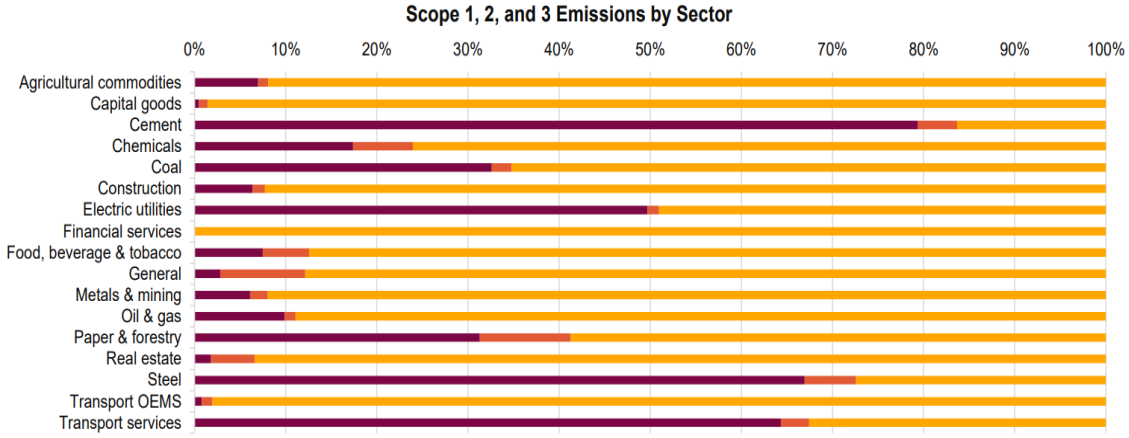
No.	Category name	Description
1	Purchased goods and services	includes all emissions from the production of products purchased or purchased by the reporting company. Products include both goods and services.
2	Means of production	includes all emissions from the production of capital goods purchased or acquired by the reporting entity.
3	Other indirect emissions from energy consumption (not included in Scope 1 or 2)	includes emissions associated with the production of fuel and energy purchased and consumed by the reporting company that are not included in Scope 1 or 2.
4	Gas transportation and distribution	includes emissions from the transportation and distribution of products purchased or purchased by the reporting company from vehicles and facilities not owned or operated by the reporting company, as well as other transportation and distribution services purchased by the reporting company.
5	Waste generated	includes emissions from the disposal and treatment of waste generated at the company's facilities or transferred to third parties.
6	Business travel	include emissions from the transportation of business-related employees in vehicles owned or operated by third parties, such as planes, trains, buses and cars.
7	Travel of employees to work	include emissions from transporting employees between home and workplace.
8	Property leased in the upper segment	includes emissions from the operation of assets leased by the reporting company that are not already included in the company's Scope 1 or 2 inventories.

9	Transportation and delivery of finished products	includes emissions resulting from the transportation and distribution of finished products in vehicles and facilities not owned or controlled by the reporting company.
10	Processing of sold products	include emissions from the processing of intermediate products that were sold by the company and then processed by third parties.
11	Utilization of finished goods	covers emissions associated with the use of products and services sold by the company.
12	End of life of finished goods	includes emissions from the disposal and recycling of end-of-life waste products sold by the company.
13	Property leased in the lower segment	includes emissions from the operation of assets owned by the reporting company (acting as lessor) and leased to other companies that are not already included in Scope 1 or 2.
14	Franchises	includes emissions from the operation of franchisees not included in Scope 1 or 2. Franchisors must account for emissions from the operations of their franchisees under Scope 1 and 2.
15	Investments	includes emissions associated with the reporting company's investments (investors, financial institutions, multilateral development banks) that are not already included in Scope 1 or 2.

Source: Corporate Value Chain (Scope 3) Accounting and Reporting Standard

In April 2022, CDP presented an analysis of the relevance of Scope 3 categories for CDP sectors with high GHG emissions. The results presented in Figure 14 demonstrate the importance of Scope 3 emissions, which on average account for 75% of the total emissions in the 17 sectors considered. The analysis considered relevant Scope 3 categories that significantly affected the total emissions in each of these sectors.

Figure 19. Scope 1, 2, 3 emissions by economic sector

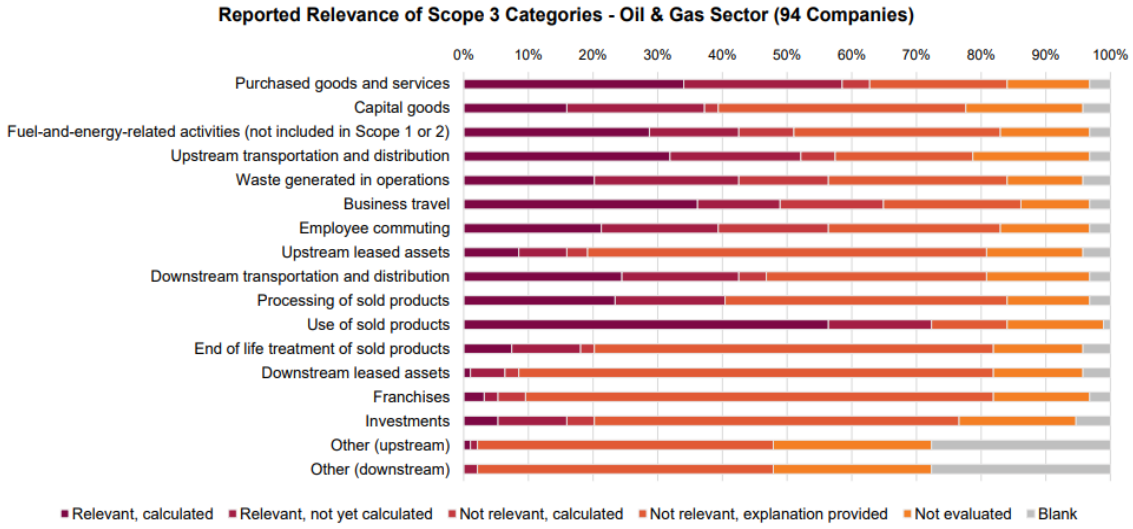


Source: CDP technical note scope 3 relevance by sector, cmp 6.

Companies in the oil and gas sector are involved in oil and gas extraction and production, transportation, transshipment and storage of oil, gas and refined products, and oil and gas refining/processing. Regardless of the stage in the value chain, Scope 3 accounts for a significant portion of emissions, especially Category 11 - Use of Finished Products. This category often

represents a larger number of emissions than Scope 1 and 2. Despite this, few oil and gas companies calculate emissions for this category, see Figure 20.

Figure 20. Relevant Scope 3 categories for the oil and gas sector

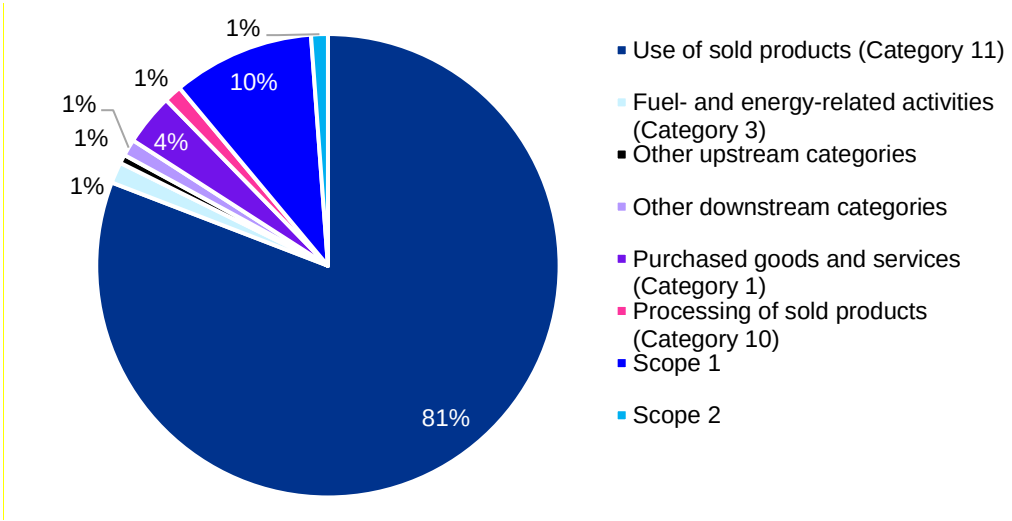


Source: [CDP technical note scope 3 relevance by sector, cmp 38.]

Based on the results of the analysis of GHG emissions disclosure by 94 oil and gas companies that participated in the CDP climate change filling in 2021, it is shown that about 57% of them calculated emissions under Scope 11. It is important to note that this category accounts for a significant share of emissions from the oil and gas sector - 91% of Scope 3 emissions and 81% of total emissions. The distribution of GHG emissions by category is presented in Figure 16.

For companies that do not participate in all stages of the value chain, emissions from purchases of oil, gas and other products must be accounted for. These emissions are included in Category 1 - Purchased Goods and Services. While this category may be significant for some companies, this category represents a small fraction of Scope 3 emissions - 4% of the total.

Figure 21. Emissions by Scope 3 categories as a % of total emissions in the oil and gas sector

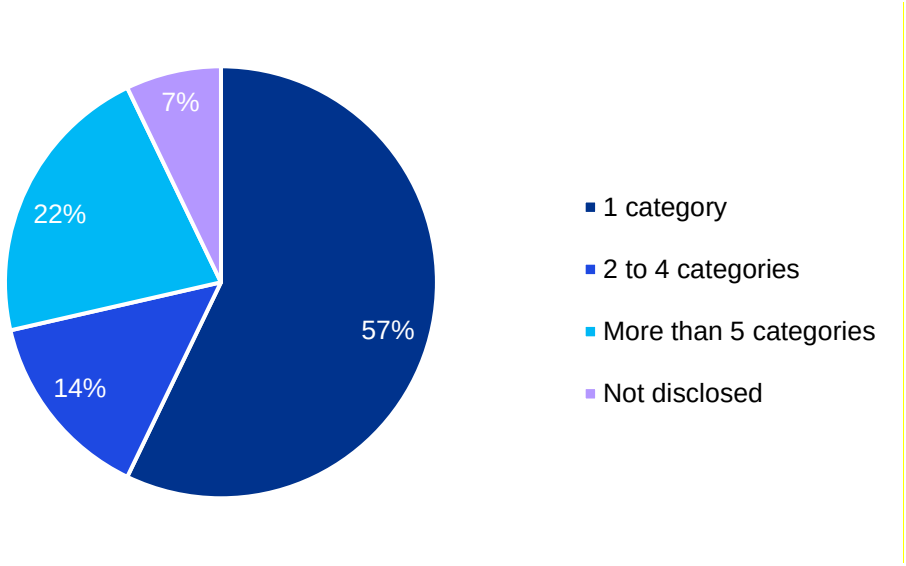


Effective Scope 3 emissions management not only meets international standards and ratings, but also contributes to a better understanding and reduction of the Company's carbon footprint.

6.3.3.1 Scope 3 GHG emission calculation methodology, definition of relevant Scope 3 categories

As part of the GHG emissions calculation, a comparative analysis was carried out for 14 oil and gas companies on Scope 3 GHG emissions disclosure. According to the results of the analysis, 12 companies from the reference group included the 11th category in their calculations, more than 70% of this group of companies estimate only one Scope 3 category and it is the 11th category.

Figure 22. Comparative analysis for 14 oil and gas companies



The conducted comparative analysis allowed to determine the most relevant Scope 3 GHG emission categories for JSC «NC «QazaqGaz». As a pilot calculation it was accepted to conduct an inventory for one category 11 «Use of finished products». The methodological apparatus for calculation of Scope 3 GHG emissions is GHG Protocol, CDP, ISO 14064 series standards.

In 2018, CDP introduced a methodology to calculate Scope 3, Category 11 emissions for the oil and gas sector, which provides formulas for both Tier 1 and higher levels of estimation complexity. According to the methodology, Companies choose the level of complexity of the assessment depending on available resources and indicators:

$$E_{S3.11} = \sum T_p \times EF_p \times EO_p, \text{ где}$$

- Tp - volume of product transportation - thousand m³;
- EFp - GHG emission factor at natural gas combustion tCO2/TJ;
- EOp - effective degree of fuel oxidation (%).

To obtain a more detailed calculation of GHG emissions, a formula with a higher level of estimation complexity was used with the following required data:

1) Estimated emission factors:

- Laboratory analysis certificates (for calculation of GHG emission factors);
- Fuel passports (lowest calorific value).

2) Quantitative indicators:

- Volumes of products sold;
- Share of products used for non-energy purposes (raw materials for production of chemicals, fertilizers, etc.).

6.3.3.2 Determination of the current level of Scope 3 emissions of JSC «NC «QazaqGaz»

In 2023, JSC «NC «QazaqGaz» for the first time carried out a quantitative assessment of greenhouse gas emissions in category 11 (use of sold products) within Scope 3.

In 2024, the scope of indirect emissions accounting was significantly expanded: emissions for Scope 1 (purchase of goods and services), 6 (business travel) and 7 (employee commuting) were additionally calculated. In addition, historical values for 2021-2023 were recalculated using a unified methodology. Scope 3 covers indirect greenhouse gas emissions arising in the Company's value chain outside its direct operational control. Such emissions include, in particular, emissions associated with the purchase of goods and services, business mobility of employees, their daily commuting, as well as the use of products sold by consumers.

By the end of 2024, the total volume of greenhouse gas emissions in categories 1, 6, 7 and 11 amounted to 872 481.86 t CO_2-eq. (see table 12).

Table 12. Calculation of GHG emissions Scope 3 (category 11) for JSC "NC "QazaqGaz"

Emissions Scope 3:	Unit measure	2024
category 1: Purchase of goods and services	metric tons CO2e	225 716,14
category 6: employee business trips	metric tons CO2e	3 039,42
category 7: Employee trips to work	metric tons CO2e	19 927,50
category 11: Use of products sold	metric tons CO2e	623 798,80
Total:	metric tons CO2e	872 481,86

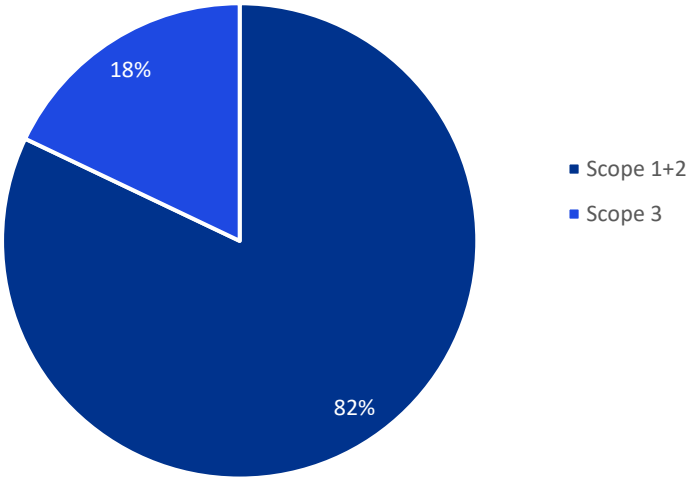
The year 2023 was chosen as the base year for categories 1 (purchased goods and services), 6 (business trips) and 7 (employee trips to work) - the first period in which a complete inventory and quantification of these categories was carried out. For category 11 (use of products sold), the base year is considered to be 2021, when comprehensive data on sales volumes were collected for the first time.

Emissions were estimated in accordance with the GHG Protocol: Technical Guidance for Calculating Scope 3 Emissions methodology, using generally accepted sources of emission factors, including the databases Climatiq, Statista, perevozka24, as well as the reference books of the European Environmental Protection Agency (EEA) and the IPCC. The calculations used industry and regional coefficients, and in the absence of national data, global values. For the transport-related categories (categories 6 and 7), emissions were calculated taking into account the distances traveled, the types of transport used, and the load level. Within category 1, the assessment was carried out

using life cycle approaches (LCA) covering the production and logistics stages. In category 11, the standard emission coefficients of methane (CH_4) and nitrous oxide (N_2O) were used, converted to the CO_2 equivalent according to the GWP values from the Fifth IPCC Assessment Report.

The approach used ensures comparability, reproducibility and compliance with international requirements for the calculation and disclosure of indirect emissions along the value chain.

Figure 23. Structure of the total greenhouse gas emissions of JSC NC QazaqGaz



According to the results of the assessment of greenhouse gas emissions in four Scope 3 categories (categories 1, 6, 7 and 11), the total emissions amounted to 872 481.86 tons of CO2, equivalent to 18% of the Company's total emissions. The main share of emissions (82%) is accounted for by direct and indirect emissions within Scope 1 and Scope 2. The structure of the total carbon footprint of JSC NC QazaqGaz is shown in Figure 18.

6.3.4 Managing risks and opportunities associated with climate change

As defined by the Intergovernmental Panel on Climate Change (IPCC), the climate risk is the adverse effects due to climate change, including climate variability and extreme events, which may affect various aspects of society, the economy and the natural environment.

The climate risk factor is a specific aspect of climate change that could have potential negative impacts on a particular area, sector or system. Climate risk factors include: changes in temperature regime, sea level rise, changes in carbon legislation, etc.

According to the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD), climate risks are categorized into 2 categories:

- Transition risks are risks arising from efforts to transition to a low-carbon economy. Transition risks include political, legal, technological, market and reputational risks. [1]
- Physical risks - risks arising from climate change can be either event-driven (acute physical risk) or driven by long-term changes in climate patterns (chronic physical risk). [1]

[1] IFRS S2 Climate-related Disclosures

Transition risks are categorized as follows:

Political and legal risks

Policy measures are divided into restrictive measures, which aim to reduce the negative impacts of climate change, and adaptive measures, which promote adaptation to climate change. Examples include introducing GHG pricing mechanisms, shifting to energy use from lower-emission sources, introducing energy-saving solutions, incentivizing water efficiency measures, and introducing more sustainable land use practices.

Legal risks associated with regulatory change due to climate change are also becoming important. As a result, there has been an increase in lawsuits due to the failure of organizations to mitigate or adapt to climate change and the lack of required disclosure of climate change-related financial risks.

Technology risks

Technology risk is associated with the introduction of new technologies that facilitate the transition to an economy with lower GHG emissions and greater energy efficiency. These changes affect a company's competitiveness, their production and distribution costs of production, and ultimately the demand for their products and services from end consumers.

Market risks

The market risk associated with climate change manifests itself through changing supply and demand dynamics for various goods and services. This is manifested in an increasing shift away from carbon-intensive products in favor of greener ones. This process is driven by increasing public awareness of the risks and opportunities associated with climate change.

Reputational risks

Reputational risks relate to the impact that a company's reputation may suffer as a result of its efforts (or lack thereof) to adapt to climate change. These risks relate to how companies respond to climate change challenges and how these responses are perceived by the public, investors, customers and other stakeholders.

Physical risks are subdivided internally as follows:

- Acute risks. Acute physical risks are risks that depend on specific events, including an increase in the intensity of extreme weather events such as cyclones, hurricanes or floods.
- Chronic risks. Chronic physical risks arise from long-term changes (e.g. sustained temperature rise) that could cause sea level rise or prolonged periods of high temperatures.

6.3.4.1 Physical climate risks

6.3.4.1.1 Climatic peculiarities of the regions where JSC NC QazaqGaz operates

Currently, JSC NC QazaqGaz is represented in 13 out of 17 regions of Kazakhstan, including Akmola, Almaty, Aktobe, Atyrau, Zhambyl, Zhetysu, West Kazakhstan, Karaganda, Kostanay,

Kyzylorda, Mangistau, Turkestan and Ulytau regions, as well as in the cities of national importance - Astana, Almaty and Shymkent.

The territory covered by the Company's operations extends almost throughout the entire territory of the Republic of Kazakhstan. Climatic conditions in Kazakhstan are characterized by a continental type of climate with large temperature amplitudes. Considerable remoteness from the oceans determines the sharply continental nature of Kazakhstan's climate with a deficit of precipitation. The location of the country in temperate latitudes (40°-50° of northern latitude) determines high indicators of solar radiation on its territory. Gradual increase of solar total radiation is observed as one moves from north to south. The plains of Kazakhstan represent the change of natural zones from forest-steppe in the north to desert in the south.

Despite the fact that the Company's facilities are located in 13 regions and 3 cities of republican significance of Kazakhstan, the analysis of climatic risks for JSC NC QazaqGaz was made for 10 regions and 2 cities of republican significance, since about 98% of the total length of the Company's gas distribution systems are located on their territory:

- Turkestan region;
- West Kazakhstan region;
- Shymkent city;
- Zhambyl region;
- Atyrau region;
- The city of Almaty;
- Aktobe region;
- Mangystau region;
- Kyzylorda region;
- Kostanay region;
- Zhetysu region;
- Almaty region

Climate risk analysis was based on the comparison of modern climate data (1995-2014) with climatic conditions before the beginning of the industrial era (1850-1900). This approach makes it possible to assess the changes that have occurred since the beginning of the industrial era, to determine the contribution of anthropogenic activities to the process of climate change, and to estimate the rate and direction of climate change, which is important for predicting future changes and identifying trends.

Retrospective data on climatic conditions were taken for the period from 1850-1900 because this is the earliest period for which near-global observations are available, and it is this period that has been used as an approximation to pre-industrial temperatures since the IPCC Fifth Assessment Report.

For climate risk analysis, the CMIP6 (Coupled Model Intercomparison Project Phase 6) model ensemble was used to recreate past climate conditions. The following parameters were evaluated:

- Rise in average temperature;
- Minimum temperature rise;
- Increase in the number of days with minimum temperature below 0 ºC;
- Increase in maximum temperature;
- Increase in the number of days with maximum temperatures above 35ºC;
- An increase in total precipitation;

- Increase in maximum 5-day precipitation;
- SPI-6 (The 6-month Standardized Precipitation Index) rose;
- Reducing the amount of snowfall;
- Increase in average surface wind speed.

As a result of data analysis, it was found that a noticeable increase in mean annual temperature is observed in the north-western regions of Kazakhstan, in particular, in Aktobe and West Kazakhstan regions. Aktobe region was identified as the region with the highest increase in mean annual temperature compared to the baseline period. The average annual temperature in this region increased by 1.346 °C. In contrast, the smallest increase in mean annual temperature was observed in the south-east of the country, in Almaty region and Almaty City, which recorded increases of 1.129 °C and 1.111 °C compared to the baseline period. The average increase in mean annual temperature over the whole territory under consideration is noted at the level of 1.209 °C.

In Aktobe and West Kazakhstan regions, the highest increase in minimum temperature for the comparable time interval with the pre-industrial period was observed, the increase amounted to 1.492°C and 1.475°C, respectively. Comparatively smaller increase in minimum temperature was recorded in Mangistau region and Almaty city, where the values amounted to 1.295°C and 1.188°C. The average minimum temperature increase for all regions is 1.374°C.

During the pre-industrial era, the average number of days with the minimum temperature below 0°C in the analyzed territory was about 143 days, while during the modern period this value decreased to about 130 days. Thus, the impact of anthropogenic activity in the analyzed territory was accompanied by an average reduction of days with minimum temperature below 0°C by 13 days.

The most significant increase in maximum temperature is noted in Aktobe region, where an excess of 1.194°C was recorded compared to the values of the base period. Kyzylorda oblast is on the second place by the increase in maximum temperature with an increase of 1.189°C. In turn, the lowest increase in maximum temperature is observed in the south-east of the country, in Almaty region and Almaty city, with values of 1.023°C and 0.982°C, respectively.

An increase in the number of days with maximum temperatures above 35°C was recorded in the southern regions of Kazakhstan, such as Turkestan, Kyzylorda and Zhambyl regions, where an increase of 10, 9 and 8 days was observed, respectively, compared to the period from 1850 to 1900. The smallest increase in such days was recorded in Almaty and Kostanay regions, as well as in Almaty city, where an increase of approximately 1 day was observed. In the baseline period, the average number of days with maximum temperatures above 35°C was almost 24 days, while in the current period this value has increased to about 31 days. This analysis indicates an increase in the number of extremely hot days in the regions under consideration over the time interval.

There is a significant increase in the average annual amount of precipitation. The largest increase was recorded in the south-east of Kazakhstan, particularly in the city of Almaty, as well as in Almaty and Zhetysu regions, where changes were recorded at the level of 0.078, 0.061 and 0.054 mm per day, respectively. The smallest increase was found in the west of the country, in Atyrau and Mangistau regions, where the increase amounted to only 0.018 and 0.012 mm per day, respectively. The average amount of precipitation in all analyzed regions at the present time is 0.799 millimeters per day, while in the pre-industrial era this value was at the level of 0.762 mm per day, which indicates an increase in the average annual precipitation by 0.037 mm per day compared to the base period.

Such parameter as the maximum amount of precipitation for 5 days was also used for analysis. It was recorded that for the modern period there was an increase in this indicator compared to the pre-

industrial period. The greatest growth is noted in the cities of Almaty and Shymkent, 2.862 and 2.798 mm, respectively. The lowest growth was recorded in Kostanay region, the value is equal to 0.767 mm.

The SPI-6 index used is a 6-month standardized precipitation index that is used as a meteorological indicator of drought. It is capable of tracking precipitation anomalies over six-month periods and also acts as a proxy for assessing medium-term impacts such as reduced river flows and reservoirs. SPI represents the deviation of precipitation at a given location and time from the long-term average according to a standard normal distribution. Lower values indicate more severe drought. The largest increase in the index is observed in Zhetysu oblast (from -14.06 to 10.43) and in Almaty city (from -12.71 to 12.15). The smallest changes are observed in western regions of Kazakhstan, such as West Kazakhstan region (from -3.3 to 6.3), Mangistau region (from -6.3 to 2.8) and Atyrau region (from -3.2 to 11.8).

A decrease in solid precipitation, represented as snow, was recorded in comparison with the pre-industrial period in all studied regions. The greatest differences are observed in Zhetysu and Kostanay regions, with values of -0.004 mm/day and -0.006 mm/day, respectively. The smallest differences are found in the west of Kazakhstan, in particular in Atyrau region (-0.028 mm/day) and West Kazakhstan region (-0.029 mm/day).

Within the framework of climate risk analysis, the change of surface wind speed was also considered: in all regions there is an increase of this indicator, only in Turkestan and Mangistau regions negative values were noted.

Summarizing the obtained results, we can highlight the main trend: intensification of aridization processes is more pronounced in the west and north-west of Kazakhstan, while the least changes in this process are observed in the south-east of the country. Moreover, an increase in precipitation is observed in the southeast, which emphasizes the diversity of climatic changes in different regions of the Company's presence.

6.3.4.1.2 Methodology for physical climate risk identification. Process approach

With increasing climate change, the identification of physical climate risks is becoming an important element of management. Companies are aware of the importance of taking measures to manage climate change affecting the Company's operations and seek to minimize their impact. This process allows not only to anticipate potential threats associated with climate change, but also to develop adaptive strategies to effectively manage these risks.

As part of the identification of physical climatic risks, the Company's facilities' resistance to the impact of climatic phenomena is assessed. The goal is to prevent the negative impact of these phenomena on production processes and reduce possible financial losses.

Within the framework of the analysis of physical risks and their impact on the infrastructure of JSC NC QazaqGaz, the process approach is used. The main purpose of its application is to determine the list of possible climatic risks affecting the continuity of production processes, integrity of the Company's assets. Identification of risks is carried out in accordance with the recommendations of the Working Group on Financial Information Related to Climate Change (TCFD) and International Financial Reporting Standard S2 Climate-related Disclosures (IFRS S2 Climate-related Disclosures).

Since JSC NC QazaqGaz has a corporate risk management system (CRMS), the approach to identification of climatic risks took into account the features of the CRMS and was based on the

methodology ENVID (Environmental Hazards Identification). Three main steps were defined for the identification of physical climate risks:

- Identification of relevant climate risk factors;
- Identification of production processes where climate risks are likely to occur;
- Formation of a complete register of physical climate risks

1. Identification of relevant climate risk factors

In order to obtain reliable information on existing climate risks, the Company needed to identify key risk factors. The risk factors were the climate parameters for which the climate change dynamics described in Section 3.3.1.1 were calculated.

2. Definition of production processes

Determination of production processes is carried out to identify potential points of realization of climate risks. The following production processes were identified for each of the Company's subsidiaries and affiliates:

- ICA, BSGP and AGP - gas transportation, gas cleaning and drying, gas compression and cooling, power supply, water supply, consumables supply;
- KTGA - gas pressure regulation, transportation through gas distribution pipelines;
- EP- gas gathering system, gas treatment, gas transportation, power supply, water supply, consumables supply.

3. Formation of climate risk register

The results of retrospective analysis, which allowed to identify relevant climatic risk factors, along with the analysis of production processes of the Company of JSC NC QazaqGaz allowed to form a register of physical climatic risks. Risk identification is sequential in nature, when for each relevant risk factor was carried out assessment of possible risks, which were supported by similar examples. When forming the register for each risk, the region of the Republic of Kazakhstan, which is characterized by the greatest significance of the risk under consideration, was identified.

An important component of the process of identification of climatic risks is conducting risk sessions with representatives of the Production and Technical Department (PTD) of JSC NC QazaqGaz and the considered subsidiaries and affiliates. The purpose of these risk sessions is validation of interim information, namely, verification of correctness of identified production processes, as well as assessment of relevance of the proposed risks.

The result of the climate risk identification is a register, which is an extensive table with the results of the step (Table 13).

Table 13. Register of physical climate risks for ICA SACs (sample)

№	Production process	Risk factor	Risk	Description of risk realization	Region
1	1 - Gas transportation	3 - Abnormal precipitation	Process interruption	Interruption of gas transportation due to destruction of pipeline supports by mudflows, landslides, floods, which may occur due to high precipitation,	Zhambyl region

				especially in foothill areas and river crossings	
2	1 - Gas transportation	3 - Abnormal precipitation	Process interruption	Interruption of gas transportation due to destruction of pipeline supports by mudflows, landslides, floods, which may occur due to high precipitation, especially in foothill areas and river crossings	Turkestan region
3	1 - Gas transportation	9 - Change in average annual precipitation	Process interruption	Interruption of gas transportation due to ground subsidence at the pipeline locations caused by softening of the ground due to an increase in average annual precipitation.	Zhambyl region

Different risks were identified for subsidiaries and affiliates of JSC NC QazaqGaz, for example:

- Due to the risk factor "increase in average temperature", there may be a risk of reduced gas cleaning and drying efficiency due to reduced equipment efficiency as the ambient temperature of the equipment affects its efficiency.
- Abnormal precipitation may cause a risk of interruption of gas transportation due to ground subsidence at the pipeline locations, which is caused by softening of the ground due to an increase in average annual precipitation. This risk is applicable to the Zhambyl, Turkestan and Almaty regions.
- Abnormal winds can cause a risk of reduced gas treatment efficiency due to dusty equipment. Dust and sand carried by the wind during dust storms can be deposited on equipment surfaces.
- Abnormal heat may cause the risk of increased resource intensity of production due to increased water consumption, as well as possible shortage of water resources in the regions.
- There is also a risk of interruption of the consumables supply process due to erosion of access roads, which may be caused by abnormal rainfall.

See Annex 2 for a full inventory of physical climate risks (Tables 40-44).

6.3.4.1.3List of relevant physical climate risks for JSC NC QazaqGaz

As a result of risk identification, registers of physical climatic risks in the context of subsidiaries and affiliates of JSC NC QazaqGaz were formed. In a generalized form it is possible to present relevant physical climatic risks in the main directions of the Company's activity

Backbone gas transportation: ICA, BSGP, AGP

For subsidiaries and affiliates involved in gas trunk transportation, the greatest number of risks arise within the processes: Gas Compression and Cooling and Power Supply. The following main types of impacts are characteristic for ICA, BSGP, AGP:

- Interruption of Gas Compression and Cooling, Gas Treatment, Gas Transportation, Power Supply, Water Supply and Consumables Supply as a result of acute factors such as abnormal precipitation and wind, and the chronic risk factor of change in average annual precipitation.

In the case of changes in average annual precipitation, the main risk is ground subsidence due to softening of the ground;

- Decrease in efficiency of production processes Gas Compression and Cooling, Gas Treatment and Power Supply mainly due to increase in temperatures, both average and maximum, due to decrease in equipment efficiency;
- Increase in the resource intensity of the Water Supply process due to the increase in temperature, which will require more water consumption for domestic needs.

Despite the fairly similar production process of the subsidiaries and affiliates under consideration and the location of facilities within the same regions, the following unique risks can be identified:

- ICA - due to the close location of ICA facilities to the Caspian Sea, the factor of sea level lowering affects the process (reducing its efficiency) of Gas Compression and Cooling in Mangistau and Atyrau regions, as the lowering of the Caspian Sea level exposes the shores with finely dispersed material (including salt crystals), which is carried by the wind and fills filters, i.e. lime scale is formed. In addition, due to the geography of the regions where ICA subsidiaries and affiliates are located, there are relevant risks that are not relevant for southern regions, namely, interruption of the processes of Gas Compression and Cooling and Gas Treatment and Dehydration due to snowfalls, which lead to snow clogging of equipment and units that cannot be cleaned in a short period of time.
- BSGP - The risks of “process interruption” and "reduced efficiency" are treated in equal proportions, while in ICA and AGP there is a significant bias towards “process interruption”
- AGP - The Change in Average Annual Precipitation risk factor is most relevant for this Affiliate because the Affiliate has more hazardous river crossings and is at greater risk of ground subsidence.

A more detailed description of the risks is provided in the physical risk register in Annex 2 (Tables 40–42).

Gas distribution and regional gasification: KTGA

The main production processes where physical risks have been identified are as follows: Gas pressure regulation and Transportation through gas distribution pipelines. The greatest number of risks arises from the risk factor Abnormal heat, there is a decrease in efficiency for the two highlighted processes due to deformation of parts under the influence of abnormally high temperatures.

The more important risk factor in terms of significance is "abnormal precipitation", which has a greater impact on the KTGA processes as it can lead to interruption of processes due to damage/destruction of equipment due to floods, floods, land subsidence, mudslides and landslides.

A more detailed description of the risks is provided in the physical risk register in Annex 2 (Table 43).

Resource base: E&P

Among the identified production processes of Exploration and Production Subsidiaries, the largest number of risks arises in "gas treatment" and "energy supply", the smallest number in "gas transportation" and "water supply".

The greatest number of risks for E&P S&A is caused by the risk factor "abnormal precipitation", which affects all allocated processes and may lead to interruption of processes due to flooding and waterlogging of infrastructure.

A more detailed description of the risks is provided in the physical risk register in Annex 2 (Table 4).

6.3.4.1.4 Determination of the most significant physical climatic risks for the activity of JSC NC QazaqGaz (qualitative assessment) in the context of two climatic scenarios

The conducted stage on identification of climatic risks allows to form a wide list of possible climatic risks relevant for subsidiaries and affiliates of JSC NC QazaqGaz. However, not all identified risks have the same significance for the company. Therefore, the next step was the qualitative identification of significant climatic risks.

According to the ENVID methodology, the significance of a risk is defined as the product of the degree of exposure to the risk and the probability of its occurrence. Accordingly, the qualitative assessment of physical climate risks included two main stages: determination of the probability of risk occurrence and the degree of its impact. The results of this stage are risk matrices with the dimension of 5x5, which are compiled in the context of the considered climatic scenarios and horizons. Assessment of the degree of impact

Assessment of the degree of impact of physical climatic risks is determined depending on the severity of consequences of risk realization on such parameters as:

- Length of shutdown of production processes;
- Impact on ancillary processes;
- Rise in resource consumption;
- Decrease in equipment efficiency.

Depending on the characteristics of the parameters outlined above, a five-point scale for assessing the degree of impact was formed (details in Table 14):

Table 14. Gradations of the degree of impact of physical climate risks

Minor damage	Minor damage	Localized damage	Serious damage	Mass impact
1 point	2 points	3 points	4 points	5 points
Minimal impact on core processes	Downtime of less than 1 day	Termination of work for a period of 1 day to 1 week	Termination of work for a period of 1 week to 1 month	Termination of work for a period from 1 month to 1 year
No impact on ancillary processes	Short-term stoppage of an auxiliary process (less than 1 hour) that does not entail production stoppage	Short-term stoppage of auxiliary process, remedied by in-house specialists (up to 12 hours)	Stop of main equipment, elimination of malfunction, impossible without involvement of external specialized services (up to 24 hours)	Stoppage of operation of the enterprise. Necessity to replace a piece of equipment/element of production buildings and structures
No increase in resource intensity	Increase of the process resource intensity to the upper level of the	Increase in the resource intensity of the process above the upper	Utilization of internal reserve resources	Attracting external resources

	annual average normative value	level of the annual average normative value, but without the need for additional resources		
No impact, no reduction in effectiveness	Reduced efficiency of auxiliary equipment less than 50%	Reduction of auxiliary equipment efficiency by more than 50%	Decrease in efficiency of main equipment operation less than 50%	Decrease in efficiency of main equipment more than 50%

In the context of this document, the probability of occurrence of a risk factor that may lead to the realization of risk is considered. The probability is assessed in terms of two climatic scenarios for the short-, medium-, and long-term horizons.

For JSC NC QazaqGaz two climatic scenarios were chosen, which correspond to the concept of low-carbon development of JSC Samruk-Kazyna - the main shareholder of JSC NC QazaqGaz.

The first scenario is SSP126, which predicts a 1.8°C increase in global average air temperature by 2100. This scenario corresponds to the scenario of deep decarbonization of the low-carbon development concept of JSC Samruk-Kazyna. SSP126 is a priority scenario for JSC NC QazaqGaz.

If the deep decarbonization scenario cannot be implemented, the second scenario SSP245 is considered, which predicts an increase in global average air temperature by 2.8°C by 2100. This scenario corresponds to the concept of decarbonization under the low-carbon development program of JSC Samruk-Kazyna.

Modeling approach

For better analysis of climatic risks, modeling of climatic risk factors was carried out. For the better reliability and completeness of the results the following were used:

- Data from two socio-economic development scenarios for which calculations were made using the CMIP6 ensemble of climate models: SSP126, SSP245.
- The most developed and advanced IPCC model ensemble is CMIP6, the Coupled Model Climate Intercomparison Project, which includes more than 30 models.
- Three-time horizons: near term, medium term and long term.
- Values were modeled as points across the following sites (Figure 24):
- Backbone gas transportation: compressor stations (ICA - 24 facilities, BSGP- 6 facilities, AGP - 14 facilities).
- Gas distribution and gasification of regions: gas distribution stations (including automatic) (KTGA - 100 objects).
- Resource base: Amangeldy, Zharkum, Ayrakty, Anabai and Pridorozhnoye fields.

Figure 24. Downloading values of climatic risk factors by specified coordinates (example)

As a result of the modeling, registers were generated, where for each of the above facilities, for 2 scenarios, for 3 time horizons, for all risk factors under study, changes relative to the baseline (1850-1900) were recorded in the respective units of measurement.

Estimation of probability of realization

The assessment of probability of realization of climatic physical risk factors was made on the basis of change of values for two scenarios in the context of time intervals: near term (up to 2040), medium term (2041-2060), long term (2081-2100). During the assessment it was determined that the probability of realization of physical climate risk factors significantly increases in the long term and between scenarios.

Since the values of risk factors are presented in different units of measurement, it is necessary to bring them to the same units of measurement. For this purpose, normalization to the range from 1 to 5 points for each risk factor was carried out. Using two formulas (1) and (2). Formula (1) was used for normalization of risk factors with positive dynamics, formula (2) with negative dynamics (SPI-6 index change).

$$\frac{(Xi - Xmin)}{(Xmax - X\min)} \times (5-1) + 1 \ (1)$$

$$\frac{(Xi - Xmax)}{(X\min - X\max)} \times (5-1) + 1 \ (2)$$

Normalization allows to assess the amplitude of changes, to identify maximum and minimum changes for each risk. Performing normalization allows you to assess the possible range of changes and determine the probability of each risk factor in points: what changes correspond to each point from 1 to 5.

Thus, the scale of assessment of the probability of risk realization in points:

- 1 - Very low
- 2 - Low
- 3 – Medium
- 4 – High
- 5 – Very high

Table 14. Probability gradations of physical climate risks realization

Risk factor	1 point	2 points	3 points	4 points	5 points
Abnormal heat, days	from 2 up to 8	from 8 up to 17	from 17 up to 27	from 27 up to 37	from 37 up to 42
Abnormally cold, days	from -50 to -46	from -46 down to -37	from -37 to -29	from -29 down to -20	from -20 down to -16
Abnormal precipitation, %	from 4.37 to 7.33.	from 7.34 until 1:26 p.m.	from 1:27 p.m. until 7:19 p.m.	from 7:20 p.m. through 12/25/12	dated 25.13 through 09/28/09
Snowfall, mm / day	from -0.14 to - 0.13	from -0.12 to -0.09	from - 0.08 to -0.06	from -0.05 to -0.03	from -0.02 to -0.01
Abnormal wind, %	from -2.64 to -1.47	from -1.48 to 0.85	from 0.86 to 3.18.	from 3.19 to 5.52.	from 5.53 to 6.69
Average temperature rise, ℃	from 2.03. to 2.37	from 2.38 before 3.03.	dated 3.04. to 3.70	from 3.71 to 4.37	from 4.38 to 4.70
Minimum temperature rise, ℃	from 1.93 to 2.33	from 2.34 to 3.13	from 3.14 to 3.93	from 3.94 to 4.73	from 4.74 to 5.13
Maximum temperature rise, ℃	from 1.90 to 2.23.	from 2.24 to 2.88	from 2.89 to 3.53.	from 3.54 to 4.18.	from 4.19 to 4.50
Change in average annual precipitation, %	from 2.94 to 5.56.	from 5.57 to 10.79	from 10.80 by 4:02 p.m.	dated 3/16/03. until 9:24 p.m.	from 21.25. to 23.86.
SPI-6 index change, %	from 68.30 to 76.09	from 52.71 to 68.29.	from 37.12 to 52.70.	from 21.53. to 37.11.	from 13.72 until 9:52 p.m.
Caspian Sea level fall, in meters	from -29 to -31.25.	from -31.26 to -35.75.	from -36.76 to -40.25	from -40.26 to -44.75.	from -44.76 to -47

Results of the qualitative assessment. Significance of risk

The result of the qualitative assessment of physical climate risks are matrices for each of the two scenarios in terms of time horizons. The matrices are obtained by intersecting the probability of risk realization under the scenarios and the degree of impact with the corresponding significance assessment. Significance was assessed by the product of the probability of realization by the degree of impact, i.e. the significance values range from 1 to 25.

Thus, all risks can be mapped onto a matrix (Table 15), which will be consistent with the ENVID qualitative assessment approach. The matrix has a dimensionality of 5 by 5, but in ENVID the matrix is 6 by 6 - the reduction of the matrix is due to the fact that zero impact was not considered, as the retrospective analysis of climate indicators did not reveal zero changes. In accordance with the scores for probability and degree of impact, a risk matrix was formed, in which 3 categories of risks can be distinguished (which corresponds to the ENVID methodology):

Low risk - identified risks for which no further mitigation measures are required. Risk monitoring is required to prevent the risk from moving out of the green area.

Medium risk - identified risks are acceptable if appropriate control measures are defined and implemented. In addition to monitoring, it is recommended to carry out mitigating measures to prevent an increase in the probability of risk realization.

High risks are identified risks that require the implementation of not only mitigating measures, but also measures to adapt to climate change. For these risks, measures to prevent the impact of this risk on the Company's activities should be actively pursued. It is this category that refers to the most significant physical climate risks.

Table 16. Matrix of climatic physical risks

Degree of impact	probability				
	1	2	1	4	1
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

6.3.4.1.4.1 Optimistic scenario SSP 126 (increase in global air temperature by +1.8°C by 2100)

This section reviews the climate risk matrices for each S&A under the SSP126 scenario and describes the most relevant risks over the time horizons considered. For a full list of matrices for all relevant risks for all considered S&A s, see Annex 3 (Tables 45-59).

Most of the identified climate risks are characterized by the following features:

- The significance of the risks in the SSP 126 scenario is lower than in the SSP 245 scenario;
- The significance of the risk factors in the SSP 126 scenario increases across time horizons, except for snowfall and the SPI-6 index;
- The significance of risk factors snowfall and SPI-6 is higher in the near term, since according to the modeling results these risk factors have negative dynamics;
- The significance of chronic risk factors, such as rising average air temperature and rising maximum air temperature, increases in the long term, as these risk factors have a cumulative effect that will only be felt over time.

1. ICA Affiliate

For JSC Integas Central Asia the greatest significance in the SSP 126 scenario is represented by risk factors (more than 15 points of significance):

- Snowfall;
- Rise in average temperature;
- Abnormal heat;
- Increase in maximum temperature;
- SPI-6 index change.

Near term:

6 out of 7 significant risks in the near term are associated with the realization of the risk factor "Snowfall", which may lead to interruption of processes:

- gas compression, gas cooling, gas purification and drying (especially in WKR and Aktobe region), as purification equipment is clogged with snow and it is impossible to free the equipment from snow in a short period of time;
- due to a downed power line.

One risk in the short-term horizon is related to interruption of power supply due to natural fires associated with dry periods, as West Kazakhstan, Kostanay and Aktobe regions are characterized by a relatively low value of SPI-6 index.

The significance of the risks associated with snowfall impacts is reduced in the long term because the annual amount of snowfall will decrease according to climate modeling.

Medium term:

5 out of 8 significant risks in the medium term are related to the realization of the risk factor "Snowfall", which may lead to interruption of processes:

- gas purification and dehydration;
- gas compression and cooling;
- power supply.

Three risks in the medium-term horizon are related to the decrease in the efficiency of gas compression and cooling: due to the increase in the maximum temperature and abnormal heat, the efficiency of equipment decreases and wear increases, which leads to a decrease in the efficiency of equipment (GPS, GCU).

Significance in comparison with near term has decreased for risks related to interruption of power supply, due to reduction of probability of natural fires for Aktobe region and snowfalls for West Kazakhstan region.

Long term:

5 out of 12 significant risks in the long term are associated with the realization of the risk factor "Snowfall", which may lead to interruption of processes:

- gas purification and dehydration;
- gas compression and cooling;
- power supply.

7 out of 12 significant risks in the long term are caused by temperature-related risk factors (increase in average temperature, increase in maximum temperature, abnormal heat), which lead to a decrease in the efficiency of processes:

- gas compression and cooling;
- gas purification and drying.

For the highlighted risks the significance increases exactly on the long-term horizon, because it is in this period that significant changes in the average air temperature are observed. The increase in temperature leads to interruption of the above processes and reduces the efficiency of the equipment.

Table 17. Quantitative distribution of risks by degree of significance for ICA Affiliate in SSP126 by time horizon

Number of Risks	Near term	Medium term	Long term
Low	27	25	23
Medium	12	13	11
High	7	8	12

2. BSGP Affiliate

For Beineu-Shymkent Gas Pipeline LLP, the following risk factors (more than 15 points of significance) are the most significant in the SSP 126 scenario:

- Abnormal heat;
- Increase in maximum temperature.

Near term:

Two risks in the short-term horizon are related to a decrease in the efficiency of gas compression and cooling due to abnormal heat, which affects the efficiency of equipment and increases wear and tear, leading to a decrease in the efficiency of equipment (GPS, GCU)

Medium term:

The risks described in the near term remain relevant for the medium term horizon.

Long term:

The risks described in the near term remain relevant for the long term horizon.

A distinctive feature of the Long term is the increased significance of the risks associated with an increase in the maximum temperature, which is relevant for gas compression and cooling processes. The impact manifests itself in reduced efficiency of the equipment, as the outdoor temperature affects its efficiency and increases wear and tear.

Table 18. Quantitative distribution of risks by level of significance for SSP126 BSGP S&A by time horizon

Number of Risks	Near term	Medium term	Long term
Low	18	19	18
Medium	5	4	3
High	2	2	4

3. AGP Affiliate

For Asian Gas Pipeline LLP, the risk factors are the most significant in the SSP 126 scenario (more than 15 points of significance):

- Abnormal heat.

Near term:

One risk in the short-term horizon is related to a decrease in the efficiency of gas compression and cooling due to abnormal heat, as the ambient temperature of the equipment affects its efficiency and increases wear and tear, which leads to a decrease in the efficiency of the equipment (GPS, GCU).

Medium term:

The risk described in the near term remains relevant for the medium term horizon.

Long term:

The risk described in the near term remains relevant for the long term horizon.

Table 19. Quantitative distribution of risks by level of significance for GCC SAC in SSP126 by time horizon

Number of Risks	Near term	Medium term	Long term
Low	17	15	15
Medium	7	9	9
High	1	1	1

4. QGA Affiliate

For JSC QazaqGaz Aimaq the greatest significance in the scenario SSP 126 are risk factors (more than 15 points of significance):

- Abnormal wing.

Near term:

Two risks in the short-term horizon are related to the realization of the risk factor abnormal wind, which leads to process interruption due to damage/destruction of equipment (as abnormal wind can cause trees and other objects to fall):

- gas pressure control;
- transportation through distribution pipelines;

Medium term:

The risks described in the near term remain relevant for the medium term horizon, but their importance is declining.

Long term:

The risks described in the medium term remain relevant for the long-term horizon.

Table 20. Quantitative distribution of risks by degree of significance for QGA Affiliate in SSP126 by time horizon

Number of Risks	Near term	Medium term	Long term
Low	6	6	6
Medium	8	8	8
High	2	2	2

5. EP Affiliate

For QazaqGaz Exploration and Production LLP the risk factors are the most significant in the SSP 126 scenario (more than 15 points of significance):

- Abnormal precipitation;

- Change in average annual precipitation;
- SPI-6 index change.

Near term:

2 out of 3 significant risks in the short term are related to interruption of the energy supply process, for two reasons:

- due to freezing rain caused by abnormal amounts of liquid precipitation in winter (as the amount of solid precipitation in winter in the form of snow decreases);
- due to icy rains, fall of supports, because with the increase of average annual precipitation the corrosion processes will affect the transmission line supports with greater force.

One risk in the short-term horizon is related to interruption of gas production due to natural fires associated with dry periods, as the southern regions are characterized by a relatively low SPI-6 value.

Medium term:

The risks described in the near term remain relevant for the medium term horizon, but in some cases their significance decreases (the significance of the risk of interruption of gas production process due to natural fires decreases).

Long term:

The risks described in the medium term remain relevant for the long-term horizon. The importance of risks associated with interruption of energy supply is increasing (due to abnormal precipitation in Zhambyl region, Turkestan region is added).

Table 21. Quantitative distribution of risks by degree of significance for SSP126 of E&PAffiliate by time horizons

Number of Risks	Near term	Medium term	Long term
Low	16	16	14
Medium	6	6	7
High	3	3	4

6.3.4.1.4.2 Transition scenario SSP 245 (+2.8°C increase in global air temperature by 2100)

This section reviews the matrices for each S&A in terms of the SSP245 scenario by time slice and describes the most relevant risks by time slice. For a full list of matrices for all relevant risks for all reviewed subsidiaries and affiliates, see Annex 4 (Tables 60-74).

Most of the identified climate risks are characterized by the following features:

- The significance of the risks in the SSP 245 scenario is higher than in the SSP 126 scenario;
- The significance of the risk factors in the SSP 245 scenario increases across time horizons, except for snowfall and the SPI-6 index
- Significance of risk factors snowfall and SPI-6 is higher in the near term, since according to the modeling results these risk factors have negative dynamics;
- The significance of chronic risk factors, such as increase in average air temperature, increase in maximum air temperature, increases and gains more significance in the long term,

because these risk factors have an accumulative effect, which will be felt only in the long term.

1. ICA Affiliate

For JSC Integraz Central Asia, the greatest significance in the SSP 245 scenario is represented by risk factors (more than 15 points of significance):

- Snowfall;
- Rise in average temperature;
- Abnormal heat;
- Increase in maximum temperature;
- Lowering of the Caspian Sea level.

Near term:

6 out of 6 significant risks in the near term are related to the realization of the risk factor "Snowfall", which may lead to interruption of processes:

- gas compression, gas cooling, gas purification and drying (especially in WKR and Aktobe region), as purification equipment is clogged with snow and it is impossible to free the equipment from snow in a short period of time;
- due to a downed power line.

The significance of the risks associated with snowfall impacts is reduced in the long term because the annual amount of snowfall will decrease according to climate modeling.

Medium term:

7 out of 12 significant risks in the mid-term horizon are related to the decrease in the efficiency of gas compression and cooling due to the increase in temperatures (average temperature, maximum temperature and abnormal heat), as the ambient temperature of the equipment affects its efficiency and increases the wear and tear of the equipment, which leads to a decrease in the efficiency of the equipment (GPS, GCS).

Risks related to snowfall described in the near term remain relevant for the medium term horizon, but in some cases their significance is decreasing (decrease in the significance of the risk of interruption of power supply for West Kazakhstan region).

Long term:

The temperature-related risks described in the medium term (mean temperature, maximum temperature and heat waves) remain relevant for the long-term horizon and their significance is only growing.

Risks of interruption of compression, cooling, drying and gas purification processes related to snowfall described in the near term are not relevant for West Kazakhstan region in the long term horizon, but in case of Aktobe region the risk remains, but with less significance.

A distinguishing feature of the long term is the increased significance of risks associated with rising temperatures (both average and maximum), which are relevant to the energy supply process. The impact is manifested in a decrease in energy supply efficiency, as temperatures exceeding +30 degrees Celsius significantly reduce the efficiency of microturbines, Gas Power Plants (GPPs), and Gas Compressor Stations (GCSs), because the density of the air decreases noticeably.

Table 22. Quantitative distribution of risks by degree of significance for ICA Affiliate in SSP245 by time horizon

Number of risks	Near term	Medium term	Long term
Low	27	23	17
Medium	13	11	16
High	6	12	13

2. BSGP Affiliate

For Beineu-Shymkent Gas Pipeline LLP, the most significant risk factors in the SSP 245 scenario (more than 15 points of significance):

- Abnormal heat;
- Rise in average temperature;
- Increase in maximum temperature.

Near term:

Two risks in the short-term horizon are related to a decrease in the efficiency of gas compression and cooling due to abnormal heat, as the ambient temperature of the equipment affects its efficiency and increases the wear and tear of the equipment, which leads to a decrease in the efficiency of the equipment (GPS, GCS)

Medium term:

The risks described in the near term remain relevant for the medium term horizon.

The difference from near term is the increased significance of the risks of decreased efficiency of gas compression and cooling associated with increasing average and maximum temperatures, as the ambient temperature of the equipment affects its efficiency and increases wear and tear.

Long term:

The risks described in the medium term remain relevant for the long-term horizon, but their significance has increased to 25 points (maximum grading score).

Table 23. Quantitative distribution of risks by level of significance for SSP245 BSGP Affiliate by time horizon

Number of risks	Near term	Medium term	Long term
Low	18	16	10
Medium	5	4	10
High	2	5	5

3. AGP Affiliate

For Asian Gas Pipeline LLP, the risk factors are the most significant in the SSP 245 scenario (more than 15 points of significance):

- Abnormal heat;
- Increase in maximum temperature;
- Rise in average temperature;
- Change in average annual precipitation.

Near term:

One risk in the short-term horizon is related to a decrease in the efficiency of gas compression and cooling due to abnormal heat, as the ambient temperature of the equipment affects its efficiency and increases wear and tear, which leads to a decrease in the efficiency of the equipment (GPS, GCS).

Medium term:

The risk described in the near term remains relevant for the medium term horizon.

The difference from near term is the increased significance of the risks of decreased efficiency of gas compression and cooling associated with increasing maximum temperature, as the ambient temperature of the equipment affects its efficiency and increases wear and tear, which reduces efficiency.

Long term:

The risks described in the near term remain relevant for the long term horizon.

Significance compared to medium term has increased for risks associated with an increase in average annual precipitation, which may lead to interruption (caused by softening of the ground) of the following processes:

- gas transportation due to ground subsidence at the pipeline locations;
- gas cleaning due to ground subsidence at the location of equipment and units;
- gas compression and cooling due to ground subsidence at the location of equipment and units;
- power supply due to ground subsidence in the areas where power lines are located.

A distinctive feature of the Long term is the increased significance of the risk associated with an increase in average temperature, which is relevant to the gas compression and cooling process. The impact manifests itself in reduced efficiency as the ambient temperature of the equipment affects its efficiency and increases wear and tear, which reduces efficiency.

Table 24. Quantitative distribution of risks by level of significance for AGP Affiliate in SSP245 by time horizon

Number of risks	Near term	Medium term	Long term
Low	17	14	14
Medium	7	9	4
High	1	2	7

4. QGA Affiliate

For JSC QazaqGaz Aimaq the greatest significance in the scenario SSP 245 are risk factors (more than 15 points of significance):

- Abnormal winds;
- Abnormal precipitation;
- Abnormal heat;
- Change in average annual precipitation.

Near term:

2 out of 4 risks in the short-term horizon are related to the realization of the risk factor abnormal wind, which leads to process interruption due to damage/destruction of equipment (as abnormal wind can cause trees and other objects to fall):

- gas pressure control;
- transportation through distribution pipelines.

2 out of 4 risks in the short-term horizon are related to the realization of the risk factor abnormal precipitation, which leads to process interruption due to damage/destruction of equipment (as abnormal precipitation can cause floods and development of mudflow and landslide processes):

- gas pressure control;
- transportation through distribution pipelines

Medium term:

The risks described in the near term remain relevant for the medium term horizon.

Long term:

The risks described in the near term remain relevant for the long-term horizon. If in the near term abnormal precipitation is relevant for Shymkent, in the long term the significance increases for Almaty.

In the long term, the significance of the growth of average annual precipitation increases, which has a similar impact mechanism to abnormal precipitation, i.e. it leads to interruption of gas regulation and transportation processes due to damage/destruction of equipment due to floods and development of mudflows and landslides. But the difference is that the increase in the average annual amount increases the frequency of occurrence of these processes, while abnormal precipitation increases the strength of impact.

In addition, the risks of reduced efficiency of gas transportation through distribution pipelines and gas pressure regulation due to premature wear of equipment caused by deformation of parts under the influence of abnormal heat increase in importance.

Table 25. Quantitative distribution of risks by level of significance for KTGA Affiliate in SSP245 by time horizon

Number of risks	Near term	Medium term	Long term
Low	6	6	2
Medium	6	6	4
High	4	4	10

5. EP Affiliate

For Exploration and Production QazaqGaz LLP, the risk factors are the most significant in the SSP 245 scenario (more than 15 points of significance):

- Abnormal heat;
- Abnormal precipitation;
- Increase in maximum temperature;
- Change in average annual precipitation;

- SPI-6 index change.Аномальная жара;

Near term:

2 out of 3 significant risks in the short term are related to interruption of the energy supply process, for two reasons:

- due to freezing rain caused by abnormal amounts of liquid precipitation in winter (as the amount of solid precipitation in winter in the form of snow decreases);
- due to icy rains, fall of supports, because with the increase of average annual precipitation the corrosion processes will affect the transmission line supports with greater force.

One risk in the short-term horizon is related to interruption of gas production due to natural fires associated with dry periods, as the southern regions are characterized by a relatively low SPI-6 value.

Medium term:

The risks described in the near term remain relevant for the medium term horizon, but in some cases their significance decreases (the significance of the risk of interruption of gas production process due to natural fires decreases).

In the medium term, two risks are growing in importance:

- reduced supply efficiency due to the need to provide employees with more special cooling and rest breaks, which are included in working hours under the labor code of the RK;
- interruption of power supply due to destruction of power lines due to ice rains caused by abnormal amounts of liquid precipitation in winter.

Long term:

The risks described in the medium term remain relevant for the long-term horizon and their importance is growing, except for the risk of interruption of the gas production process due to natural fires (this risk is no longer relevant in the long-term horizon).

A distinctive feature of the Long term is an increase in the importance of risks associated with the main production processes (whereas in the near and medium term the impact was only on auxiliary processes) of E&P Affiliate: gas gathering system, gas treatment, gas transportation. The impact of these risks is manifested as follows:

- interruption of the gas production process due to flooding and waterlogging of infrastructure, which may be caused by abnormal rainfall;
- interruption of the gas preparation and transportation process due to ground subsidence at infrastructure locations, which is caused by softening of the ground due to an increase in the average annual precipitation;
- reduced gas treatment efficiency due to lower equipment efficiency as ambient temperature affects its efficiency.

Table 26. Quantitative distribution of risks by level of significance for the SSP 245 E&P S&A by time horizons

Number of Risks	Near term	Medium term	Long term
Low	16	11	8
Medium	6	9	9
High	3	5	8

6.3.4.2 Transient climate risks

6.3.4.2.1 Methodology for identification of transient climate risks

Identifying transient climate risks is an integral part of strategic risk management and sustainable development activities. This allows the Company to take into account current trends such as global decarbonization of production processes, a shift in consumer preferences towards less carbon-intensive products, stricter climate change-related legislation, etc. and ensure that the Company is prepared for future challenges and opportunities.

As noted in the previous sections, transient climate risks fall into four categories:

- political and legal;
- technological;
- market-based;
- reputational.

Similar to physical climatic risks identification of transitional risks had the following approach: for each category were identified significant risk factors, which were analyzed possible risks. Since the transitional risks are less tied to geography (level of regions, oblasts), their assessment was carried out at the level of JSC NC QazaqGaz without detailing by subsidiaries and affiliates.

Due to the specific nature of transitional risks, there is no common source for identifying the risk factors of transitional risks, so different sources were considered for each category.

Political and legal risks

1. *Analysis of the legal framework:* study of existing and potential future regulations related to climate change and reduction of GHG emissions in Kazakhstan and in the world. On their basis, the risk factors associated with the introduction or tightening of carbon legislation were identified.
2. *Assessing policy trends:* analyze policy trends and orientations regarding climate issues, such as the introduction of carbon taxes or energy efficiency standards.

Technological risks

1. *Innovative changes:* identification of new technologies that can have a significant impact on the Company's operations, such as modernization of equipment and replacement with more energy-efficient equipment, transition to greener installations.
2. *Research and development:* analyze the investment in research and development that may be necessary to adapt to new technological requirements.

Market risks

1. *Changes in consumer demand:* assessing the impact of climate change on consumer demand and supply in the oil and gas industry. Analyze market trends and consumer preferences related to low-carbon products and services. Identify potential changes in gas demand, carbon pricing.
2. *Competitive adaptation:* analysis of climate change adaptation measures by competing companies.

Reputational risks

1. *Communications management:* analyzing a company's readiness to effectively manage its reputation in the context of climate risks.
2. *Social research:* analyzing public opinions and expectations of the oil and gas industry in the context of climate issues (falling reputation of gas companies against the backdrop of the transition to a low-carbon economy).

The above sources allowed the Company to determine the list of relevant risk factors that may lead to the occurrence of transient climatic risks. Relevant for JSC NC QazaqGaz transient risks are described in the following section.

6.3.4.2.2 List of relevant transient climatic risks for JSC NC QazaqGaz

JSC NC QazaqGaz has identified relevant transitional risks for itself, taking into account the TCFD recommendations and provisions of IFRS S2.

Table 27. List of relevant transient climatic risks for JSC NC QazaqGaz

№	Risk factor	Risk	Risk description	Responsible
Political and legal				
1	GHG emission quotas at the national level	Cost increase	Increase in costs caused by exceeding and purchasing additional quotas due to the tightening of carbon regulation in Kazakhstan, namely the introduction of a carbon tax, which implies the introduction of thresholds for permissible specific GHG emissions to strengthen the pace of decarbonization and achieve the national goal 2060, as well as due to the reduction in the volume of quotas issued to QazaqGaz subsidiaries and affiliates.	Strategy and Sustainable Development Department
2	Introduction of mandatory disclosure of information on climate risks	Additional resource requirements	Increase in additional reporting costs due to the introduction of non-financial information disclosure requirements under IFRS S1, S2.	Strategy and Sustainable Development Department
3	Introduction of restrictions on methane emissions in connection with the development of a national methane plan within the framework of the methane charter	Increased costs due to the introduction of state restrictions on methane emissions caused by the development of a national methane plan within the framework of the methane charter	Increase in costs due to governmental restrictions on methane emissions (e.g., national methane emission reduction program) in accordance with the Global Agreement on Methane Emissions Reductions	Strategy and Sustainable Development Department
4	Carbon regulation in China	Cost increase	Increased costs due to the potential implementation of a carbon mechanism in China	Strategy and Sustainable Development Department
Technological				

5	The need to introduce low-carbon technologies according to the Strategy for Achieving Carbon Neutrality of the Republic of Kazakhstan	Increased costs caused by the introduction of technologies to reduce emissions and/or increase GHG sequestration	Increase in the cost of implementing technologies to reduce emissions	Production and technical department
6	Development of low-carbon technologies	Increase in costs due to purchase of I-REC certificates	Increased costs associated with the use of emission offset mechanisms of coverage 2 I-REC certificates	Production and technical department
7	Equipment modernization requirements	Cost increase	Increase in costs as a result of capital investments for modernization of equipment to reduce GHG emissions and to comply with the requirements of BAT approved in the Oil and Gas Production BAT manuals	Production and technical department
Market				
8	Changes in demand for fossil fuels	Decrease in profit due to lower gas demand	Decreased profit as a result of lower demand for natural gas due to the global trend towards decarbonization and divestment from fossil fuels	Strategy and Sustainable Development Department
Reputational				
9	Stigmatization of the gas industry	Decrease in investment attractiveness	Decrease in investment attractiveness due to stigmatization of the gas industry and global priority of RES energy use, which will lead to the outflow of key stakeholders (banks, investors, stock exchanges, etc.).	Strategy and Sustainable Development Department

Political and legal transition risks - risks associated with changes in international and state legislative acts and requirements. For JSC NC QazaqGaz there are two main levels of risks entailing the growth of costs: national and international. The national level includes: tightening of carbon regulation in Kazakhstan, namely the introduction of a carbon tax, which implies the introduction of thresholds for permissible specific GHG emissions to increase the rate of decarbonization and achieve the national goal of carbon neutrality until 2060, as well as the introduction of state restrictions on methane emissions (eg, national program to reduce methane emissions) in accordance with the Global Agreement to Reduce Methane Emissions. The international level includes: the potential introduction of a mechanism of transboundary carbon regulation in China, as well as additional costs for reporting caused by the introduction of requirements for disclosure of non-financial information under IFRS S1, S2.

Technological transition risks are risks associated with the introduction of new technologies that facilitate the transition to a low GHG emission and more energy efficient economy. The main risk-factors of technology improvement are the requirements of equipment modernization, as well as the development of low-carbon technologies (RES). JSC NC QazaqGaz may face increased costs associated with the introduction of technologies that reduce emissions. In particular, costs associated with the use of scope 2 emission offset mechanisms (I-REC certificates) are increasing. In addition, the costs associated with capital investments required to modernize equipment and bring it into

compliance with the requirements of the best available technologies (BAT) set out in the BAT guides in "Oil and Gas Production" to reduce greenhouse gas emissions are increasing.

Market transition risks are risks associated with changes in consumer behavior and increase in the cost of raw materials for manufactured products. In JSC NC QazaqGaz, the key market transitional risk is a decrease in revenue due to changes in demand for fossil fuels.

Reputational transition risks - risks related to the perception of the company from the side of investment attractiveness and customer demand. Stigmatization of the gas industry may lead to a decrease in investment attractiveness for JSC NC QazaqGaz, which together with the global priority of RES energy use will lead to the outflow of key stakeholders.

6.3.4.2.3 Determination of the most significant transient climatic risks for the activity of JSC NC QazaqGaz (qualitative assessment) in the context of two climatic scenarios

Not all identified transitional risks have the same significance for the Company. Therefore, the potential damage resulting from the realization of these risks was further assessed. Qualitative assessment of transient climate risks included two main stages: determination of the probability of risk realization in the context of two selected scenarios and the degree of its impact.

Estimation of probability of realization

The transient climate risk likelihood assessment is a process of qualitatively assessing the likelihood of various scenarios (SSP 126, SSP 245) and risks associated with climate change.

For identified risks, a qualitative assessment is made about the possibility of realization of the risk factor under consideration. This may include assessing the likelihood of changes in legislation, assessing the need for technological upgrades, market changes and other factors related to the transition to more sustainable practices in response to climate challenges.

Based on this analysis, a probability score is awarded on a scale from 1 to 5, where each score corresponds to a certain probability of realization of the risk factor under consideration (in percent):

- 1 point - <5%;
- 2 points - 5–25%;
- 3 points - 25–40%;
- 4 points - 40–80%;
- 5 points - >80%.

Probability scores were assigned for two scenarios (SSP 126, SSP 245) and in terms of three-time intervals: before 2040, 2041-2060, 2081-2100.

Impact assessment

The degree of impact of transitional climate risk reflects the measure of impact that climate change and strategies for transition to sustainable practices may have on the Company's operations. Therefore, to assess the degree of impact, the most representative indicator is financial losses (damage).

Based on the diversity and heterogeneity of transient climate risks, the assessment of financial damage takes on an individual character. This is due to different regulations, the level of technological development and other factors that determine the unique characteristics of each risk.

The following steps were taken to assess the degree of impact:

1) Development of a methodological approach for calculating the financial damage caused by the realization of transient climate risks. An individual calculation method is established for each risk due to unique features and factors causing the risk.
2) Identify the necessary metrics to calculate, including the factors and quantitative metrics that affect risk.
3) Conducting a top-level quantitative assessment based on different scenarios and time periods, allowing for a variety of scenarios and damage dynamics over time

Further, each risk was assigned a score from 1 to 5, where each score corresponds to the amount of financial damage. These ranges correspond to the general corporate methodology of risk assessment of JSC NC QazaqGaz. The degree of risk that JSC NC QazaqGaz is ready to take in order to achieve its strategic and operational objectives is determined by the risk appetite, which should not exceed 10% of consolidated EBITDA. Thus, the size of the risk appetite in 2022 is equal to 49.5 billion tenge.

Table 29. Gradations of the degree of impact of transient climate risks

Score	Description	Quantitative assessment	
		% of risk appetite	billion tenge
1	Absence of any consequences in case of risk realization	25%	< 12,375
2	Consequences from the realization of the risk are not significant	50%	12,375-24,75
3	The consequences from the realization of the risk are not significant and can be fully corrected	75%	24,75-37,125
4	The consequences from the realization of the risk are very significant, but can be corrected to a certain extent	100%	37,125-49,5
5	If the risk is realized, the Company will be practically unable to recover from the consequences associated with this risk	above the risk-appetite level	>49,5

Thus, a specialized assessment method is developed and applied for each risk, taking into account its specific characteristics and impact:

Table 29. Transient climate risk assessment methods

Risk	Indicators for calculating the financial burden
Political and legal	
Increase in costs caused by exceeding and purchasing additional quotas due to the tightening of carbon regulation in Kazakhstan, namely the introduction of a carbon tax, which implies the introduction of thresholds for permissible specific GHG emissions to strengthen the pace of decarbonization and achieve the national goal 2060, as well as due to the reduction in the volume of quotas issued to QazaqGaz subsidiaries and affiliates.	1) Volume of greenhouse gas emissions for 2022 2) Number of greenhouse gas emission allowances for 2021 according to the National Greenhouse Gas Emission Allocation Plan 2021 3) Average value of carbon unit at auction in 2021 in the Republic of Kazakhstan 4) Percentage of reduction in the number of issued quotas according to the national greenhouse gas emission reduction targets of the Republic of Kazakhstan
Increase in additional reporting costs due to the introduction of non-financial information disclosure requirements under IFRS S1, S2.	1) Average salary of an ecologist in Kazakhstan per year in tenge 2) Percentage growth of real wages in Kazakhstan 3) Number of staff required
Technological	

Increase in the cost of implementing technologies to reduce emissions	1) The market value of building large-scale renewable energy infrastructure facilities such as: wind farm, solar power plant and hydroelectric power plant.
Increased costs associated with the use of emission offset mechanisms of coverage 2 I-REC certificates	1) Emissions of scope 2 for 2021 in thousand tons CO2-eq. 2) Target for scope 2 emissions by 2032, assuming implementation of the recommended reduction measures 3) Global average price of I-REC certificates
Market	
Decreased profit as a result of lower demand for natural gas due to the global trend towards decarbonization and divestment from fossil fuels	1) Volume of international transit of JSC «NC «QazaqGaz» for 2022, in mln m^3 2) Natural gas demand forecast (bcm) from the International Energy Agency 3) Purchase price of gas per 1000 cubic meters by China
Reputational	
Decrease in investment attractiveness due to stigmatization of the gas industry and global priority of RES energy use, which will lead to the outflow of key stakeholders (banks, investors, exchanges, etc.).	1) Income of NC QazaqGaz JSC from financial investments for 2022, in tenge 2) World Natural Gas Transportation Investment Forecast from the International Energy Agency

6.3.4.2.4 Results of scenario analysis (SSP126, SSP245)

The qualitative climate risk assessment phase allowed the formation of a broad list of transient climate risks, but not all of the identified risks were qualitatively assessed due to some limitations:

- lack of forecasts on the expected number and mechanism of methane emission quotas allocation did not allow assessing the risk associated with the increase in costs resulting from the introduction of state restrictions on methane emissions in accordance with the national methane emission reduction program;
- The lack of data on the carbon intensity threshold in China did not allow an assessment of the risk associated with increased costs resulting from the potential introduction of a carbon regulatory mechanism in China;
- Due to the fact that the BAT Reference Book "Oil and Gas Production" has not yet been implemented, it is impossible to assess the risk of cost growth as a result of capital investments in modernization of equipment to reduce GHG emissions and comply with the requirements of the approved BAT.

The significance of transient climate risks, for which a qualitative assessment was conducted, is considered in the context of two climate scenarios on a short-, medium-, and long-term horizon.

The first SSP126 scenario predicts a 1.8°C increase in global average air temperature by 2100. The scenario is characterized by stringent climate policies, rapid decarbonization and a focus on sustainable development. It assumes that aggressive measures are taken to mitigate climate change.

The second scenario, SSP245, projects a 2.8°C increase in global average air temperature, by 2100. The scenario is characterized by a trajectory of increasing greenhouse gas emissions over the century and assumes that mitigation efforts will be limited and global emissions will continue to increase significantly.

Table 30. Results of the assessment of the significance of transitional risks in the context of two scenarios

№	Risk factor	Risk	Significance of risk in SSP-126			Significance of risk in SSP-245		
Political and legal			**Short term**	**Medium term**	**Long term**	**Short term**	**Medium term**	**Long term**
1	GHG emission quotas at the national level	Cost increase	**5**	**5**	**0**	**5**	**5**	**5**
2	Introduction of mandatory disclosure of information on climate risks	Additional resource requirements	**5**	**5**	**5**	**5**	**5**	**5**
Technological								
3	The need to introduce low-carbon technologies according to the Strategy for Achieving Carbon Neutrality of the Republic of Kazakhstan	Increased costs caused by the introduction of technologies to reduce emissions and/or increase GHG sequestration	**6**	**20**	**0**	**6**	**15**	**4**
4	Development of low-carbon technologies	Increase in costs due to purchase of I-REC certificates	**5**	**5**	**0**	**5**	**5**	**5**
Market								
5	Changes in demand for fossil fuels	Decrease in profit due to lower gas demand	**10**	**25**	**0**	**10**	**20**	**25**
Reputational								
6	Stigmatization of the gas industry	Decrease in investment attractiveness	**12**	**15**	**0**	**6**	**8**	**15**

The results of the scenario analysis revealed both significant general trends and peculiarities characterizing the dynamics of transient climatic risks for JSC NC QazaqGaz.

General trends

Scenario analysis revealed similar features in the realization of certain risks, especially in the sphere of political, legal and technological aspects. Risks associated with the purchase of additional carbon credits, reporting on the disclosure of non-financial information and the use of I-REC certificates, demonstrates a homogeneous nature of realization in both scenarios considered. These risks during the relevant time horizons belong to the category with low significance, assessed at 5 points according to the established classification. The exception is the long-term horizon for the risks associated with the purchase of additional carbon credits and the use of I-REC certificates, which is due to limitations in the calculation of significance at the medium-term horizon due to compliance with national targets for achieving carbon neutrality by 2060 and targets to achieve 50% of the energy mix from renewable sources by 2050.

In addition, the risk associated with the introduction of technologies aimed at reducing greenhouse gas emissions can be attributed to the general context. This risk manifests itself in a similar way in both scenarios, with high significance in the medium-term horizon and low significance in the near-term horizon. However, there is a noticeable difference in this risk, namely

the lack of significance in the long-term horizon in the SSP126 scenario, which is due to the limitation of the national goal to achieve carbon neutrality by 2060.

Features

The differences between the two scenarios are manifested in the realization of market and reputational risks. The risk associated with a decrease in revenue due to lower demand for natural gas due to global trends of decarbonization and fossil fuel divestment has different dynamics. It is projected, according to the IEA, that in the NZE (Net Zero Emissions by 2050) scenario, corresponding to SSP126, natural gas demand will decrease to zero by 2060, while in the APS (Announced Pledges Scenario) scenario, corresponding to SSP245, this will only happen by 2100. This factor determines different dynamics of risk realization in different time horizons.

The risk associated with a decrease in investment attractiveness due to the stigmatization of the gas industry also shows significant differences due to a significant divergence in the degree of significance. In the NZE scenario, this risk is characterized by medium significance in the near-term horizon and high significance in the medium-term horizon. In the APS scenario, the risk of medium significance is present only in the medium-term horizon, while high significance is observed in the long-term horizon. This is explained by the fact that according to the IEA projections in SSP126, global investments in natural gas transportation are planned to be reduced to zero by 2060, while in the SSP245 scenario this will only happen after 2100.

Decrease in demand for natural gas and decrease in investment attractiveness represent risks of high significance, but they have different impacts. Since reduction in demand for natural gas is assigned 25 points, and reduction in investment attractiveness only 15 points, it is justified by the fact that losses from loss of investment income are less significant for JSC NC QazaqGaz. Financial investment income in 2022 amounted to approximately 36 billion tenge, which means that the loss of 100% of investment is not comparable to the reduction of natural gas demand to zero, which may cause damage of more than $1 billion.

6.3.4.3 Climatic possibilities

6.3.4.3.1 Methodology for identifying climate opportunities

In the context of developing a climate risk management and decarbonization program for JSC NC QazaqGaz, it is necessary to consider the relationship between climate opportunities and risks, since any climate change can be considered as a risk for the Company on the one hand, and as an additional opportunity on the other. Climate opportunities, in this context, represent prospects for achieving positive results during the Company's transition to a low-carbon economy.

The classification of climate opportunities can be presented in the form of several categories reflecting different aspects of the Company that can significantly benefit from adaptation and transition to sustainable practices. According to TCFD recommendations, climate opportunities are identified under the following categories:

1. Efficient use of resources. Reducing overall energy consumption and increasing the Company's productivity by implementing energy efficient technologies in production processes. Realization of the opportunity through replacement of outdated technologies with more energy-efficient analogues, implementation of modern monitoring and control systems, as well as regular maintenance of equipment to maintain its efficiency.

2. Energy sources: Conversion of production to alternative energy sources such as solar and wind energy. Stimulate the realization of the opportunity by providing financial support or subsidies for the purchase of solar panels, wind turbines and related equipment.

3. Markets: Diversification of the Company's activities through the search for new markets and assets. The main driver of the opportunity is interaction with government agencies and banks, which makes it possible to obtain green financing and loans at lower rates when implementing environmental projects.

4. Products and services: Introduce innovative low-emission products and services. Realize the opportunity by providing products and services to realize low carbon demand such as green and blue hydrogen production with energy efficiency throughout the supply chain.

5. Sustainability: Development of the Company's business model taking into account climate change and related transitional and physical risks. Adaptation to the dynamics of climate change through the integration of climate factors into the Company's development strategy, as well as increasing the Company's investment attractiveness.

The identification was based on different sources depending on the category of climate capabilities considered:

1. Analyzing the legal framework: The study of regulations governing climate change and low-carbon energy transition was carried out.

2. Technological innovations: The applicability of new technologies for decarbonization and energy efficiency has been analyzed. As a result of technological advances, there is an opportunity to use innovative methods to increase energy efficiency, reduce carbon footprint (including blue hydrogen production, biomethane and CCUS implementation) and optimize resource consumption. Innovation can lead to increased profits through the realization of new products and services.

3. Market trends and consumer preferences: Opportunities in new markets or asset types have been sought to diversify the Company's operations and better prepare for the transition to a low-carbon economy. Increased demand for gas as a transition fuel may contribute to the Company's earnings. In addition, the Company may be able to obtain green loans and raise green finance as it implements its own decarbonization projects

4. Exploring renewable energy sources: Considered the possibility of introducing renewable energy production (RES) for own needs and its commercialization, which contributes to increasing the Company's investment attractiveness.

6.3.4.3.2 List of relevant climatic opportunities for JSC NC QazaqGaz

The result of identification is a register of relevant climate opportunities for JSC NC QazaqGaz.

Table 31. Register of climatic opportunities of JSC NC QazaqGaz

№	Factor	Effect	Opportunity
Efficient use of resources			
1	Availability of energy efficient solutions	Cost reduction	Reduction of costs by increasing the efficiency of production and sales processes through the implementation of energy-efficient solutions
Energy sources			

2	Subsidizing and state support for the use of RES technologies	Cost reduction	Reduction of costs of RES technology implementation through subsidies
3	Growing demand for low-carbon products	Increase in revenue	Increase in revenue from production and sale of RES energy
Products and services			
4	Growing demand for low-carbon products	Increase in revenue	Increase in revenue from production and sale of "green and blue hydrogen"
5	Implementation of climate projects under Art. 6 par 4 and international cooperation under Art. 6 p. 2 of the PC	Increase in revenue	Increase in revenue from the sale of carbon units generated by climate projects
6	Development of low-carbon technologies	Increase in revenue	Increase in revenue from the provision of transportation services for captured CO2 as part of the development of the carbon capture, storage and transportation system (CCUS), as well as transportation of biomethane and biogas. JSC NC QazaqGaz can transport biomethane/biogas to end-users as a low-carbon alternative to conventional natural gas.
Sustainability			
7	Utilization of green finance mechanism	Growth of investment attractiveness	Increased investment attractiveness due to obtaining green financing (obtaining green loans) for decarbonization projects (RES, modernization of buildings and equipment, introduction of energy efficient equipment)
8	Changes in the availability of capital	Growth of investment attractiveness	Increased investment attractiveness of the Company due to obtaining GGCS (Green Gas Certification Scheme) certificate
9	Temperature rise	Cost reduction	Reduced costs due to higher temperatures, as heating costs for facilities and equipment will be reduced.
Markets			
10	Increase in gas demand	Increase in revenue	Increase in revenue due to increased demand for gas, caused by: substitution of coal with gas as part of the energy transition; conversion of coal-fired CHPPs to gas in all major cities of gasified regions of the Republic of Kazakhstan (according to the action plan for the implementation of the Concept for the transition of the Republic of Kazakhstan to a "green economy" for 2021-2030); the need to maintain balance in energy systems with the growing number of RES (RES are non-permanent energy sources, they need backup generation from fossil fuel power plants).

Efficient use of resources. Rational use of resources is of particular importance in the context of JSC NC QazaqGaz. Improvement of efficiency of production and sales processes occurs due to successful implementation of energy efficient solutions, which ultimately leads to resource savings and reduction of financial costs of the Company.

Energy sources. Two factors stand out in the energy sector: subsidies and government support for the deployment of renewable energy technologies (RES), and growing demand for low-carbon products. Each factor causes a positive effect, contributing to the growth of investment attractiveness and increasing profits. Opportunities for of JSC NC QazaqGaz are manifested in the reduction of costs in the implementation of RES technologies due to the receipt of subsidies and increased revenue from the production and sale of alternative energy.

Products and services. Within the category, the key effect for JSC NC QazaqGaz is profit growth. As a result of increasing demand for low-carbon products and the development of technologies to reduce carbon emissions, opportunities for the Company to increase revenue through the production and sale of "blue hydrogen", as well as providing services for transportation of captured CO2 within the development of carbon capture, storage and transportation system (CCUS). Biomethane and biogas could be an alternative low-carbon product for transportation. The company, realizing climate projects under Art. 6 para. 4 and international cooperation under Art. 6 p. 2 of the Paris Agreement, it has the opportunity not only to contribute to the fight against climate change, but also to further increase its revenue from the sale of carbon units based on the results of its efforts to reduce greenhouse gas emissions.

Sustainability. There are two positive effects in the field of sustainable development of the Company - increase in investment attractiveness and cost reduction. The growth of investment attractiveness is due to the active involvement of JSC NC QazaqGaz in decarbonization projects and obtaining GGCS certificate (Green Gas Certification Scheme). Cost reduction is manifested through temperature change, which results in lower costs for personnel outfitting, heating of structures and equipment, cleaning of equipment, buildings and other infrastructure from snow.

Markets. The main driver of market relations of JSC NC QazaqGaz is the increase in demand for natural gas. This leads to growth of profit and investment attractiveness. Increase in revenue is caused by active substitution of coal with gas within the framework of national energy transition to "green economy", planned in 2021-2030 by transferring coal-fired CHPs to gas in all major cities of gasified regions of the Republic of Kazakhstan. In addition, natural gas acts as a reserve energy source to maintain the balance in energy systems with the growing number of RES. At the same time, the increase in investment attractiveness is manifested due to the rapid growth of the green finance market (issuance of green bonds and green loans), which has a positive effect in the implementation of decarbonization projects of JSC NC QazaqGaz.

6.3.4.3.3 Determination of the most significant climatic opportunities for the activity of JSC NC QazaqGaz (qualitative assessment) in the context of two climatic scenarios

The qualitative climate opportunity assessment process involved two main steps: determining the likelihood of the opportunity being realized under the two selected scenarios, and assessing the extent to which it would have a positive impact.

Estimation of probability of realization of the opportunity

The likelihood of realizing climate opportunities was assessed in terms of two climate scenarios, which are similar to those used in transient climate risk assessments (SSP 126, SSP 245).

This process involves assessing the occurrence of the opportunity factor under consideration, such as assessing the likelihood of legislative change, the possibility of receiving government support, analyzing market trends, and other factors related to shifting to more resilient practices in response to climate challenges.

Based on this analysis, opportunities are assigned a probability score on a scale of 1 to 5, where each score corresponds to a certain probability of realization of the factor in question (in percent):

- 1 point - <5%;
- 2 points - 5–25%;
- 3 points - 25–40%;
- 4 points - 40–80%;
- 5 points - >80%.

Assessment of the degree of positive impact

The degree of impact of a climate opportunity reflects the level of positive impact that is associated with the possible effects of climate change and strategies to transition to sustainable practices on the Company's operations. Therefore, to assess the degree of impact, the most representative indicator is additional sources of capital.

Based on the diversity and heterogeneity of climate opportunities, the degree of impact in monetary terms is individualized. This is due to different regulations, level of technological development and other factors that determine the unique characteristics of each opportunity.

The following key qualitative assessment steps are identified during the process of ranking climate opportunities by impact:

- Develop a methodological approach for calculating the degree of impact caused by the realization of climate opportunities. An individualized calculation method is established for each opportunity, taking into account its unique characteristics and factors.
- Identify the necessary metrics to calculate, including factors and quantitative metrics that influence climate capabilities.
- Conduct a top-level qualitative impact assessment based on different scenarios and time horizons. This allows for the consideration of a variety of scenarios and the dynamics of impact over time.

Each opportunity was then assigned a score from 1 to 5, where each score corresponds to the degree of positive impact in monetary terms. The grading of the degree of impact of climate opportunities is similar to that used in the assessment of transient climate risks.

Thus, for each opportunity, a specialized evaluation method is developed and applied to each opportunity, taking into account its specific characteristics.

Table 32. Methods for assessing climate opportunities

Opportunity	Data for calculating the degree of impact in monetary terms
Efficient use of resources	
Reduction of costs by increasing the efficiency of production and sales processes through the implementation of energy-efficient solutions	1) Plan of measures on energy saving and energy efficiency improvement of ICA LLP for 2021-2025. 2) Action Plan for energy saving and energy efficiency improvement of AGP LLP for 2023-2027. 3) Action Plan for Energy Saving and Energy Efficiency Improvement of KTGA LLP for 2021-2025.
Energy sources	

Reduction of costs of RES technology implementation through subsidies	1) Resolution of the Government of the Republic of Kazakhstan on approval of the Rules for granting investment subsidies 2) Cost of construction of RES plants
Increase in revenues from production and sale of RES energy	1) Price per kWh for WPP and SES 2) Benchmark for RES projects of the reference group companies
Products and services	
Increase in revenue from production and sale of "green and blue hydrogen"	1) Green Hydrogen Production and Distribution Project in Mangistau Oblast for 2 million tons by 2027-2031. 2) Cost of hydrogen
Increase in revenue from the sale of carbon units generated by climate projects	1) A 1000 ha forestry project aimed at the production of carbon units 2) Value of 1 carbon unit
Increase in revenue from the provision of transportation services for captured CO2 as part of the development of the carbon capture, storage and transportation system (CCUS), as well as transportation of biomethane and biogas. QazaqGaz can transport biomethane/biogas to end-users as a low-carbon alternative to conventional natural gas.	1) IEA forecast of international transit volume 2) Price for transportation and storage of CO2 3) MUP stocks in the country
Sustainability	
Increased investment attractiveness due to obtaining green financing (obtaining green loans) for decarbonization projects (RES, modernization of buildings and equipment, introduction of energy efficient equipment)	1) Assumed rate on green loans 2) Estimated cost of RES projects
Increased investment attractiveness of the Company due to obtaining GGCS (Green Gas Certification Scheme) certificate	1) Income of JSC NC «QazaqGaz from financial investments 2) IEA forecast of global clean energy investment
Reduced costs due to higher temperatures, as heating costs for facilities and equipment will be reduced.	1) CMIP6 model ensemble data 2) Electricity, heating, cooling and steam purchased for consumption, GJ 3) Volume of own production of electricity, heating, cooling, GJ 4) Specific energy intensity of JSC NC «QazaqGaz for 2019-2021, GJ/ thousand tenge

6.3.4.3.4 Results of scenario analysis (SSP126, SSP245)

This section contains the results of the analysis of potential opportunities in the context of climate change, aimed at determining the extent of their positive impacts and their likelihood of occurrence. However, despite the desire for a comprehensive assessment, not all identified climate opportunities were analyzed qualitatively. This is due to a lack of data and the absence of forecasts required to assess the potential for increased revenue due to increased gas demand caused by the substitution of coal with gas as part of the energy transition and the transition of coal-fired thermal power plants to gas in all major cities in the gasified regions of the Republic of Kazakhstan.

Scenarios that are similar to those used in transient climate risk assessments, such as SSP126 and SSP245, were used to carry out the qualitative assessment. The importance of climate opportunity analysis is a key component at short, medium and long-term time horizons in the different climate scenarios.

Thus, considering climate opportunities under both scenarios allows for an assessment of their significance and potential impacts over different time periods, providing a better understanding of

possible climate change trends and opportunities. In doing so, scenario analysis is a key tool for identifying different developmental perspectives, regardless of the specific future scenario, which provides valuable information for informed decision-making in climate policy and planning.

Table 33. Results of the assessment of the significance of climate opportunities under the two scenarios

№	Factor	Effect	Significance of the capability in SSP-126			Significance of the capability in the SSP-245		
Efficient use of resources			through 2040	2041-2060	2081-2100	through 2040	2041-2060	2081-2100
1	Availability of energy efficient solutions	Cost reduction	5	0	0	5	0	0
Energy sources								
2	Subsidizing and state support for the use of RES technologies	Cost reduction	3	5	0	3	5	4
3	Growing demand for low-carbon products	Increase in revenue	0	5	5	0	4	5
Products and services								
4	Growing demand for low-carbon products	Increase in revenue	3	5	0	3	5	0
5	Implementation of climate projects under Art. 6 par 4 and international cooperation under Art. 6 para. 2 of the PC	Increase in revenue	3	4	25	2	3	12
6	Development of low-carbon technologies	Increase in revenue	20	25	0	15	20	25
Sustainability								
7	Utilization of green finance mechanism	Growth of investment attractiveness	4	5	0	2	4	3
8	Changes in the availability of capital	Growth of investment attractiveness	6	12	15	4	8	10
9	Temperature rise	Cost reduction	5	5	5	5	5	5

In each of the scenarios considered, the Company may identify potential opportunities depending on future development trends. It is important to note that some of these opportunities acquire greater benefits depending on specific timeframes. The results obtained during the scenario analysis revealed both general trends and features that characterize the dynamics of climate opportunities for JSC NC QazaqGaz.

General trends

The analysis reveals common characteristics in the implementation of specific capabilities across categories. This facilitates the development of effective capability implementation planning strategies, ensuring their successful implementation in a variety of scenarios.

In both scenarios there is a possibility to reduce costs by implementing energy efficient solutions. These potential manifests itself only in the near horizon and is estimated at 5 points, since the relevant activities of JSC NC QazaqGaz are planned for the period up to 2025-2027. It is important to note that the expected effect of this opportunity will reach its limit in the near future, after which further reduction of energy consumption will become unaffordable. Taking into account that the plans for implementation of these measures have already been developed and are planned to be implemented in the specified period, the probability of successful implementation is more than 80%.

The next similar opportunity in both scenarios is an increase in revenue from the production and sale of energy from renewable energy sources (RES). Both scenarios are characterized by a projected increase in revenue from RES in the medium- and long-term horizon, as according to the vertical strategy, QazaqGaz aims to reduce emissions under Scope 2 by 2060 by converting two EGPAs of ICA to RES. It is important to note that the construction of both wind and solar power plants is taken into account when assessing this possibility, since these types of RES have the greatest prospects for development in the Republic of Kazakhstan. In addition, the calculations take into account that, first of all, JSC NC QazaqGaz will direct the produced energy to meet its own needs, and the excess volume will be intended for sale.

In addition to the previous opportunity, another opportunity to reduce the costs of introducing RES technologies, based on subsidies, should be highlighted. This opportunity also brings benefits in both scenarios, but its degree of impact is higher in the medium-term horizon. The support comes in the form of investment subsidies from the government, which allow reimbursement of up to 30% of the actual costs of construction and installation works and equipment purchase. This is done net of value added tax and excise duties, based on supporting documentation. The main effect of this opportunity is manifested in the medium-term horizon, taking into account the national goals of the Republic of Kazakhstan to increase the share of energy from RES to 50% by 2050.

Another promising opportunity is the increase in revenues from the production and sale of green and blue hydrogen, which was equally valued in both scenarios. This opportunity provides benefits in the near- and medium-term horizons, as JSC NC QazaqGaz is already developing a project on production and distribution of "green" hydrogen in Mangistau region for a volume of 2 million tons by 2027-2031. However, this possibility is not considered in the long-term horizon, as hydrogen will become a universal commodity by 2100 and it is expected that there will be no significant growth in profits or sales volume compared to the near and medium term.

The final common opportunity for the two scenarios is the reduction in costs due to higher temperatures. This opportunity provides consistent benefits over all time horizons. In the analysis we used data from the CMIP6 model ensemble on the average change in the number of days with temperature below 0 degrees in the regions of presence of JSC NC QazaqGaz. Taking into account the global trend of temperature increase in both scenarios, the number of days with negative temperature decreases, which contributes to savings on heating of buildings and equipment.

Distinctive features

The scenario analysis identified specific features of the realization of specific opportunities covering different categories. It is important to note that the significance of these results may vary depending on the time horizon and the chosen scenario.

The two scenarios differ markedly in the significance of the opportunity to increase revenue from the sale of carbon units. This opportunity offers significant benefits over the long-term horizon, especially in the SSP126 scenario, where it reaches a maximum significance of 25 points. This opportunity assumes climate offset projects (e.g. forestry project) to produce carbon units. The main reason for the differences between the scenarios is the projected value of a carbon unit, which is significantly higher in the SSP126 scenario (on average 2 times higher over time horizons). This is due to the fact that the SSP126 scenario is characterized by stricter regulation, therefore, the demand for carbon units will be higher than in the SSP245 scenario.

Another distinctive opportunity is the increased revenue from the provision of CO2, biogas and biomethane transportation services, as well as from the storage of captured CO2. This aspect provides substantial benefits in the near to medium term horizon. It is important to consider substitution of natural gas transportation with alternatives, as the IEA NZE scenario assumes a 48% reduction in total transportation by 2040 and a reduction to zero by 2060. In the context of the APS scenario, transportation reductions are projected at 24% by 2040, 59% by 2060 and reaching zero by 2100. This indicates the need to find alternatives for transportation, where CO2, biogas and biomethane can play this role, compensating for the decreasing share of transported natural gas. It should also be noted that the potential profit from storing captured CO2 depends on the percentage of filling of available MUP reserves. The differences between the scenarios are evident in the filling percentages: in the SSP126 scenario it is 40% by 2040 and 60% by 2060; in SSP245 it is 20% by 2040, 40% by 2060 and 40% by 2100.

Both scenarios present opportunities related to increased investment attractiveness due to the GGCS certificate. This opportunity has an impact in all time horizons, especially in the long-term horizon of the SSP126 scenario. The GGCS Clean Gas Certificate opens the door for the Company to attract investment in the clean energy sector. This is particularly relevant given that projected investment in clean energy exceeds growth in the conventional energy sectors for the foreseeable future. The main differences between the scenarios lie in the likelihood of this opportunity materializing. For the SSP126 scenario, the probability of the opportunity materializing over all time horizons is 25-40%, as this scenario represents deep decarbonization with stringent regulation, which increases the likelihood of growth in clean energy investment. In contrast, for scenario SSP245 the probability of realizing the opportunity over all time horizons is estimated to be 5-25%, as this scenario is characterized by more lenient regulation, and hence less urgent need for clean energy investments.

The final opportunity for both scenarios is to increase investment attractiveness through green finance. This opportunity promises benefits in the near to medium term horizon. Green finance refers to the possibility of obtaining green loans for sustainable projects, with interest rates significantly lower than traditional loans. This offers the Company the prospect of accessing more favorable financial resources for large infrastructure projects such as renewable energy plants. The difference between the scenarios is that, due to stricter regulation, the possibility of using green finance is limited

in the medium-term horizon for the SSP126 scenario. In the SSP245 scenario, the opportunity is considered up to 2100, but with a reduced probability over the time horizons.

6.3.5 Adaptation and mitigation measures in the field of climate change

JSC NC QazaqGaz systematically implements both measures to adapt to climate risks and activities to decarbonize and reduce energy consumption, ensuring balanced business development in the context of climate change.

6.3.5.1 Adaptation measures: resilience to climate risks

JSC NC QazaqGaz is taking systemic steps to adapt to climate change, aimed at reducing the vulnerability of infrastructure, production processes and supply chains. In the context of increasing physical climate risks - including an increase in average air temperature, more frequent droughts, changes in the water regime and an increase in extreme meteorological events - the Company considers adaptation as a key element in ensuring sustainability and continuity of operations

In 2024, a comprehensive analysis of physical climate risks was conducted covering the Company's key infrastructure facilities. As a result, a register of 67 risks was formed, classified by impact type and linked to specific assets. The analysis included both current threats (such as an increase in the frequency of extreme temperatures or floods) and long-term climate trends that potentially affect the reliability and resilience of facilities.

The adaptation measures implemented by QazaqGaz are aimed at mitigating the impact of identified risks. These include reassessing the vulnerability of process equipment, updating design standards and operating standards taking into account climatic factors, implementing solutions for power and water supply backup, and increasing the sustainability of engineering infrastructure. For the most critical facilities, local engineering surveys and adjustments to operating regulations are planned.

Along with technical measures, institutional integration of adaptation issues into strategic planning and risk management processes is carried out. Climate risks are included in the general list of ESG risks subject to annual analysis and monitoring. Regular interaction with subsidiaries is carried out to exchange information and assess the effectiveness of the measures implemented. Particular attention is paid to the development of personnel competencies in the field of climate adaptation and the formation of internal potential for the analysis and management of climate threats on a systemic basis.

6.3.5.2 Mitigation measures: emission reduction and energy efficiency

JSC NC QazaqGaz implements a large-scale set of mitigation measures aimed at reducing greenhouse gas (GHG) emissions, including methane and carbon dioxide, as well as improving the energy efficiency of production processes. The company views these measures as a strategic tool in achieving the goals of reducing the carbon footprint and sustainable development of the gas industry in the context of the transition to a low-carbon economy.

QazaqGaz's key priority in mitigation is to reduce direct emissions of methane, one of the greenhouse gases with the most significant climate impact. In 2023, the share of methane emissions in the Company's total direct emissions was more than 37%, with the largest contribution coming

from activities such as emergency and process emissions during equipment purging, leaks during operation, and flaring. To reduce them, QazaqGaz is implementing a number of technological solutions, including:

Additionally, as part of improving operational efficiency, gas-fired equipment is being modernized. The efficiency of boiler units is being increased, gas pumping units (GPU) are being repaired and cleaned, and air pre-cooling systems are being introduced. These measures not only reduce the volume of fuel burned, but also significantly improve the energy efficiency of production facilities.

Indirect emissions (Scope 2) generated by electricity consumption are also in the focus of the decarbonization agenda. QazaqGaz is taking steps to reduce its dependence on carbon-intensive electricity, including through the construction of its own renewable energy installations, the conclusion of contracts for the supply of “green” electricity and the transition of some equipment to more energy-efficient solutions. Automated energy consumption and lighting management systems are actively developing.

A separate area is participation in the greenhouse gas emissions trading system (KazETS). QazaqGaz undergoes an annual emissions inventory, ensures reporting to government agencies and plans to use flexible mechanisms, including the purchase of carbon units and the implementation of offset projects. In particular, forest climate initiatives are being considered aimed at restoring degraded lands and biological diversity, which also allows for the offsetting of part of the methane and carbon dioxide emissions.

6.4. Key findings

Reduction of greenhouse gas emissions (Scope 1, 2):

1. As a result of the analysis of the Company's current GHG emission structure and industry recommendations, key areas of the Company's decarbonization were identified, including: reduction of fugitive methane emissions, reduction of emissions from gas flaring and reduction of emissions from energy consumption.

2. As a result of the implementation of technological and organizational measures envisaged by the Green Development and Deep Decarbonization scenarios, specific emissions according to Scope 1 by 2033 can be, respectively, maintained at the 2021 level of 0.0705 tCO_2-eq./GJ, or reduced by 10% to 0.0635 tCO_2-eq./GJ. According to Scope 2, GHG emissions can be reduced by 33% compared to 2021.

Monitoring of Scope 3 GHG emissions: Scope 3 GHG emissions by category 1, 6,7,11 – 872 481,86 tCO2-eq.

Managing the risks and opportunities associated with climate change:

1. Physical climatic risks. For JSC NC QazaqGaz in the short-term horizon the number of risks that can cause a significant impact on the Company's activities is insignificant. The greatest number of risks is realized in the long-term horizon up to 2100. Moreover, if the growth of global temperature will be more than 2 degrees, the number of high risks will be 2 times more than if the growth of global temperature could be contained in the range up to 1.8 degrees.

2. Transitional climate risks. Scenario analysis revealed common trends in the realization of transitional climate risks for JSC NC QazaqGaz related to the purchase of carbon credits, reporting on non-financial information and the use of I-REC certificates - these risks have low significance in both scenarios considered. The differences between the scenarios are manifested in the realization of market and reputational risks. In the SSP126 scenario, natural gas demand is reduced to zero by 2060, while in the SSP245 scenario it is reduced only by 2100. Thus, the greatest risks arise in the medium-term horizon of the SSP126 scenario, and the most significant risk is the risk of reduced profits as a result of reduced demand for natural gas due to the global trend towards decarbonization and fossil fuel divestment.

3. Climate opportunities. JSC NC QazaqGaz has conducted a scenario analysis, identifying potential opportunities in different development scenarios tied to future trends. There are general trends covering different categories of opportunities, which allows to develop effective strategies for their realization in a variety of scenarios: reducing costs by implementing energy efficient solutions in the near-term horizon; increasing revenues from the production and sale of energy from renewable energy sources (RES) is a promising opportunity in the medium- and long-term horizon; receiving subsidies for the implementation of RES technologies also brings benefits and has a greater impact in the medium term; and increasing energy efficiency is a promising opportunity in the medium-term horizon. However, the opportunity to increase revenue from the provision of transportation services for captured CO2, biomethane and biogas is the most significant.

7. Records

7.1. There are no records in this documented.

8. Revising, amending, storing and distributing

8.1. Revision, amendment, storage and distribution of this Program shall be in accordance with the requirements of documented Program DP-02, Records Management.

8.2. The “Original” hard copy of this Program shall be executed and kept in the IMS OSP of the Company.

8.3. A scanned version of this Program shall be posted on the Company's and Affiliates Internet portal.

9. Annexes

9.1 Annex 1. Relative values of SSP126, 245 for risk factors by area (only those we considered)

Table 34. SSP126: risk factors by area, near term

	Near term									
	Physical chronic					Physical acute				
AVG	T	TN	TX	PR	SPI-6	Frost days	TX35	RX5day	Snowfall	Surface wind
Atyrau region	2.44	2.54	2.34	6.19	18.83	-25.34	16.41	9.03	-0.05	-0.50
West Kazakhstan region	2.57	2.76	2.45	6.12	23.46	-24.01	13.24	9.83	-0.05	0.16
Aktobe region	2.61	2.83	2.47	6.64	22.28	-22.16	14.50	8.76	-0.03	0.00
Mangistau region	2.26	2.24	2.16	5.54	17.43	-26.05	19.48	9.01	-0.03	-1.10

Almaty region	2.22	2.42	2.18	11.28	41.42	-24.36	10.53	10.65	-0.02	-0.66
Zhambyl region	2.28	2.49	2.26	13.71	39.87	-24.42	19.29	12.97	-0.02	-0.47
Kyzylorda region	2.47	2.63	2.38	9.75	26.61	-23.59	20.59	11.52	-0.02	-0.67
Turkestan region	2.27	2.48	2.28	13.02	34.22	-25.34	20.81	13.77	-0.03	-0.91
Kostanay region	2.54	2.81	2.38	6.58	25.81	-19.06	8.64	6.81	-0.02	1.93

Table 35. SSP126: risk factors by area, medium term

	Medium term									
	Physical chronic					Physical acute				
AVG	T	TN	TX	PR	SPI-6	Frost days	TX35	RX5day	Snowfall	Surface wind
Atyrau region	2.84	2.90	2.72	7.16	21.17	-29.03	19.96	9.62	-0.05	-0.66
West Kazakhstan region	2.99	3.15	2.86	6.92	24.53	-27.99	16.37	10.27	-0.06	0.18
Aktobe region	3.04	3.22	2.90	8.02	28.87	-25.57	17.59	9.86	-0.04	-0.11
Mangistau region	2.64	2.59	2.54	6.56	22.63	-28.61	23.44	9.07	-0.04	-1.29
Almaty region	2.66	2.85	2.63	12.77	49.27	-28.58	13.13	11.05	-0.04	-1.19
Zhambyl region	2.70	2.89	2.70	14.16	44.30	-28.51	23.43	14.09	-0.04	-1.05
Kyzylorda region	2.88	3.03	2.81	10.01	29.54	-26.94	24.65	12.33	-0.03	-1.08
Turkestan region	2.67	2.83	2.70	13.37	35.58	-29.25	24.82	13.81	-0.05	-1.45
Kostanay region	2.99	3.25	2.83	8.03	32.97	-21.73	10.97	10.07	-0.03	1.64

Table 36. SSP126: risk factors by area, long term

	Long term									
	Physical chronic					Physical acute				
AVG	T	TN	TX	PR	SPI-6	Frost days	TX35	RX5day	Snowfall	Surface wind
Atyrau region	2.94	3.04	2.85	9.35	29.69	-30.91	20.16	12.03	-0.06	-0.99
West Kazakhstan region	3.08	3.28	2.96	8.89	32.82	-29.83	16.52	13.08	-0.07	-0.31
Aktobe region	3.14	3.38	3.00	10.66	35.77	-27.87	17.24	13.35	-0.04	-0.47
Mangistau region	2.73	2.70	2.66	8.08	26.27	-30.55	23.65	12.23	-0.04	-1.55
Almaty region	2.72	2.93	2.72	14.24	52.79	-30.15	12.72	13.03	-0.04	-1.20
Zhambyl region	2.77	2.99	2.81	16.20	48.17	-30.40	23.24	17.26	-0.04	-0.92
Kyzylorda region	2.97	3.16	2.92	11.37	31.71	-28.86	24.47	15.40	-0.03	-1.17
Turkestan region	2.75	2.94	2.82	13.12	35.41	-30.97	25.15	16.56	-0.05	-1.33
Kostanay region	3.10	3.42	2.95	10.24	40.16	-23.82	10.30	11.49	-0.03	1.04

Table 37. SSP245: risk factors by area, Near term

	Near term									
	Physical chronic					Physical acute				
AVG	T	TN	TX	PR	SPI-6	Frost days	TX35	RX5day	Snowfall	Surface wind

Atyrau region	2.40	2.50	2.23	6.64	24.46	-24.42	15.89	10.75	-0.05	-0.26
West Kazakhstan region	2.52	2.70	2.33	6.81	29.18	-23.77	12.70	10.32	-0.05	0.78
Aktobe region	2.55	2.77	2.33	8.12	29.96	-21.55	13.88	9.10	-0.03	0.41
Mangistau region	2.21	2.19	2.07	6.13	23.54	-24.62	19.52	11.49	-0.03	-1.24
Almaty region	2.22	2.44	2.13	11.93	45.92	-24.70	10.79	10.87	-0.03	-0.68
Zhambyl region	2.27	2.52	2.22	13.14	43.06	-25.21	19.47	13.82	-0.03	-0.37
Kyzylorda region	2.44	2.63	2.30	9.76	30.96	-23.93	20.27	12.14	-0.02	-0.61
Turkestan region	2.27	2.49	2.23	11.42	35.11	-25.76	20.77	12.90	-0.04	-0.64
Kostanay region	2.49	2.76	2.25	7.26	27.90	-18.55	8.58	6.77	-0.02	2.97

Table 38. SSP245: risk factors by area, medium term

	Medium term									
	Physical chronic					Physical acute				
AVG	T	TN	TX	PR	SPI-6	Frost days	TX35	RX5day	Snowfall	Surface wind
Atyrau region	3.17	3.27	3.02	7.34	27.13	-32.53	22.59	13.43	-0.06	-0.62
West Kazakhstan region	3.35	3.56	3.19	6.48	26.37	-32.31	18.40	11.61	-0.07	0.42
Aktobe region	3.40	3.66	3.21	8.65	30.34	-29.18	19.93	11.49	-0.04	0.10
Mangistau region	2.92	2.86	2.78	7.59	28.59	-31.16	26.38	14.13	-0.04	-1.31
Almaty region	2.99	3.26	2.93	13.83	51.43	-32.25	15.32	13.26	-0.04	-1.18
Zhambyl region	3.03	3.32	3.03	15.41	45.04	-33.01	27.28	16.66	-0.04	-0.62
Kyzylorda region	3.22	3.45	3.11	10.07	30.35	-31.97	27.86	13.15	-0.03	-0.76
Turkestan region	3.00	3.26	3.02	12.83	37.58	-33.67	28.53	15.07	-0.05	-0.84
Kostanay region	3.36	3.72	3.14	8.12	31.29	-25.31	12.38	9.47	-0.03	2.54

Table 39. SSP245: risk factors by area, long term

	Long term									
	Physical chronic					Physical acute				
	T	TN	TX	PR	SPI-6	Frost days	TX35	RX5day	Snowfall	Surface wind
Atyrau region	4.30	4.44	4.19	10.32	36.20	-45.06	32.83	18.19	-0.09	-1.34
West Kazakhstan region	4.57	4.85	4.41	9.31	36.74	-45.29	26.93	15.50	-0.11	-0.56
Aktobe region	4.64	4.99	4.47	11.42	39.50	-41.39	29.00	16.80	-0.07	-0.58
Mangistau region	3.99	3.92	3.89	10.24	35.55	-41.57	37.42	18.42	-0.06	-1.91
Almaty region	4.06	4.39	4.04	20.76	75.50	-44.50	21.87	19.95	-0.06	-1.70
Zhambyl region	4.11	4.44	4.17	22.25	67.35	-45.27	37.73	24.49	-0.06	-1.14
Kyzylorda region	4.36	4.64	4.31	13.28	39.45	-44.28	38.38	19.20	-0.05	-1.39
Turkestan region	4.07	4.35	4.17	17.93	50.29	-45.22	38.93	22.82	-0.08	-1.11
Kostanay region	4.65	5.13	4.43	11.79	46.02	-36.39	18.27	14.26	-0.05	1.18

Table 40. Register of climatic physical risks of ICA Affiliates

	Description of risk realization	Region
1	Interruption of gas transportation due to destruction of pipeline supports by mudflows, landslides, floods, which may occur due to high precipitation, especially in foothill areas and river crossings	Zhambyl region
2	Interruption of gas transportation due to destruction of pipeline supports by mudflows, landslides, floods, which may occur due to high precipitation, especially in foothill areas and river crossings	Turkestan region
3	Interruption of gas transportation due to ground subsidence at pipeline locations caused by softening of the ground due to an increase in average annual precipitation	Zhambyl region
4	Interruption of gas treatment and drying process due to abnormal snowfall (especially in WKR and Aktobe region), as the treatment equipment is clogged with snow and it is impossible to free the equipment from snow in a short period of time. In the forecasted future there is a decrease in the amount of snowfall, but in the above mentioned areas even with a decrease this risk will be relevant	Aktobe region
5	Interruption of gas treatment and drying process due to abnormal snowfall (especially in WKR and Aktobe region), as the treatment equipment is clogged with snow and it is impossible to free the equipment from snow in a short period of time. In the forecasted future there is a decrease in the amount of snowfall, but in the above mentioned areas even with a decrease this risk will be relevant	West Kazakhstan region
6	Reduced gas cleaning and drying efficiency due to lower equipment efficiency as the ambient temperature of the equipment affects its efficiency	Aktobe region
7	Reduced gas cleaning and drying efficiency due to lower equipment efficiency as the ambient temperature of the equipment affects its efficiency	West Kazakhstan region
8	Interruption of the gas cleaning and drying process due to ground subsidence at the locations of units and equipment, which is caused by softening of the ground due to an increase in the average annual precipitation rate	Zhambyl region
9	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Turkestan region
10	Interruption of gas compression and cooling process due to abnormal snowfall (especially in WKR and Aktobe region), as equipment and units are blocked by snow and it is impossible to free them from snow in a short period of time. In the forecasted future there is a decrease in the amount of snowfall, but in the above mentioned areas even with a decrease this risk will be relevant	Aktobe region
11	Interruption of gas compression and cooling process due to abnormal snowfall (especially in WKR and Aktobe region), as equipment and units are blocked by snow and it is impossible to free them from snow in a short period of time. In the forecasted future there is a decrease in the amount of snowfall, but in the above mentioned areas even with a decrease this risk will be relevant	West Kazakhstan region
12	Interruption of gas compression and cooling due to abnormal winds, as abnormal winds can cause damage to structures (e.g., roof blow-offs), units and equipment	West Kazakhstan region
13	Interruption of gas compression and cooling due to abnormal winds, as abnormal winds can cause damage to structures (e.g., roof blow-offs), units and equipment	Aktobe region
14	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Aktobe region
15	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	West Kazakhstan region
16	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Aktobe region
17	Decrease in the efficiency of gas compression and cooling due to lower efficiency of the equipment (gas compressor, gas compressor unit), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment.	West Kazakhstan region

18	Interruption of the gas compression and cooling process due to ground subsidence at the location of units and equipment, which is caused by softening of the ground due to an increase in the average annual precipitation rate	Zhambyl region
19	Reduced efficiency of gas compression and cooling due to filling of filters with salt particles (formation of lime scale) carried by wind, as due to lowering of the Caspian Sea level and exposure of shores with finely dispersed material (including salt crystals).	Atyrau region
20	Interruption of power supply due to power line breakage due to abnormal snowfall (especially in WKR and Aktobe oblast). In the forecasted future there is a decrease in the amount of snowfall, but in the above mentioned areas even with a decrease this risk will be relevant	Aktobe region
21	Interruption of power supply due to power line breakage due to abnormal snowfall (especially in WKR and Aktobe oblast). In the forecasted future there is a decrease in the amount of snowfall, but in the above mentioned areas even with a decrease this risk will be relevant	West Kazakhstan region
22	Interruption of power supply due to damage to wires, poles, and other power systems during high winds.	West Kazakhstan region
23	Interruption of power supply due to damage to wires, poles, and other power systems during high winds.	Aktobe region
24	Decrease in the efficiency of energy supply, as the efficiency of microturbines, HPPPs and HPEAs decreases significantly when the temperature rises above +30 degrees Celsius, as the air density becomes noticeably lower	Aktobe region
25	Decrease in the efficiency of energy supply, as the efficiency of microturbines, HPPPs and HPEAs decreases significantly when the temperature rises above +30 degrees Celsius, as the air density becomes noticeably lower	West Kazakhstan region
26	Decrease in the efficiency of energy supply, as the efficiency of microturbines, HPPPs and HPEAs decreases significantly when the temperature rises above +30 degrees Celsius, as the air density becomes noticeably lower	Aktobe region
27	Decrease in the efficiency of energy supply, as the efficiency of microturbines, HPPPs and HPEAs decreases significantly when the temperature rises above +30 degrees Celsius, as the air density becomes noticeably lower	West Kazakhstan region
28	Interruption of power supply due to natural fires associated with dry periods, as West Kazakhstan, Kostanay and Aktobe oblasts are characterized by relatively low SPI-6 index value.	Aktobe region
29	Interruption of power supply due to natural fires associated with dry periods, as West Kazakhstan, Kostanay and Aktobe oblasts are characterized by relatively low SPI-7 index value.	West Kazakhstan region
30	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Turkestan region
31	Increased resource intensity of water supply due to water scarcity and cost. Due to reduced snowfall, the soil may be drier in the spring and summer months and the water table may drop, which may cause water scarcity.	Aktobe region
32	Increased resource intensity of water supply due to water scarcity and cost. Due to reduced snowfall, the soil may be drier in the spring and summer months and the water table may drop, which may cause water scarcity.	West Kazakhstan region
33	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Aktobe region
34	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	West Kazakhstan region
35	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Aktobe region
36	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	West Kazakhstan region
37	Increase in resource intensity of water supply due to increased water consumption in dry weather. During drought, water consumption for domestic purposes will increase	Aktobe region
38	Increase in resource intensity of water supply due to increased water consumption in dry weather. During drought, water consumption for domestic purposes will increase	West Kazakhstan region
39	Interruption of supply of consumables due to road flooding. Heavy rains cause flooding of plains and overflow of rivers, making road transportation inaccessible and destroying bridges used for cargo transportation.	Zhambyl region

40	Interruption of supply of consumables due to road flooding. Heavy rains cause flooding of plains and overflow of rivers, making road transportation inaccessible and destroying bridges used for cargo transportation.	Turkestan region
41	Interruption of supply of consumables due to road closures caused by abnormal snowfall (especially in WKO and Aktobe oblast). In the forecasted future there is a decrease in the amount of snowfall, but in the above mentioned areas even with a decrease this risk will be relevant	Aktobe region
42	Interruption of supply of consumables due to road closures caused by abnormal snowfall (especially in WKO and Aktobe oblast). In the forecasted future there is a decrease in the amount of snowfall, but in the above mentioned areas even with a decrease this risk will be relevant	West Kazakhstan region
43	Interruption of consumable supplies due to increased traffic accidents, which may be caused by an increase in dust storms, as the number of dust storms will increase with an increase in surface wind speed and frequency.	West Kazakhstan region
44	Interruption of consumable supplies due to increased traffic accidents, which may be caused by an increase in dust storms, as the number of dust storms will increase with an increase in surface wind speed and frequency.	Aktobe region
45	Interruptions in the supply process due to natural fires, which may occur during the dry period, as WKR, Aktobe and Kostanay regions are characterized by relatively low value of SPI-6 index, which indicates the likelihood of dry periods.	Aktobe region
46	Supply interruptions due to natural fires, which may occur during the dry period, as WKR, Aktobe and Kostanay oblasts are characterized by relatively low value of SPI-6 index, which indicates the probability of occurrence of dry periods.	West Kazakhstan region

Table 41. Register of climatic physical risks of S/As of GPBS Affiliates

	Description of risk realization	Region
1	Interruption of gas transportation due to destruction of pipeline supports by mudflows, landslides, floods, which may occur due to high precipitation, especially in foothill areas and river crossings	Turkestan region
2	Interruption of gas transportation due to ground subsidence at pipeline locations caused by softening of the ground due to an increase in average annual precipitation	Turkestan region
3	Interruption of the gas cleaning process due to ground subsidence at the locations of units and equipment, which is caused by softening of the ground due to an increase in the average annual precipitation rate.	Turkestan region
4	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Turkestan region
5	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Kyzylorda region
6	Interruption of gas compression and cooling due to flooding in areas where compressor stations are located due to sudden and intense precipitation. Floods can cause emergency shutdown of compressors due to flooding of electrical control systems	Turkestan region
7	Interruption of gas compression and cooling due to abnormal winds, as abnormal winds can cause damage to structures (e.g., roof blow-offs), units and equipment	Aktobe region
8	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Aktobe region
9	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Aktobe region
10	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Kyzylorda region
11	Interruption of the gas compression and cooling process due to ground subsidence at the location of units and equipment, which is caused by softening of the ground due to an increase in the average annual precipitation rate	Turkestan region
12	Reduced efficiency of power supply, since as temperatures rise above +30 degrees Celsius, air density becomes noticeably lower than under standard conditions, the power and efficiency of all microturbines, HPPPs and HPEAs also decrease. That is, for example, their Capstone C30 microturbine does not produce more than 20-22 kW of power (out of 30 kW) in extreme heat (+30 and above), but at such temperatures the cooling systems consume more electricity.	Turkestan region
13	Reduced efficiency of power supply, since as temperatures rise above +30 degrees Celsius, air density becomes noticeably lower than under standard conditions, the power and efficiency of all microturbines, HPPPs and HPEAs also decrease. That is, for example, their Capstone C30 microturbine does not produce more than 20-22 kW of power (out of 30 kW) in extreme heat (+30 and above), but at such temperatures the cooling systems consume more electricity.	Kyzylorda region
14	Interruption of power supply due to damage to wires, poles, and other power systems during high winds.	Aktobe region
15	Reduced efficiency of energy supply, since as temperatures rise above +30 the density of air becomes noticeably lower than under standard conditions, the power and efficiency of all microturbines, HPPPs and HPEAs also decrease.	Aktobe region
16	Decrease in the efficiency of energy supply, as the efficiency of microturbines, HPPPs and HPEAs decreases significantly when the temperature rises above +30 degrees Celsius, as the air density becomes noticeably lower	Aktobe region
17	Decrease in the efficiency of energy supply, as the efficiency of microturbines, HPPPs and HPEAs decreases significantly when the temperature rises above +30 degrees Celsius, as the air density becomes noticeably lower	Kyzylorda region
18	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Turkestan region

19	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Kyzylorda region
20	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Aktobe region
21	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Aktobe region
22	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Kyzylorda region
23	Increase in resource intensity of water supply due to shortage and appreciation of water resources due to possible droughts in Mangistau and Kyzylorda provinces	Aktobe region
24	Interruption of consumable supplies due to erosion of access roads, which may be caused by abnormal rainfall events	Turkestan region
25	Interruption of consumable supplies due to an increase in traffic accidents, which may be caused by an increase in dust storms, as the number of dust storms will increase with an increase in surface wind speed and frequency.	Aktobe region

Table 42. Register of climatic physical risks of AGP Affiliates

	Description of risk realization	Region
1	Interruption of gas transportation due to destruction of pipeline supports by mudflows, landslides, floods, which may occur due to high precipitation, especially in foothill areas and river crossings	Almaty region
2	Interruption of gas transportation due to ground subsidence at pipeline locations caused by softening of the ground due to an increase in average annual precipitation	Almaty region
3	Interruption of the gas cleaning process due to flooding of production facilities. Abnormal precipitation in the southern regions may lead to flooding, especially at facilities near water bodies.	Almaty region
4	Interruption of the gas cleaning process due to ground subsidence at the locations of power lines and equipment, which is caused by softening of the ground due to an increase in the average annual precipitation rate	Almaty region
5	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Turkestan region
6	Interruption of gas compression and cooling due to abnormal winds, as abnormal winds can cause damage to structures (e.g., roof blow-offs), units and equipment	Almaty region
7	Interruption of gas compression and cooling due to abnormal winds, as abnormal winds can cause damage to structures (e.g., roof blow-offs), units and equipment	Zhambyl region
8	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Turkestan region
9	Reduced efficiency of gas compression and cooling due to lower efficiency of equipment (GPS, GCS), as the ambient temperature of the equipment affects its efficiency and increases wear and tear of the equipment	Turkestan region
10	Interruption of the gas compression and cooling process due to ground subsidence at the location of equipment and units, which is caused by softening of the ground due to an increase in the average annual precipitation rate	Almaty region
11	Reduced efficiency of energy supply, since as temperatures rise above +30 degrees Celsius, the density of air becomes noticeably less than under standard conditions, the power and efficiency of all microturbines, HPPPs and HPEAs also decrease.	Turkestan region
12	Interruption of power supply due to damage to wires, poles, and other power systems during high winds.	Almaty region
13	Interruption of power supply due to damage to wires, poles, and other power systems during high winds.	Zhambyl region
14	Decrease in the efficiency of energy supply, as the efficiency of microturbines, HPPPs and HPEAs decreases significantly when the temperature rises above +30 degrees Celsius, as the air density becomes noticeably lower	Turkestan region
15	Decrease in the efficiency of energy supply, as the efficiency of microturbines, HPPPs and HPEAs decreases significantly when the temperature rises above +30 degrees Celsius, as the air density becomes noticeably lower	Turkestan region
16	Interruption of the power supply process due to ground subsidence in the areas where the transmission lines are located, which is caused by softening of the ground due to an increase in the average annual precipitation amount	Almaty region
17	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Turkestan region
18	Increased resource intensity of water supply due to water scarcity and cost. Due to reduced snowfall, the soil may be drier in the spring and summer months and the water table may drop, which may cause water scarcity.	Turkestan region
19	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Turkestan region
20	Increased resource intensity of water supply due to increased water consumption during hot weather. Water consumption for domestic purposes will increase as the temperature rises	Turkestan region
21	Increase in resource intensity of water supply due to increased water consumption in dry weather. During drought, water consumption for domestic purposes will increase	Turkestan region

22	Increase in resource intensity of water supply due to increased water consumption in dry weather. During drought, water consumption for domestic purposes will increase	Almaty region
23	Supply chain interruption due to road flooding. Heavy rains cause flooding of plains and rivers, making road transportation inaccessible	Almaty region
24	Supply interruption due to an increase in traffic accidents, which may be caused by an increase in dust storms, as the number of dust storms will increase with an increase in surface wind speed and frequency.	Almaty region
25	Supply interruption due to an increase in traffic accidents, which may be caused by an increase in dust storms, as the number of dust storms will increase with an increase in surface wind speed and frequency.	Zhambyl region

Table 43. Register of climatic physical risks of KTGA Affiliates

№	Description of risk realization	Region
1	Reduced efficiency of gas pressure regulation due to premature wear of equipment due to deformation of parts under the influence of abnormally high temperatures	Mangistau region
2	Reduced efficiency of gas pressure regulation due to premature wear of equipment due to deformation of parts under the influence of abnormally high temperatures	Zhambyl region
3	Interruption of gas pressure regulation process due to damage/destruction of equipment, due to floods, floods, land subsidence, mudslides and landslides caused by abnormal precipitations	Shymkent city
4	Interruption of gas pressure regulation process due to damage/destruction of equipment, due to floods, floods, land subsidence, mudslides and landslides caused by abnormal precipitations	city of Alma-Ata
5	Interruption of the gas pressure regulation process due to damage/destruction of equipment, as abnormal winds may cause trees and other objects to fall on above-ground sections of the pipeline	Kostanay region
6	Reduced efficiency of gas pressure regulation due to premature wear of equipment due to deformation of parts under the influence of abnormally high temperatures	Aktobe region
7	Reduced efficiency of gas pressure regulation due to premature wear of equipment due to deformation of parts under the influence of abnormally high temperatures	Aktobe region
8	Interruption of gas pressure regulation process due to damage/destruction of equipment, due to floods, floods, land subsidence, mudslides and landslides caused by an increase in average annual precipitation	city of Alma-Ata
9	Reduced efficiency of gas distribution pipeline transportation due to premature wear of equipment due to deformation of parts under the influence of abnormally high temperatures	Mangistau region
10	Reduced efficiency of gas distribution pipeline transportation due to premature wear of equipment due to deformation of parts under the influence of abnormally high temperatures	Zhambyl region
11	Interruption of transportation through distribution pipelines due to pipeline destruction by mudflows, landslides, floods, which may occur due to high precipitation levels	Shymkent city
12	Interruption of transportation through distribution pipelines due to pipeline destruction by mudflows, landslides, floods, which may occur due to high precipitation levels	city of Alma-Ata
13	Interruption of gas distribution pipeline transportation due to ruptures of onshore pipeline sections, as abnormal winds may cause trees and other objects to fall onto onshore pipeline sections	Kostanay region
14	Reduced efficiency of gas distribution pipeline transportation due to premature wear of equipment due to deformation of parts under the influence of abnormally high temperatures	Aktobe region
15	Reduced efficiency of gas distribution pipeline transportation due to premature wear of equipment due to deformation of parts under the influence of abnormally high temperatures	Aktobe region
16	Interruption of transportation through distribution pipelines due to pipeline destruction by mudflows, landslides, floods, which may occur due to an increase in average annual precipitation	city of Alma-Ata

Table 44. Register of climatic physical risks of EP Affiliates

№	Description of risk realization	Region
1	Interruption of gas production due to flooding and waterlogging of infrastructure, which may be caused by abnormal rainfall	Zhambyl region
2	Interruption of gas production due to flooding and waterlogging of infrastructure, which may be caused by abnormal rainfall	Turkestan region
3	Interruption of gas production process due to destruction of infrastructure by abnormal winds	Zhambyl region
4	Interruption of gas production due to fires as the risk of droughts increases in the arid southern regions	Turkestan region
5	Reduced gas treatment efficiency due to lower efficiency of the equipment as the ambient temperature of the equipment affects its efficiency	Turkestan region
6	Interruption of the gas treatment process due to damage to filtration and separation units, due to waterlogging (also water and dampness may damage electronics and mechanisms), resulting in temporary equipment shutdown. The processes listed above are associated with abnormal precipitation.	Zhambyl region
7	Interruption of the gas treatment process due to damage to filtration and separation units, due to waterlogging (also water and dampness may damage electronics and mechanisms), resulting in temporary equipment shutdown. The processes listed above are associated with abnormal precipitation.	Turkestan region
8	Reduced gas treatment efficiency due to dusty equipment. Dust and sand carried by wind during dust storms can be deposited on equipment surfaces, stronger winds can increase the intensity of dust storms.	Zhambyl region
9	Reduced gas treatment efficiency due to lower efficiency of the equipment as the ambient temperature of the equipment affects its efficiency	Turkestan region
10	Reduced gas treatment efficiency due to lower efficiency of the equipment as the ambient temperature of the equipment affects its efficiency	Turkestan region
11	Interruption of the gas treatment process due to ground subsidence at the location of units and equipment, which is caused by softening of the ground due to an increase in the average annual precipitation rate.	Zhambyl region
12	Interruption of gas transportation due to ground subsidence at pipeline locations caused by softening of the ground due to an increase in average annual precipitation	Zhambyl region
13	Reduced efficiency of power supply due to overheating of transmission lines, which may be caused by an increase in days with temperatures above 35 degrees Celsius	Turkestan region
14	Interruption of power supply due to destruction of power transmission lines due to freezing rain caused by abnormal amounts of liquid precipitation in winter (as the amount of solid precipitation in winter in the form of snow decreases)	Zhambyl region
15	Interruption of power supply due to destruction of power transmission lines due to freezing rain caused by abnormal amounts of liquid precipitation in winter (as the amount of solid precipitation in winter in the form of snow decreases)	Turkestan region
16	Interruption of the power supply process due to power line breakage, due to the impact of abnormal winds	Zhambyl region
17	Reduced efficiency of power supply due to overheating of transmission lines, which may be caused by an increase in average temperature	Turkestan region
18	Reduced efficiency of power supply due to overheating of transmission lines, which may be caused by an increase in maximum temperatures	Turkestan region
19	Interruption of the power supply process due to destruction of transmission lines due to falling supports, since with increasing average annual precipitation the corrosion processes will affect the transmission line supports with greater force.	Zhambyl region
20	Increase in resource intensity of water supply due to significant increase in water consumption due to abnormal heat wave	Turkestan region
21	Increased resource intensity of water supply due to increased water consumption. As the maximum temperature increases, water consumption will increase.	Turkestan region
22	Reduced supply efficiency due to the fact that more special cooling and rest breaks will have to be provided to employees, which are included in the working time according to the labor code of the RK.	Turkestan region

23	Interruption of supply due to erosion of access roads, which may be caused by abnormal rainfall events	Zhambyl region
24	Interruption of supply due to erosion of access roads, which may be caused by abnormal rainfall events	Turkestan region
25	Supply interruption due to an increase in traffic accidents, which may be caused by an increase in dust storms, as the number of dust storms will increase with an increase in surface wind speed and frequency.	Zhambyl region

9.2 Annex 2: Optimistic scenario SSP 126 (+1.8°C increase in global air temperature by 2100)

Table 45. Significance of physical climate risks in SSP 126 for ICA SAs

		probability				
		1	2	3	4	5
Degree of impact	1		30, 33, 34, 35, 36, 39, 40, 44	43	31, 32, 38, 41, 42, 46	37, 45
	2	19	1, 2	3, 8, 18		
	3		24, 25, 26, 27		29	28
	4		13, 23	12, 22	20, 21	
	5		6, 7, 9, 14, 15, 16, 17		4, 5, 10, 11	

Table 46. Significance of physical climate risks in mid-term SSP 126 for ICA SAs

		Probability				
		1	2	3	4	5
Degree of impact	1		33, 34, 39, 40, 44	30, 32, 35, 36, 42, 43	37, 38, 45, 46, 41, 31	
	2		1, 2, 19	3, 8, 18		
	3		24, 25	26, 27	28, 29	
	4		13, 23	12, 21, 22	20	
	5		6, 7, 14, 15	5, 9, 11, 16, 17	4, 10	

Table 45. Significance of physical climate risks in long term SSP 126 for ICA SAs

		Probability				
		1	2	3	4	5
Degree of impact	1		39, 40, 43, 44	30, 32, 33, 34, 35, 36, 42	37, 38, 45, 46, 41, 31	
	2		1, 2	3, 8, 18, 19		
	3			26, 27, 24, 25	28, 29	
	4		12, 13, 22, 23	21	20	
	5		4, 10	5, 7, 6, 9, 11, 14, 15, 16, 17	4, 10	

Table 48. Significance of physical climate risks in near term SSP 126 for BSGP SAs

		Probability				
		1	2	3	4	5
Degree of impact	1		20, 21, 22, 24, 25	18, 19	23	
	2		1, 6, 15, 16, 17	2, 11, 12, 13		
	3		14	3		
	4		7			
	5		8, 9, 10	4, 5		

Table 49. Significance of physical climate risks in mid-term SSP 126 for BSGP SAs

		Probability				
		1	2	3	4	5
Degree of impact	1	25	20, 21, 22, 24	18, 19	23	
	2		1, 6, 15, 17, 16	2, 11, 12, 13		
	3	14		3		
	4	7				
	5		8, 9, 10	4, 5		

Table 50. Significance of physical climate risks in long term SSP 126 for BSGP SAs

		Probability				
		1	2	3	4	5
Degree of impact	1	25	20	19, 21, 22, 24	18, 23	
	2		15	1, 2, 11, 6, 13, 16, 17	12	
	3	14		3		
	4	7				
	5		8	9, 10, 5	4	

Table 51. Significance of physical climate risks in near term SSP 126 for AGPs

		Probability				
		1	2	3	4	5
Degree of impact	1	19, 20	18, 23, 24, 25	22, 17	21	
	2		1, 3, 6, 7			
	3	14, 15		11		
	4		12, 13	16, 10, 4, 2		
	5	8, 9		5		

Table 52. Significance of physical climate risks in mid-term SSP 126 for AGP

		Probability				
		1	2	3	4	5
Degree of impact	1		19, 20, 18, 23, 24, 25	17, 22	21	
	2		1, 3, 6, 7			
	3		14, 15	11		
	4		12, 13	16, 10, 4, 2		
	5		8, 9	5		

Table 53. Significance of physical climate risks in long term SSP 126 for AGP

		Probability				
		1	2	3	4	5
Degree of impact	1		19, 20, 23, 24, 25	17, 18, 22	21	
	2		1, 3, 6, 7			
	3		14, 15	11		
	4		12, 13	16, 10, 4, 2		
	5		8, 9	5		

Table 54. Significance of physical climate risks in near term SSP 126 for KTGA

		Probability				
		1	2	3	4	5
Degree of impact	1		6, 14			
	2		7, 15			
	3		2, 10	1, 9		
	4			8, 16		
	5		3, 4, 11, 12		5, 13	

Table 55. Significance of physical climate risks in mid-term SSP 126 for KTGA

		Probability				
		1	2	3	4	5
Degree of impact	1		6, 14			
	2			7, 15		
	3		2, 10	1, 9		
	4			8, 16		
	5		3, 4, 11, 12	5, 13		

Table 56. Significance of physical climate risks in long term SSP 126 for KTGA

		Probability				
		1	2	3	4	5
Degree of impact	1			6, 14		
	2			7, 15		
	3		2, 10	1, 9		
	4			8, 16		
	5		3, 4, 11, 12	5, 13		

Table 57. Significance of physical climate risks in near term SSP 126 for the EP

		Probability				
		1	2	3	4	5
Degree of impact	1		21, 24, 25	20, 23		
	2		3, 7, 8, 17, 18	5, 6, 13		
	3		2, 9, 10	1, 11, 12		
	4			22		
	5		15, 16	14, 19	4	

Table 58. Significance of physical climate risks in mid-term SSP 126 for EP

		Probability				
		1	2	3	4	5
Degree of impact	1		21, 24, 25	20, 23		
	2		3, 7, 8, 17, 18	5, 6, 13		
	3		2, 9, 10	1, 11, 12		
	4			22		
	5		15, 16	4, 19, 14		

Table 59. Significance of physical climate risks in the mid-term SSP 126 for EP

		Probability				
		1	2	3	4	5
Degree of impact	1		25	20, 21, 24	23	
	2		3, 8, 17	5, 7, 18, 13	6	
	3		2, 9	10	1, 11, 12	
	4			22		
	5		16	4, 15	14, 19	

9.3 Annex 3. Transition scenario SSP 245 (+2.8°C increase in global air temperature by 2100)

Table 60. Significance of physical climate risks in near term SSP245 for ICA

		Probability				
		1	2	3	4	5
Degree of impact	1	31, 41	30, 33, 34, 35, 36, 39, 40, 44	43	32, 37, 38, 45, 46, 42	31, 41
	2	19	1, 2	3, 8, 18		
	3		24, 25, 26, 27		28, 29	
	4	20	13, 23	12, 22	21	20
	5		6, 7, 9, 14, 15, 16, 17		11	4, 10

Table 61. Significance of physical climate risks in mid term SSP245 for ICA

		Probability				
		1	2	3	4	5
Degree of impact	1		39, 44	30, 32, 33, 34, 35, 40, 36, 42, 43	37, 38, 45, 46, 41, 31	
	2		1	2, 3, 8, 18, 19		
	3			24, 25, 26, 27	28, 29	
	4		13, 23	12, 21, 22	20	
	5		4, 10	5, 6, 7, 9, 11, 14, 15, 16, 17	4, 10	

Table 62. Significance of physical climate risks in long term SSP245 for ICA

		Probability				
		1	2	3	4	5
Degree of impact	1		43, 44	31, 37, 41, 45	39, 30, 32, 40, 42, 38, 46	33, 34, 35, 36
	2				1, 2, 3, 8, 18	19
	3			28	29	24, 25, 26, 27
	4		13, 22, 23, 12	20	21	
	5			4, 10	5, 9, 11	6, 7, 14, 15, 16, 17

Table 63. Significance of physical climate risks in near term SSP245 for BSGP

		Probability				
		1	2	3	4	5
Degree of impact	1		20, 21, 22, 24, 25	18, 19	23	
	2		1, 6, 16, 15, 17	2, 11, 12, 13		
	3		14	3		
	4		7			
	5		8, 9, 10	4, 5		

Table 64. Significance of physical climate risks in mid-term SSP245 for BSGP

		Probability				
		1	2	3	4	5
Degree of impact	1		25	20, 21, 22, 24	18, 19, 23	
	2			2, 1, 6, 11, 15, 16, 17	12, 13	
	3		14	3		
	4		7			
	5			8, 9, 10	4, 5	

Table 65. Significance of physical climate risks in long term SSP245 for BSGP

		Probability				
		1	2	3	4	5
Degree of impact	1	25			23, 24	18, 19, 20, 21, 22
	2				1, 2, 6, 11	12, 13, 15, 16, 17
	3	14			3	
	4	7				
	5					4, 5, 8, 9, 10

Table 66. Significance of physical climate risks in near term SSP245 for AGPs

		Probability				
		1	2	3	4	5
Degree of impact	1	19, 20	18, 23, 24, 25	17, 22	21	
	2		1, 3, 6, 7			
	3	14, 15		11		
	4		2, 4, 10, 12, 13, 16			
	5	8, 9		5		

Table 67. Significance of physical climate risks in mid-term SSP245 for AGPs

		Probability				
		1	2	3	4	5
Degree of impact	1		19, 23, 24, 25	20, 18, 17, 21, 22		
	2		1, , 6, 7			
	3		14	11, 15		
	4		12, 13	16, 10, 4, 2		
	5		8	5, 9		

Table 68. Significance of physical climate risks in long term SSP245 for AGP

		Probability				
		1	2	3	4	5
Degree of impact	1	22, 24	25	21, 23	17, 18, 19, 20	
	2	6	7	13		
	3				11, 14, 15	
	4	12	13		16, 10, 4, 2	
	5				5, 8, 9	

Table 69. Significance of physical climate risks in near term SSP245 for KTGA

		Probability				
		1	2	3	4	5
Degree of impact	1		6, 14			
	2		7, 15			
	3		2, 10	1, 9		
	4			8, 16		
	5		4, 12	3, 11	5, 13	

Table 70. Significance of physical climate risks in mid-term SSP245 for KTGA

		Probability				
		1	2	3	4	5
Degree of impact	1			6, 14		
	2			7, 15		
	3		2, 10		1, 9	
	4			8, 16		
	5		4, 12	3, 11	5, 13	

Table 71. Significance of physical climate risks in long term SSP245 for KGTA

		Probability				
		1	2	3	4	5
Degree of impact	1					6, 14
	2					7, 15
	3			2, 10		1, 9
	4					8, 16
	5			4, 12	3, 11, 5, 13	

Table 72. Significance of physical climate risks in near term SSP245 for EP

		Probability				
		1	2	3	4	5
Degree of impact	1		21, 24, 25	20, 23		
	2		3, 7, 8, 17, 18	5, 6, 13		
	3		2, 9, 10	1, 11, 12		
	4			22		
	5		15, 16	14, 19	4	

Table 73. Significance of physical climate risks in mid-term SSP245 for EP

		Probability				
		1	2	3	4	5
Degree of impact	1		25	21, 24	20, 23	
	2		3, 8	7, 17, 18	5, 6, 13	
	3		2	9, 10	1, 11, 12	
	4				22	
	5		16	4, 15	14, 19	

Table 74. Significance of physical climate risks in long term SSP245 for EP

		Probability				
		1	2	3	4	5
Degree of impact	1		25		24	20, 21, 23
	2		3, 8		7, 17	5, 6, 13, 18
	3		2		9	1, 11, 12, 10
	4					22
	5		4, 16		15	14, 19

Change registration sheet

Number changes	Page numbers	Total sheets in the document	Numbers of sections to which the changes relate	Description of changes	Notation of changes		
					Full name	Signature	Date

Acknowledgement sheet

No.	Full name of the employee		Position	Date	Siganture