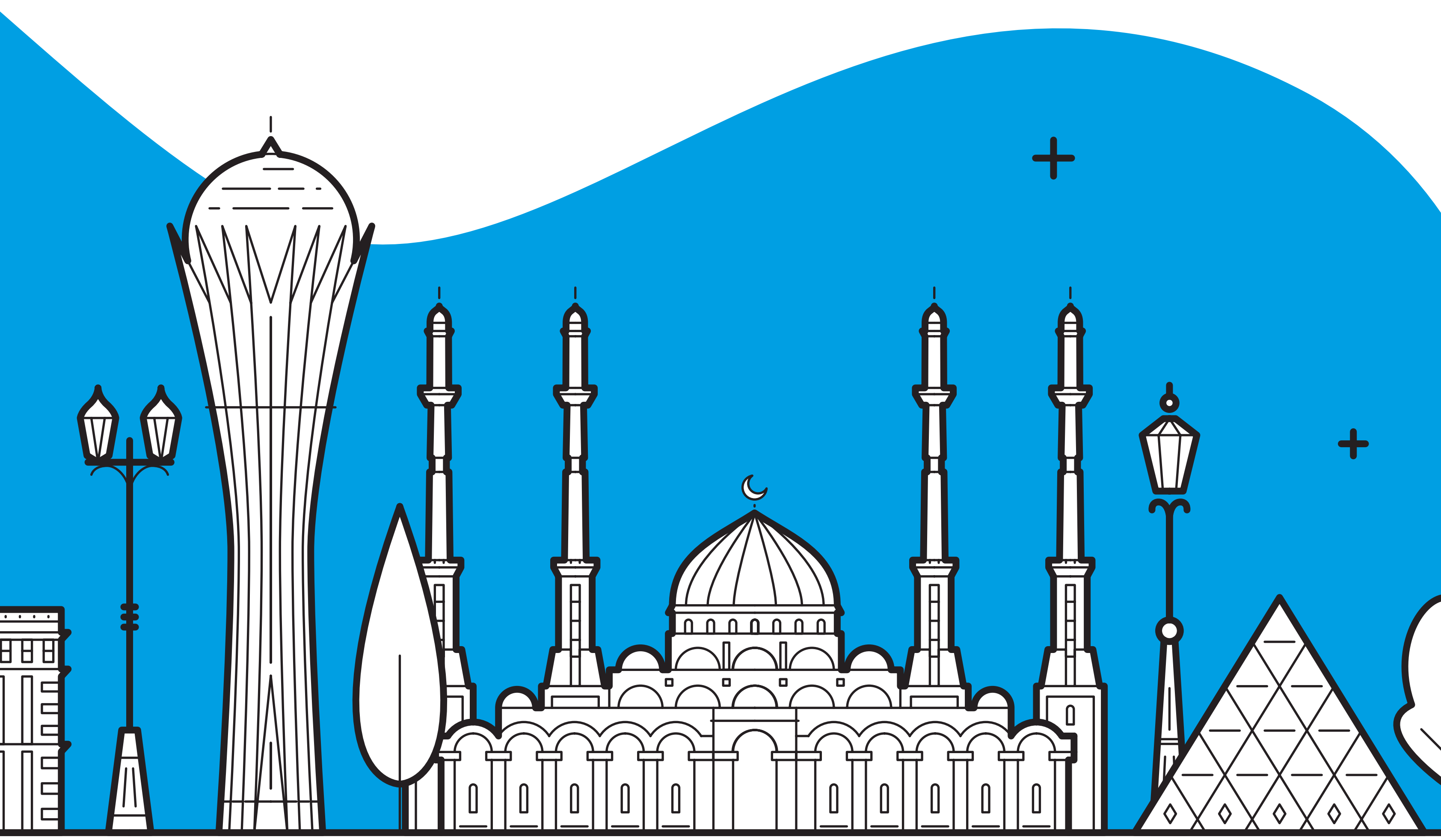
KAZAKHTELECOM

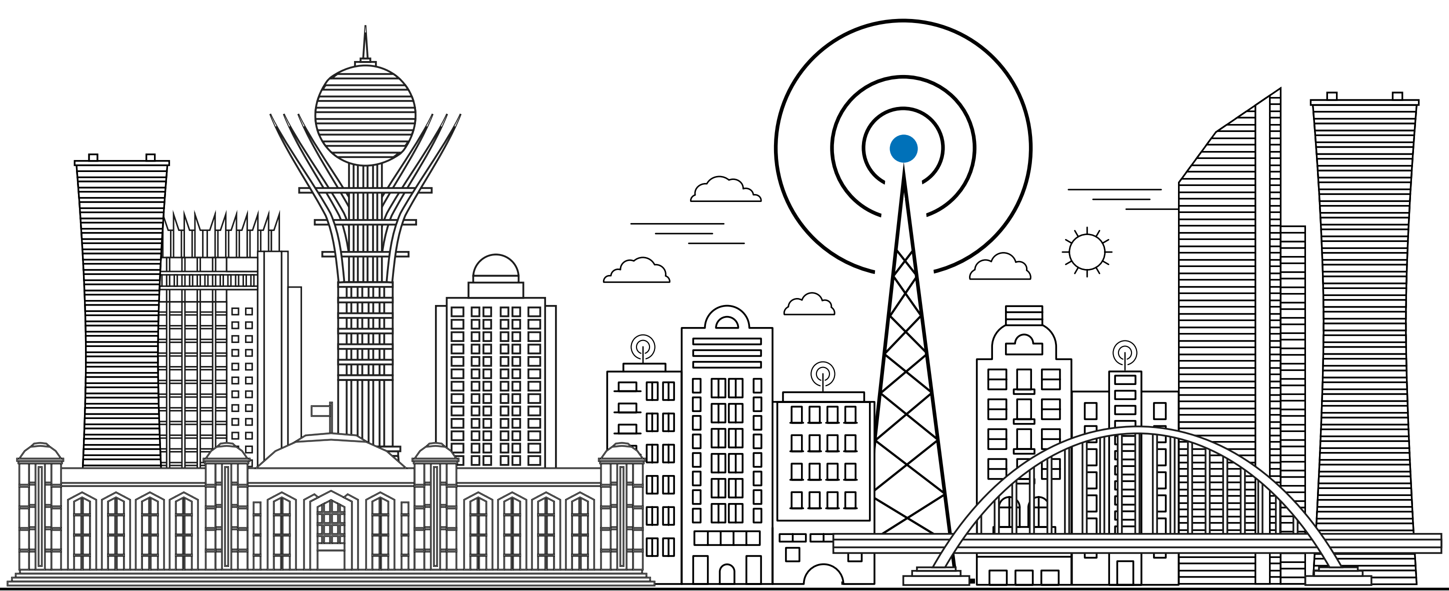
Assessment of Climate-related Risks and Opportunities for Kazakhtelecom JSC

Analytical Report



2024

Contents



Disclaimer on Limitations of Assessments, Forecasts, and Data Accuracy

This report has been prepared considering predictive climate modelling and data analysis based on best global practices and analytical research. In formulating the scenarios, international recommendations and data from authoritative sources such as McKinsey & Company, the U.S. Government Accountability Office (GAO), S&P Global, and analytics and forecasts from the Intergovernmental Panel on Climate Change (IPCC) were utilized. Calculations also took into account the experience of similar companies in the telecom sector, such as Deutsche Telekom, which have implemented adaptation measures in response to climate change.

Special attention was paid to the specifics of the Republic of Kazakhstan, including national reports from the World Bank and the United Nations Development Programme (UNDP), as well as the requirements of national environmental protection legislation. This approach allowed for the adjustment of international methodologies and recommendations to suit the conditions and needs of Kazakhstan's telecom sector, considering the impact of climate change on infrastructure and operational activities in the region.

All assessments and forecasts presented in this report are indicative and probabilistic in nature and should not be considered as exact outcomes or commitments by Kazakhtelecom JSC or its consultants. They are based on hypothetical scenarios and assumptions that may vary significantly with changes in external factors, data, or underlying premises – such as changes in climate conditions, market fluctuations, and regulatory amendments. The results may change based on new data and evolving conditions, making them estimative rather than guaranteed.

The scenario analysis in this report is based on the TCFD (Task Force on Climate-related Financial Disclosures) methodology and is intended to illustrate potential climate-related risks and opportunities. However, this analysis involves a degree of uncertainty and acknowledges that many of the factors under consideration may change over time. Any conclusions drawn from this report should take into account the limitations and constraints of scenario modelling, including the uncertainty of future climate and economic conditions.

All data used in this report may be incomplete, outdated, or sourced from third parties over whom we have no control regarding their accuracy and completeness. No warranties, express or implied, are made concerning the accuracy, reliability, completeness, or suitability of the information presented for any purpose.

Kazakhtelecom JSC and its consultants are not responsible for any errors or omissions in the content of this report and disclaim liability for any losses or damages arising from the use or reliance on the information contained herein. Users should not rely solely on the assessments and forecasts provided when making decisions. It is recommended to conduct independent analyses and, if necessary, seek professional advice from qualified specialists in relevant fields.

By using this report, you agree that Kazakhtelecom JSC and its consultants are not liable for any consequences arising from the use of the information presented and release them from any claims related to inaccuracies, omissions, or other deficiencies in the content of this report. When interpreting and applying the data provided, it is advisable to consider current changes in policies and market conditions.

Purpose of the Report

The purpose of this report is to conduct a qualitative and quantitative assessment of the impact of climate-related risks and opportunities on the financial performance and operational resilience of Kazakhtelecom JSC (hereinafter referred to as Kazakhtelecom, the company). The modelling is based on no fewer than two scenarios, derived from internationally recognised climate models, to evaluate the effects of climate change on the company's business operations.

The assessment focuses on developing climate change scenarios specific to Kazakhtelecom's priority assets and critical operational components. This approach enables the company to model and understand potential climate-related risks and opportunities it may encounter in the future.

The key objectives of the assessment include:

1. Identification of physical and transition climate-related risks through the analysis of past and current changes in climate conditions/trends, taking into account the specific characteristics of the company's business.
2. Evaluation of the geographical location of assets to identify regions susceptible to climate change.
3. Collection of historical data on climate impacts on the business and the use of climate models (IPCC, NGFS) to forecast future risks.
4. Assessment of assets and business processes most vulnerable to climate change, prioritization, and classification by significance.
5. Utilization of climate models to assess the likelihood of climate events occurring.
6. Analysis of the potential impact of significant climate-related risks and opportunities on Kazakhtelecom's financial performance.
7. Development of recommendations and methodologies for integrating climate-related risks into the company's risk management system.
8. Formulation of proposals for monitoring climate change and preparing climate-related risk disclosures in accordance with TCFD recommendations[1].

Thus, the report aims to enhance the company's resilience to climate-related challenges by integrating climate scenario analysis into Kazakhtelecom's strategy and operational activities. This approach will enable the company to mitigate the impacts of climate change while simultaneously promoting sustainable and low-carbon business development.

[1] The reporting also incorporates the IFRS S2 standard concerning the requirements for identifying and disclosing climate-related risks and opportunities, as well as their integration into the company's strategic and financial planning.

Overview of the Methods Used in the Preparation of the Report

The TCFD (Task Force on Climate-related Financial Disclosures) is recognized as the leading international framework for conducting climate assessments of the financial and operational impacts of climate-related risks. It enables the evaluation of not only physical risks, such as extreme weather events or temperature changes, but also transition risks associated with shifts in policy, technology, and market conditions. Due to its structured approach, TCFD helps companies understand how climate change may affect their financial resilience and operational performance in the future, facilitating more accurate modeling and the development of adaptation strategies. A key feature of this approach is its focus on future climate scenarios, allowing companies to assess the impacts of various climate conditions and better prepare for potential changes.

Furthermore, the TCFD integrates climate-related risks into the overall risk management strategy, linking the climate agenda with long-term strategic planning and business resilience. The TCFD methodology not only aids in assessing the financial implications of climate-related risks but also aims to attract the attention of stakeholders, such as investors and regulators, to issues of climate resilience. This makes the TCFD an especially valuable tool for companies seeking to enhance their transparency regarding climate-related risks and opportunities, as well as to develop long-term adaptation strategies.

The TCFD Task Force was established by the Financial Stability Board (FSB) in December 2015 in response to growing concerns about the financial risks posed by climate change.

The TCFD has played a key role in raising awareness of climate-related financial risks and accelerating the adoption of climate risk reporting. The TCFD methodology has become the industry standard for disclosing climate-related risks, facilitating a shift in how companies and investors approach climate challenges and opportunities.

Simultaneously with the publication of its 2023 Status Report on October 12, 2023, the TCFD fulfilled its mandate. The Financial Stability Board (FSB) has tasked the IFRS Foundation with the responsibility of further developing the standard as part of the IFRS framework, monitoring companies' progress in disclosing climate-related information.

Companies applying the IFRS S1/S2 standard will align with the TCFD recommendations, as these recommendations are fully integrated into the standards of the International Sustainability Standards Board (ISSB). Companies can continue to use the TCFD recommendations. Utilizing the TCFD recommendations serves as a good starting point for companies on their path toward implementing the ISSB standards.

The ISSB was established in November 2021 to develop "sustainability disclosure standards that provide investors and other capital market participants with information about a company's sustainability-related risks and opportunities to help them make informed decisions."

On June 26, 2023, the ISSB issued two international sustainability disclosure standards:

- IFRS S1 "General Requirements for Disclosure of Sustainability-related Financial Information";
- IFRS S2 "Climate-related Disclosures".

IFRS S1 and IFRS S2 are effective for annual periods beginning on or after 1 January 2024. This means that in 2025, investors will be able to see information based on inputs from entities applying these standards in the 2024 reporting period.

The ISSB operates under the auspices of the International Financial Reporting Standards Foundation (IFRS Foundation) and aims to bring together various existing sustainability standards and guidelines, such as those developed by the Global Reporting Initiative (GRI), TCFD and others.

The requirements of IFRS S2 «Climate-related Disclosures» include and fully correspond with the four core areas and 11 recommended disclosures published by the TCFD.

Scenario analysis helps companies identify potential impacts of climate change on their operations and financial performance, develop effective strategies for managing these risks, and seize emerging opportunities. It also facilitates clear, transparent, and comparable disclosures of climate-related risks and opportunities for investors, regulators, and other stakeholders.

Since the publication of the TCFD report, there has been an increased focus on scenario analysis in financial reporting and climate-related risk disclosure. Many companies and financial institutions have adopted scenario analysis as a key tool for assessing climate-related risks and opportunities, as well as for aligning their strategies with a low-carbon and sustainable future.

The adoption of scenario analysis has been driven by the recognition that climate change poses significant financial risks to businesses and investors. Failing to address these risks can lead to serious economic and social consequences. Scenario analysis provides businesses with a framework for identifying, assessing, and managing these risks in a structured and systematic manner, as well as for taking proactive measures to build resilient growth.

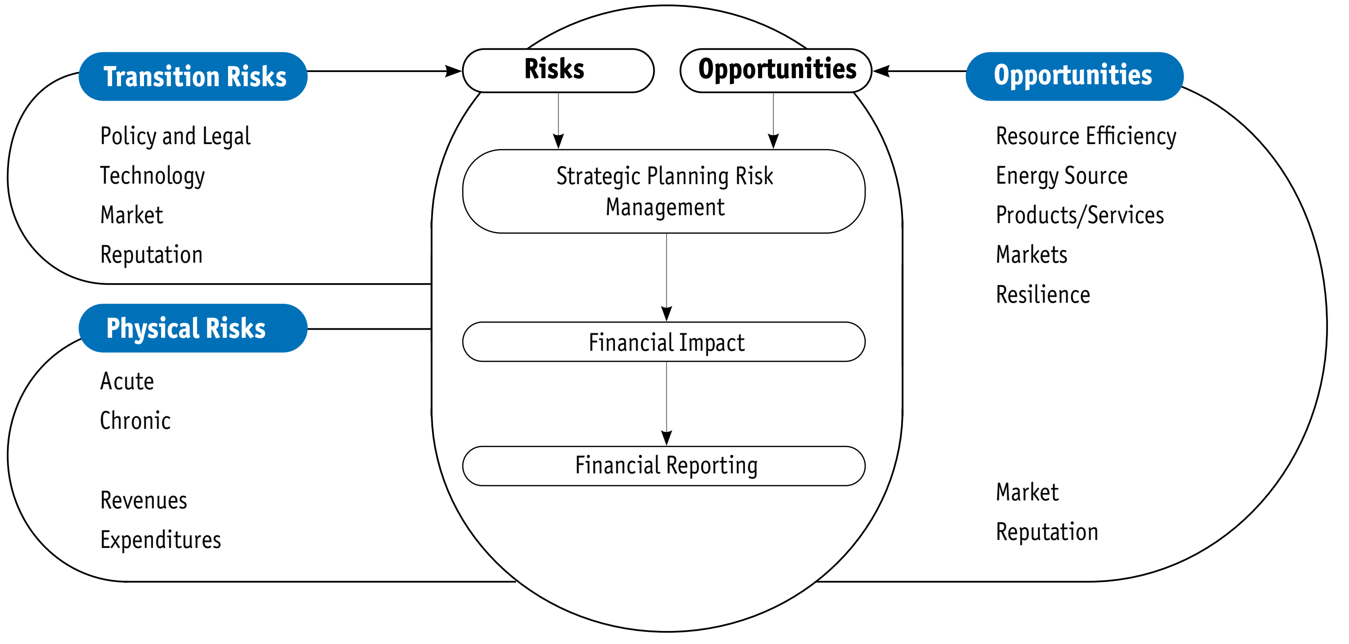
This report includes the identification of the potential climate sensitivity of the Kazakhtelecom value chain and the application of developed climate scenarios for climate modeling.

Methodological Framework

The TCFD presented its final recommendations, which provide a framework for companies and organizations aimed at enhancing the disclosure of climate-related financial risks through existing reporting mechanisms. These recommendations emphasize the importance of transparent accounting of climate risks to support effective capital allocation decisions.

After a company assesses climate-related issues and develops appropriate response measures, it will be able to evaluate the actual and potential impacts of these risks on key financial metrics, including revenues, expenses, assets, liabilities, equity, and sources of financing. The primary climate-related risks, such as transition and physical risks, as well as emerging opportunities that should be considered in strategic planning and risk management, are presented in Figure 1, which aids in assessing their financial implications.

Figure 1. Key Climate-Related Risks

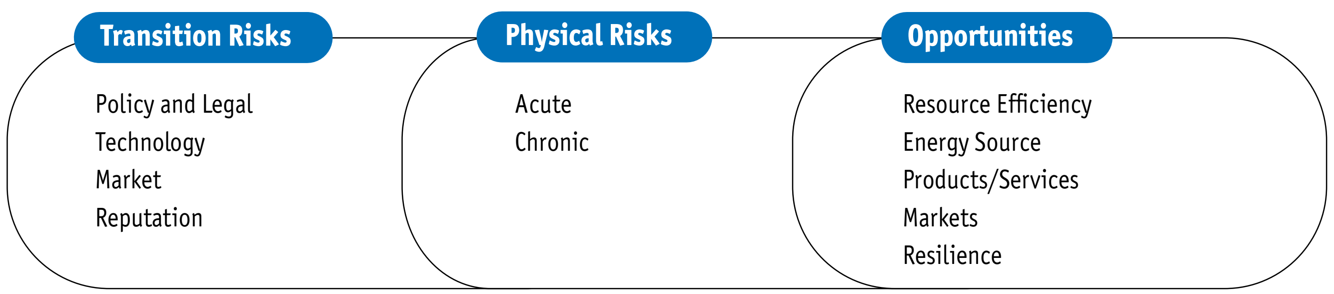


Source: TCFD Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities

The TCFD Task Force has categorized climate-related risks into two main categories: (1) risks related to the transition to a low-carbon economy and (2) risks associated with the physical impacts of climate change. Within each of these categories, specific subcategories have been identified for a more detailed assessment of risks.

The TCFD methodology identifies five key categories of climate-related opportunities that are associated with enhancing resource efficiency and reducing costs, transitioning to low-carbon energy sources, developing new products and services, entering new markets, and strengthening resilience in the supply chain (Figure 2).

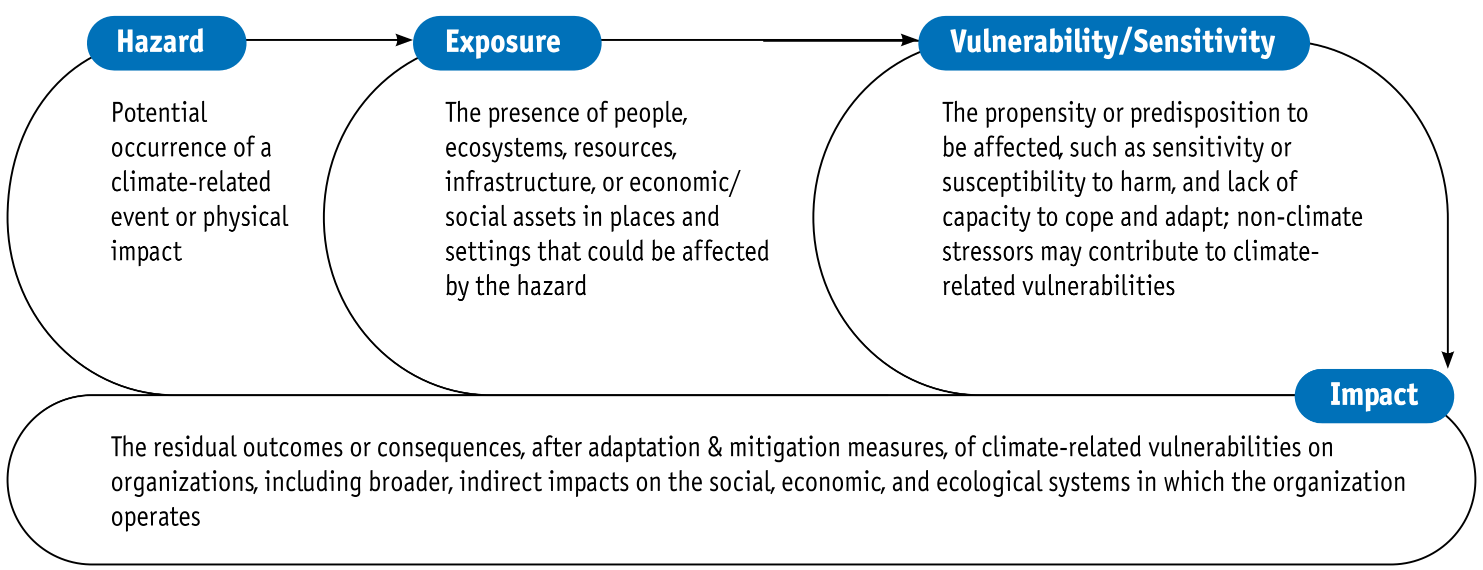
Figure 2. Categories of Climate-Related Risks and Opportunities



Source: TCFD Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities

Based on this information, the company should identify its current climate-related risks and opportunities (Figure 2), as well as analyze existing issues, information gaps, and the potential consequences of these risks and opportunities.

Figure 3. Framework for Analyzing Climate-Related Risks and Opportunities

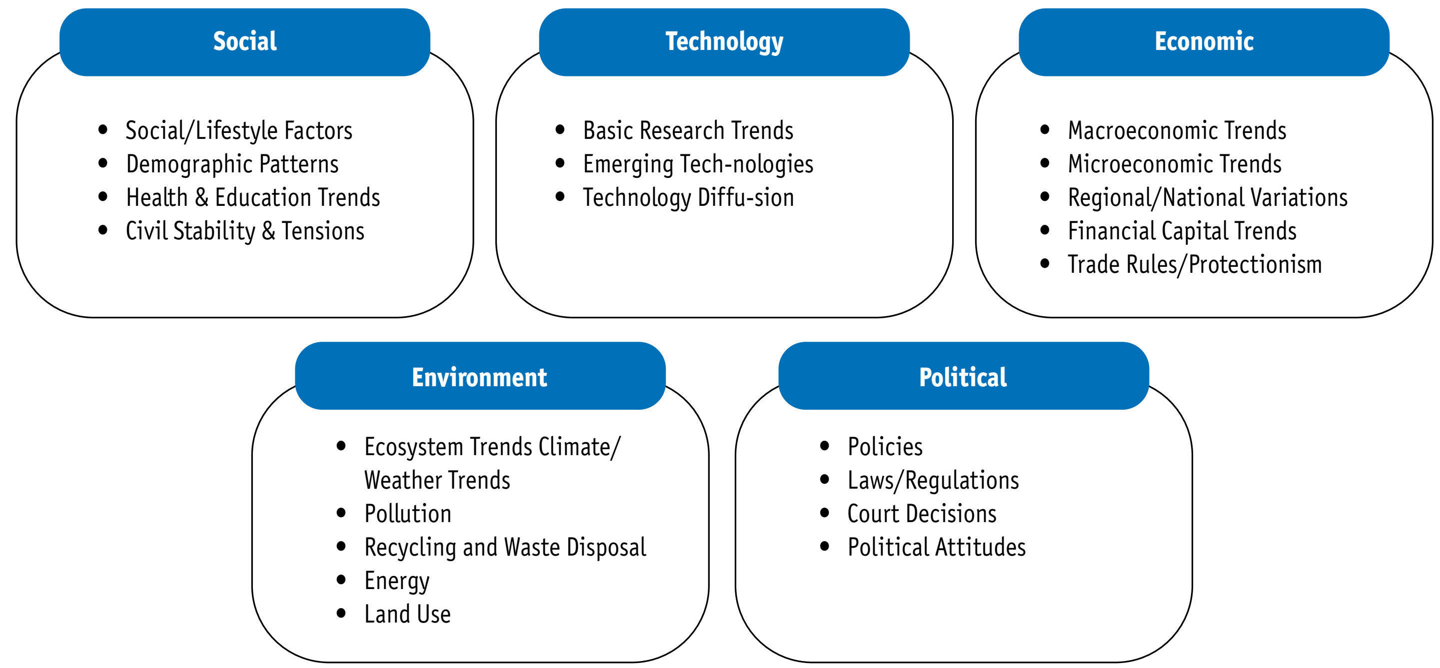


Source: TCFD Guidance on Scenario Analysis for Non-Financial Companies

There are various methods for identifying key trends, patterns, factors, and associated uncertainties. A good starting point is to assess the company's climate environment. STEEP analysis (Social, Technological, Economic, Environmental, and Political factors) can also be utilized to identify significant drivers (Figure 4).

STEEP analysis is applicable at local, national, and global levels to identify key forces that may vary depending on the scale.

Figure 4. STEEP Model of Key Types of Factors



Source: TCFD Guidance on Scenario Analysis for Non-Financial Companies

For many organizations, the most significant impacts of climate change are likely to materialize in the medium and long term, though the exact timing and scale remain uncertain. This uncertainty creates challenges in understanding the potential effects of climate change on a company's business, strategy, and financial performance. To effectively consider potential climate-related risks and opportunities in planning, organizations need to assess how these factors may evolve under various scenarios and the implications they may have for their operations.

The assessment group[2] (hereinafter referred to as the Group) used scenario analysis to explore these aspects and integrated the results into the company's strategies and planning processes.

[2] This report was prepared by an expert group (Assessment Group) focused on evaluating climate-related risks and opportunities for Kazakhtelecom JSC.

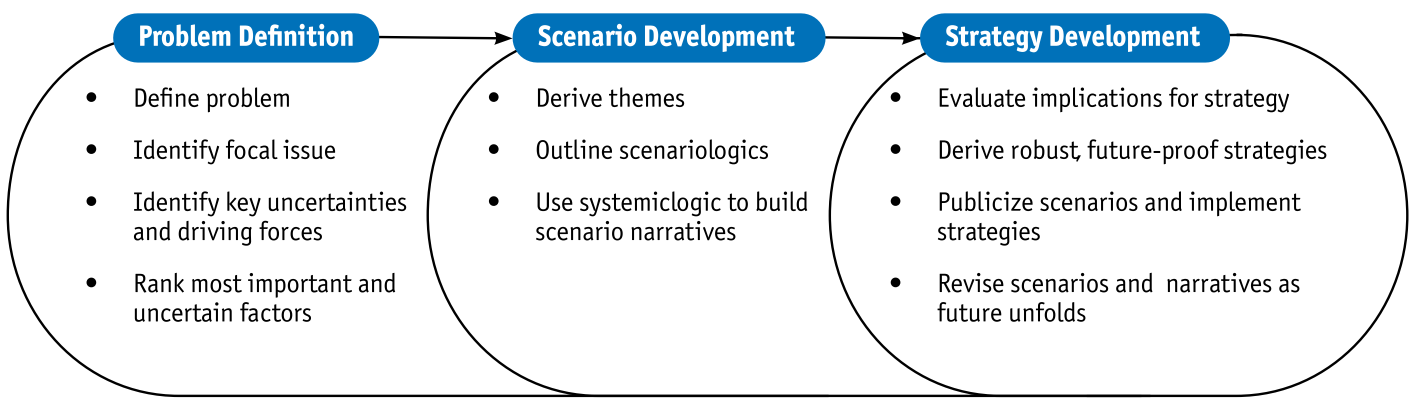
Application of Scenario Analysis

The assessment of climate-related risks and scenario analysis for Kazakhtelecom JSC was conducted using the methodology recommended by the TCFD. The TCFD framework emphasizes the importance of applying scenario analysis to evaluate climate-related risks and opportunities. The company focused on a structured approach that ensures transparency, consistency, and comparability of results, in accordance with the TCFD recommendations for assessing climate impacts on assets and operations.

Scenario analysis is an established method used to develop strategic plans aimed at enhancing their flexibility or resilience in the face of uncertainty. However, using scenario analysis to assess climate-related risks and opportunities and their potential impact on business is a relatively new approach. Given the importance of forward-looking assessments of climate-related risks, the TCFD Task Force considers scenario analysis an important and valuable tool for both understanding the strategic implications of climate-related risks and opportunities and informing stakeholders about how the company is adapting to these challenges. Additionally, scenario analysis provides critical information for investors, lenders, and insurers, enabling them to better evaluate the future financial condition of the company.

Scenario analysis involves three key stages: defining the issue, developing scenarios, and using them in strategy formulation, allowing for the consideration of different future scenarios in making informed decisions (Figure 5).

Figure 5. Key Stages of Scenario Analysis



Source: TCFD Guidance on Scenario Analysis for Non-Financial Companies

A scenario is a conceptual pathway leading to a specific outcome. Its purpose is not to predict the future in its entirety but to highlight key aspects of possible events and draw attention to the main factors that will influence their development. It is important to remember that scenarios are hypothetical models, not precise forecasts or predictions, and do not constitute a sensitivity analysis. Scenario analysis is used to deepen strategic thinking, allowing for a re-examination of traditional views on the future. In conditions of uncertainty, scenarios help explore alternative approaches that can significantly alter standard business processes.

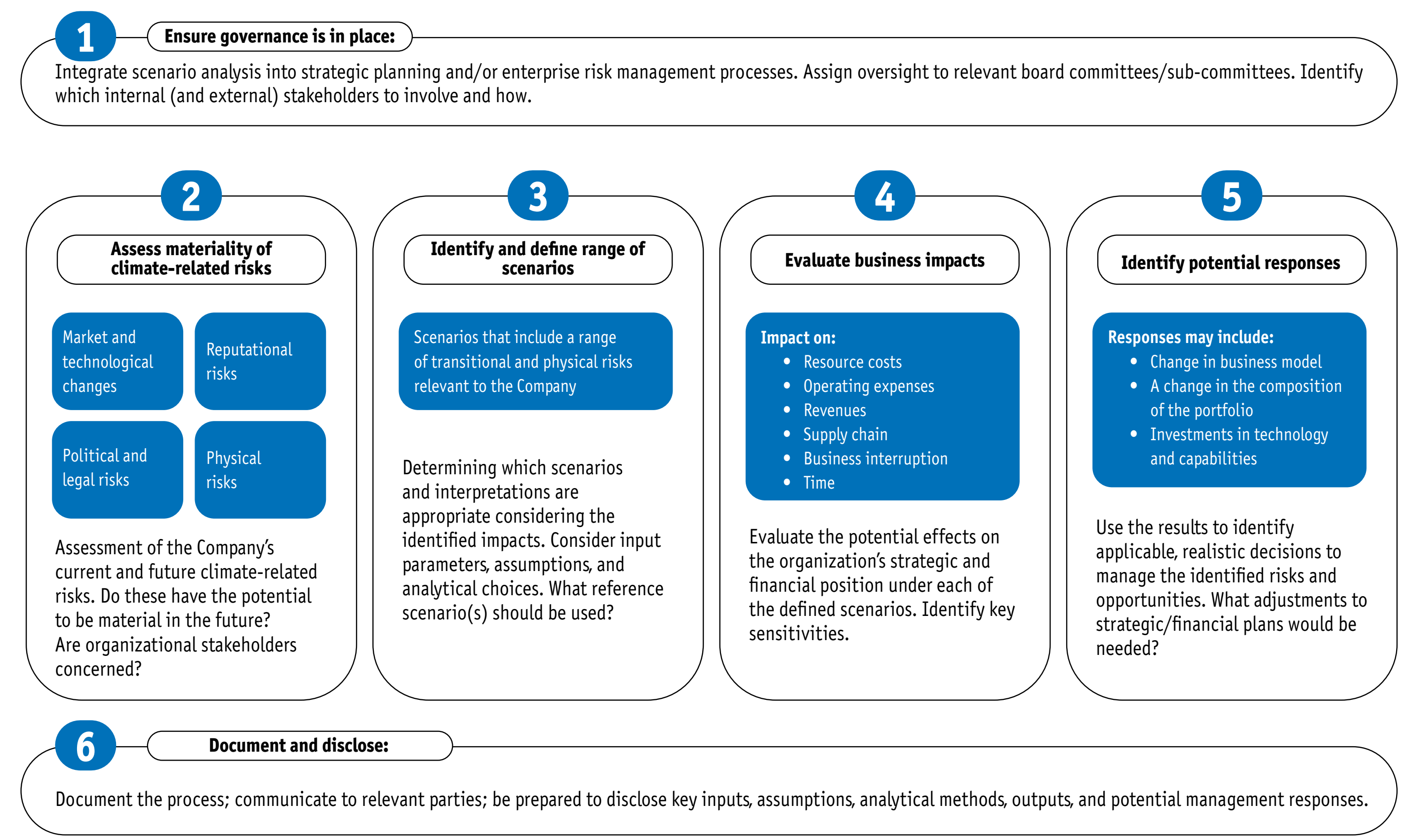
As part of the climate assessment for Kazakhtelecom, relevant climate scenarios developed by the IPCC were considered. These scenarios,

widely used by the scientific community and policy analysts, help evaluate future vulnerability to climate change.

In addition, an assessment of the nature of climate-related risks and opportunities that the company may face was conducted. Since the company's operations are concentrated in the telecommunications sector, climate-related risks and opportunities differ significantly from those typical of other industries. The potential impact of climate change on the company's business depends on several key factors, necessitating a comprehensive approach to analysis and planning:

- the geographical distribution of the Kazakhtelecom value chain, including both suppliers (upstream) and customers (downstream);
- the nature and location of Kazakhtelecom's physical assets;
- market structure and dynamics;
- characteristics of Kazakhtelecom's customer base;
- the influence of key stakeholders on the company's strategic decisions.

Figure 6. Process of Scenario Analysis for Climate-Related Risks and Opportunities



Source: TCFD Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities

As part of conducting scenario analysis according to TCFD methodology (Figure 6), the following measures were taken:

- Ensured complete transparency of parameters, assumptions, and analytical approaches, including data sources and the climate models used.
- Conducted a comparative analysis of various climate scenarios, which allowed for a comprehensive assessment of potential climate-related risks and opportunities.
- Implemented a methodological framework that enables tracking the dynamics of climate-related risks over several years and ensures data comparability across periods.
- Prepared a report to inform stakeholders about the company's climate-related risks and opportunities.

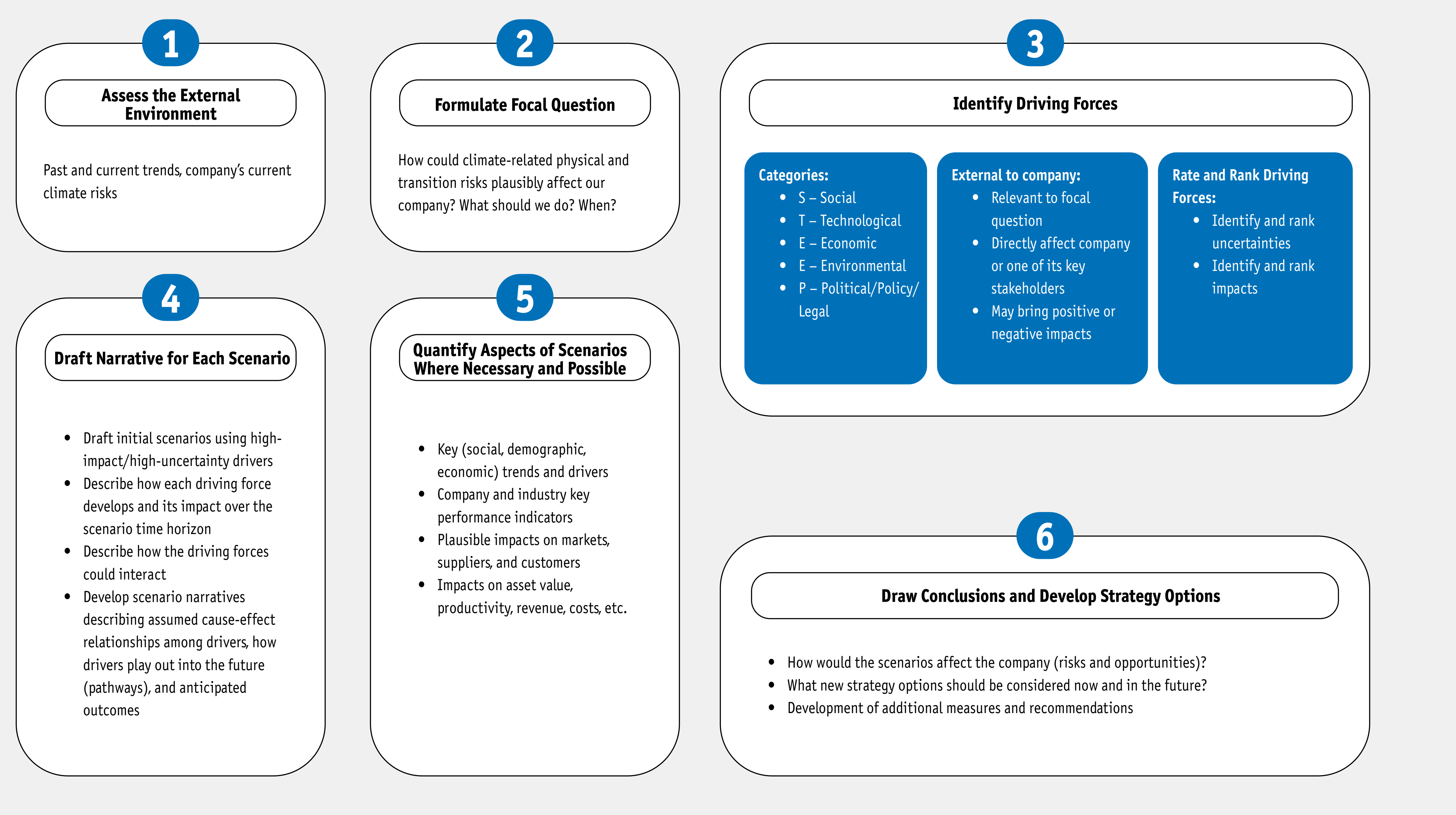
To assess the company's climate-related risks, it is essential to consider a wide range of potential trends that climate change may trigger. These changes can pertain to social, economic, and environmental aspects. For example, chronic and acute physical events can directly or indirectly impact business facilities, operations, and supply chains. Climate change can also disrupt ecosystems that provide businesses with raw materials and other resources.

Climate change can impact the social and economic systems in which companies operate, including markets, society, legislative and regulatory frameworks, as well as innovation. It is essential to consider not only individual risks but also systemic risks, along with risk dynamics, feedback loops, and irreversible consequences.

Even if a company does not believe it is directly exposed to climate-related risks, the impacts of climate change may affect it indirectly through changes in supply chains or consumer markets.

To effectively manage climate-related risks and opportunities, companies need to follow a systematic analysis process (Figure 7). At each stage of this process, it is important to consider both external and internal factors that could impact the company's operations. The process includes assessing the external environment, formulating key questions, identifying main drivers, and conducting scenario analysis. These steps help deepen the understanding of the impacts of climate-related risks and prepare recommendations for strategic decision-making.

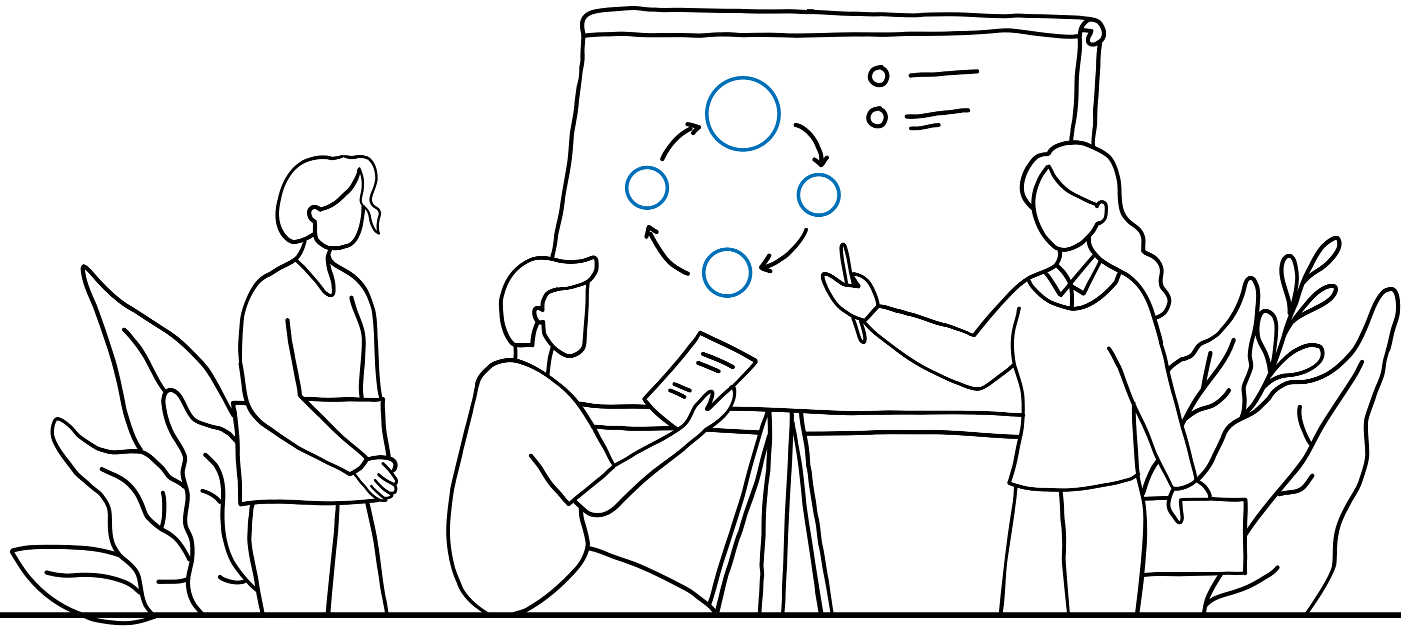
Figure 7. Detailed Overview of the Scenario Analysis Process



Source: TCFD Guidance on Scenario Analysis for Non-Financial Companies

In modeling the physical climate-related risks for Kazakhtelecom, a number of assumptions were made that must be considered when interpreting the analysis results. These assumptions relate to the level of data granularity, the climate scenarios applied, as well as the limitations concerning geographical coverage and the specifics of the assets being analyzed.

Modeling the physical climate-related risks for Kazakhtelecom, based on scenario analyses, was conducted using approximate data representing averaged estimates for the relevant regional zones. A selection of



assets was made for the analysis of physical risks, including 25 data centers located across various regions of Kazakhstan. The use of generalized geographic locations allowed for the consideration of key macro-level climate parameters. The results of the analysis should be interpreted with regard to possible assumptions arising from the granularity of the input data. For the modeling of physical climate-related risks for Kazakhtelecom, historical data from two key sources were utilized. The first source was the Climate Change Knowledge Portal from the World Bank Group, which provides access to global climate data for Kazakhstan. The second source comprised public data on the Climate of the Cities in Kazakhstan from RSE on PVC "Kazhydromet", covering the climate parameters of the country's regions. This data served as the input for the scenario analysis of physical climate-related risks.

Financial modeling of climate-related risks for Kazakhtelecom was conducted based on an existing financial model covering the period from 2019 to 2027. However, it should be noted that the model has not been updated to reflect changes for 2024, which presents a potential limitation in forecasting. Despite this, the company does not perceive significant risks associated with this aspect, citing the stability of key financial indicators. Until 2027, the calculations of cash flows were carried out by Kazakhtelecom based on internal methodologies and data regarding population and household sizes obtained from official sources such as the World Bank and eGov. Starting from 2027, the modeling was based on the company's approaches, with data extrapolation conducted up to 2060, taking demographic changes into account.

Climate Change Scenarios

Internationally recognized scenarios are developed by international research or regulatory groups. Such scenarios provide valuable information about potential greenhouse gas emissions, physical climate change, environmental impacts, and socio-economic conditions. At the same time, an organization may choose to develop its own set of climate-related scenarios or utilize customizable (mixed) climate scenarios.

Physical climate scenarios typically represent the results of global climate models that illustrate the Earth's climate response to changes in greenhouse gas concentrations in the atmosphere. The scenarios developed by the Intergovernmental Panel on Climate Change (IPCC), based on Representative Concentration Pathways (RCPs), serve as examples of physical climate scenarios endorsed by the IPCC. The results of these models are often "scaled" to determine potential local climate changes, which are then used to develop climate impact scenarios (initial impacts such as floods or droughts, secondary impacts such as crop loss, and tertiary impacts such as hunger).

Transition scenarios typically present plausible assumptions regarding the development of climate policies and the adoption of climate-friendly technologies to limit greenhouse gas emissions. Transition scenarios draw conclusions, often based on modeling, about how policies and technologies related to energy supply and greenhouse gas emissions interact with economic activity, energy consumption, and GDP, among other key factors. Such scenarios can have material implications for organizations in specific sectors of the economy in the short, medium, and long term. These scenarios may reflect a faster or slower transition depending on the varying rates of change in key parameters.

Climate Change Risks: Physical and Transition Risks

According to the TCFD recommendations, climate-related risks are broadly divided into two categories: transition risks and physical climate risks. Transition risks arise from the shift to a low-carbon economy. Physical risks are associated with damage and material losses resulting from the long-term financial impacts caused by natural hazards in a changing climate.

Physical risks are associated with the impacts of climate change. These risks can be triggered by specific events (acute) or linked to long-term changes in climate patterns (chronic). Physical risks can have financial consequences for organizations, such as direct damage to assets and indirect impacts caused by supply chain disruptions. The financial performance of organizations may also be affected by changes in the availability, sources, and quality of water; food security; and extreme temperature variations affecting organizational facilities, operations, supply chains, transportation needs, and employee safety.

Transition risks are associated with the pace and extent to which an organization manages and adapts to internal and external changes to reduce greenhouse gas emissions and transition to renewable energy. The transition requires changes in policies and regulations, as well as market shifts to address mitigation and adaptation issues related to climate change. Depending on the nature, speed, and direction of these changes, transition risks may present varying levels of financial and reputational risk for organizations. Conversely, if an organization is a low-carbon emitter and operates in the renewable energy sector or climate transition market, it may face market, technological, and reputational opportunities.

Climate-related Opportunities

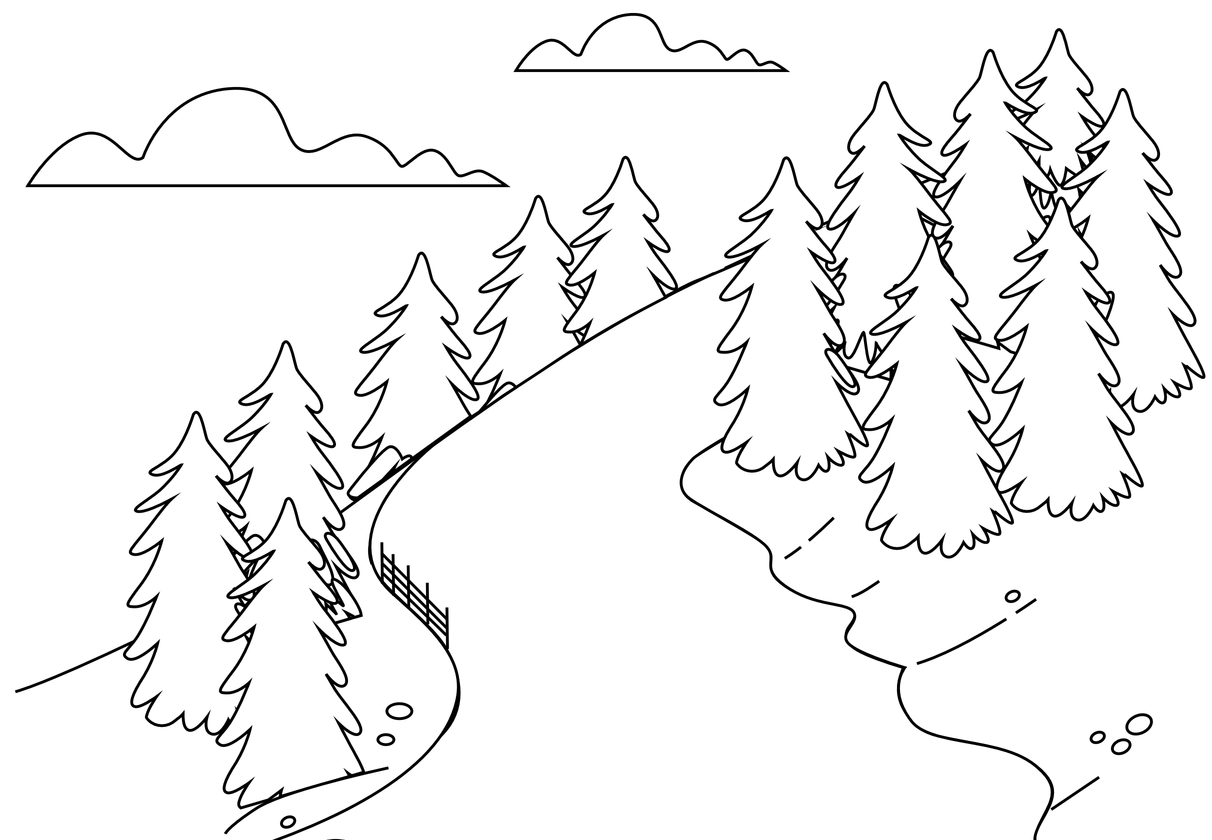
Efforts to mitigate and adapt to climate change also create opportunities for organizations, such as improved resource efficiency and cost savings, the adoption of low-carbon energy sources, the development of new products and services, access to new markets, leveraging new policies that subsidize efficiency and clean energy, and building resilience throughout the supply chain. Climate-related opportunities will vary depending on the region and sector in which the organization operates.

Climate-related Financial Impacts

The financial impacts of climate-related risks are recognized as a significant issue for businesses, investors, governments, and financial institutions. Climate-related risks encompass a wide range of financial challenges and uncertainties arising from the physical and transition impacts of climate change.

Key Aspects of the Financial Impacts of Climate-related Risks

Potential financial impacts of physical risks include:	Potential financial impacts of transition risks include:
Damage to assets and loss thereof	Asset devaluation
Disruptions in the supply chain	Increased costs to comply with new regulations
Increased operational costs	Higher capital costs due to policy changes
Unexpected recovery expenses	Decreased demand for goods and services associated with a carbon economy
Higher costs for regulatory compliance	Rising costs for upgrading and adapting technologies
Limited access to resources	Changes in market conditions and competitiveness
Decreased asset value	Reduced investment attractiveness due to the shift to more sustainable practices
Interruption of business operations and forced downtime	Changes in consumer preferences and behavior
	Litigation risks and reputational losses
	Limited access to financing from ESG-focused investors



Scenario Models for Climate Assessment of Kazakhtelecom JSC

To select the optimal model for assessing climate-related risks, an analysis of best practices among international telecommunications companies was conducted. We examined the models used across various sectors and concluded that RCP scenarios (IPCC) most accurately reflect the company's needs. The results of the analysis confirm that most benchmark companies apply a combination of climate scenarios, with the most common being RCP8.5, RCP2.6, RCP4.5, and the NZE2050[3] scenario. These models best meet the criteria of accuracy and relevance, demonstrating effectiveness in assessing climate-related risks and opportunities.

Additionally, an important factor in selecting models was the participation of companies in the annual ESG scoring conducted by CSA S&P Global.

In particular, the following reports from benchmark companies were reviewed:

- OTE Group (Integrated Report 2022)
- Telenor (Annual Report 2022)
- Deutsche Telekom (Corporate Responsibility Report 2022)
- Elisa (Sustainability Report 2022)
- INWIT (Integrated Report 2022)
- Telefonica (Consolidated management report 2022)
- Swisscom (Sustainability Report 2022)
- Singtel (Sustainability Report 2023)
- Tele2 (Annual and Sustainability Report 2022)
- Telstra (Sustainability Report 2023)

[3] See Appendix 1. Express Analysis of Climate Models Used by Peer Companies.

NZE2050 (Net Zero Emissions 2050) и RCP (Representative Concentration Pathways)

are different concepts related to climate scenarios and modeling used to assess the impacts of climate change.

Here are the main differences between them:

1. NZE2050 (Net Zero Emissions 2050):

Goal: NZE2050 is a scenario that aims for net zero carbon emissions by 2050. This means that all anthropogenic greenhouse gas emissions will be balanced by the removal of these gases, for instance, through natural sinks like forests or through technological solutions.

Context: The NZE2050 scenario is actively utilized within the framework of the Paris Agreement and various climate strategies of countries and companies. It is linked to global efforts to limit the increase in the planet's temperature to 1.5°C.

Focus: NZE2050 is focused on long-term emission reduction targets and scenarios for achieving climate neutrality. It serves more as a strategic scenario for climate policy.

2. RCP (Representative Concentration Pathways):

Goal: RCP (Representative Concentration Pathways) is a set of climate scenarios used in global climate models to project various levels of greenhouse gas concentrations in the atmosphere and their consequences. RCPs are designed to assess the impacts of different emission scenarios on the Earth's climate system.

Context: Within the framework of the IPCC (Intergovernmental Panel on Climate Change), four main RCP scenarios were developed: RCP2.6, RCP4.5, RCP6.0, and RCP8.5. These scenarios represent different trajectories of greenhouse gas concentrations and are associated with varying levels of warming. For example, RCP2.6 assumes significant emission reductions, potentially limiting warming to 1.5–2°C, while RCP8.5 describes a «business as usual» scenario with maximum emissions and significant warming.

Focus: RCPs are oriented toward scientific modeling of climate change and its consequences based on emission scenarios. They are used to evaluate climate-related risks and the impacts of climate change.

Key differences:

Goal: NZE2050 focuses on the strategic objective of achieving net zero emissions, while RCPs describe various scenarios of greenhouse gas concentrations and their consequences for the climate.

Application: NZE2050 is used in climate policy and corporate strategies, whereas RCPs are scientific models employed to project climate change.

Timeframes: NZE2050 is specifically oriented towards the year 2050 as the target date for achieving climate neutrality, while RCPs cover a broad range of timeframes and potential emission scenarios.

These two concepts complement each other: RCPs help model the consequences of different emission trajectories, including scenarios like NZE2050, which represents a specific target for achieving net zero emissions.

These three scenarios encompass both worst-case and optimistic forecasts, allowing companies to prepare for various future scenarios and make informed strategic decisions. Additionally, benchmark companies actively utilize the NZE2050 scenario, which plays a crucial role in long-term planning aimed at achieving climate goals and contributes to the development of strategies aligned with international climate agreements and sustainable development objectives.

RCP[4] (Representative Concentration Pathways) scenarios represent a set of greenhouse gas (GHG) concentration trajectories used by the Intergovernmental Panel on Climate Change (IPCC) to assess the potential impacts of climate change.

There are four RCP scenarios, ranging from a low-emission scenario (RCP2.6) to a high-emission future scenario (RCP8.5). Each scenario considers a range of factors, including technological, economic, and behavioral changes affecting the environment.

RCP2.6 is a low-emission scenario in which aggressive mitigation efforts lead to a peak in greenhouse gas emissions around 2020, followed by a rapid decline to nearly zero by the end of the century. This scenario assumes a strong shift towards renewable and low-carbon energy sources, widespread implementation of energy efficiency measures, and significant changes in land use.

RCP4.5 is a medium-emission scenario where emissions peak around mid-century, followed by a decline to about half of peak levels by 2100. This scenario assumes moderate efforts to implement technological changes.

RCP8.5 is a high-emission scenario where emissions continue to rise throughout the 21st century, with minimal efforts to mitigate climate change. This scenario assumes the continued use of fossil fuels, limited adoption of renewable energy, and minimal technological advancements.

RCP scenarios are used to assess the impacts of climate change on various sectors, such as agriculture, healthcare, and infrastructure. These scenarios provide a range of potential outcomes based on global greenhouse gas emissions levels and help guide future adaptation and mitigation strategies.

Net Zero Emissions by 2050 (NZE2050) is a scenario designed to achieve net zero greenhouse gas emissions by 2050. This scenario envisions significant carbon emission reductions across all sectors of the economy. The main objective is to reduce emissions to a level that can be offset by natural or technological carbon removal methods, such as reforestation or carbon capture and storage technologies.

The NZE2050 scenario requires a shift to renewable energy sources, increased energy efficiency, the adoption of innovative technologies, and a fundamental change in consumption patterns. Achieving this goal also demands extensive international cooperation, significant investments in new technologies, and policies aimed at sustainable development. The NZE2050 scenario is critical for limiting global warming to 1.5°C, aligning with the goals of the Paris Agreement on climate.

[4] Detailed information on RCP scenarios is available at www.ipcc.ch.

Assessment Boundaries and Categories of Climate-Related Risks for Kazakhtelecom JSC

The primary business activity of Kazakhtelecom is the provision of infocommunication services, including telephony, data transmission networks, broadband internet (B2B and B2C), video conferencing, SIP telephony (Session Initiation Protocol), IPTV (Internet Protocol Television), and hosting services.

In 2021, an initial greenhouse gas (GHG) emissions inventory was conducted for the following branches of Kazakhtelecom, operating across all regions of Kazakhstan:

- Corporate Business Division;
- Retail Division;
- Division Network;
- Information Technology Division;
- Telecom-Komplekt Directorate;
- Service Factory;
- Directorate of the Academy of Information and Communication Technologies;
- Telecommunications and Infrastructure Facilities Construction Directorate.

Subsidiaries and other affiliated organizations were not included within the boundaries of the GHG emissions inventory. As the greenhouse gas accounting system improves, the Company plans to expand the inventory boundaries (for more details, see the 2022–2032 Low-Carbon Development Plan).

For the analysis of physical climate-related risks, a number of assets were selected, including 25 data centers located in major cities and regional centers across the Republic of Kazakhstan. These 25 assets cover three segments of the company's value chain: infrastructure, operations, and services.

Figure 8. Data Centers (DC) of Kazakhtelecom JSC

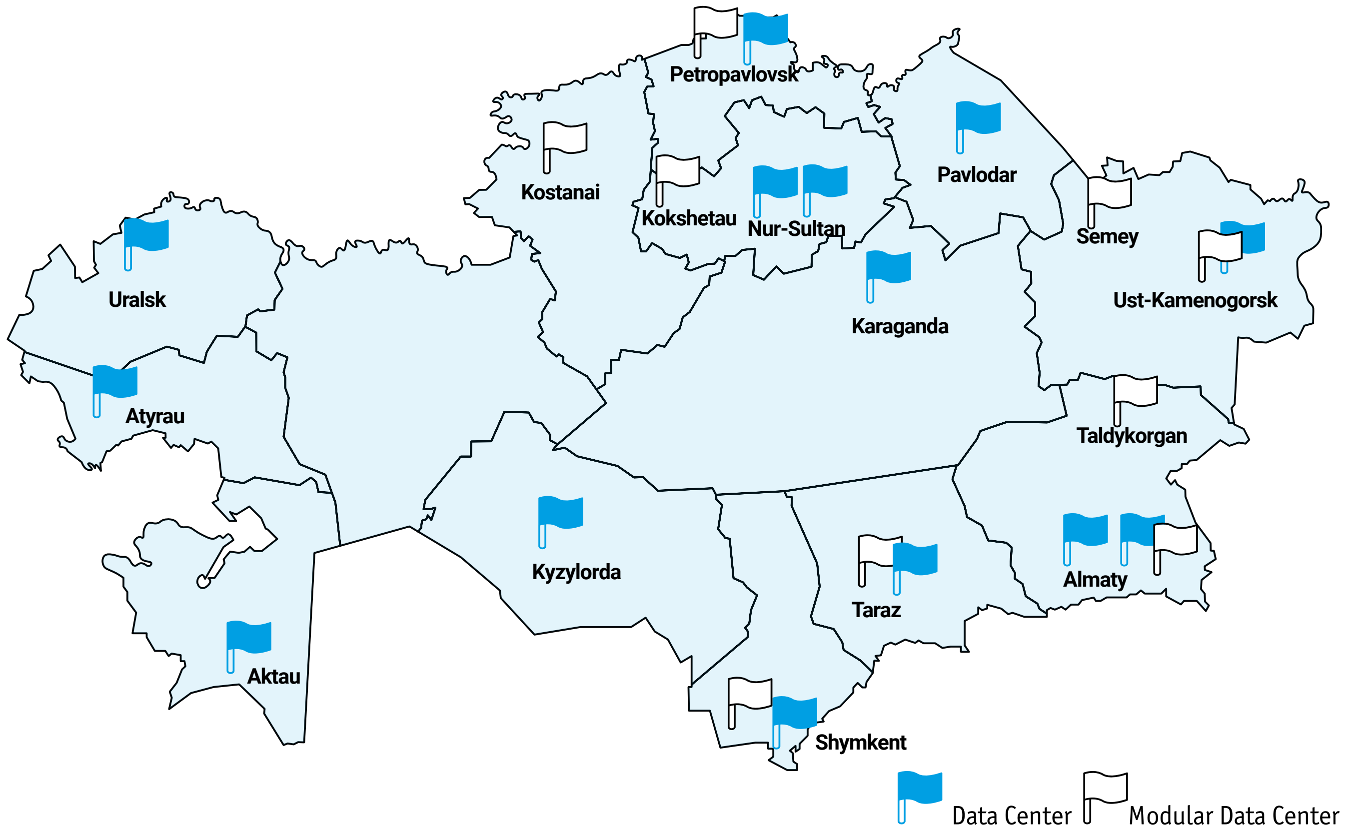


Table 1. Distribution of assets of Kazakhtelecom JSC by region

Name of the asset	Facility address by city	Regions	Number of Assets
Data Centers (DC)	Akkol	Akmola region	
Data Centers (DC)	Astana	Akmola region	
DC EXPO NTMC	Astana	Akmola region	5
Data Centers (DC)	Astana	Akmola region	
MDC NTMC	Kokshetau	Akmola region	

Name of the asset	Facility address by city	Regions	Number of Assets
MDC NTMC	Almaty	Almaty	5
SE ITD	Almaty	Almaty	
Data Centers (DC)	Almaty	Almaty	
MDC	Almaty	Almaty	
MDC NTMC	Taldykorgan	Almaty	
IDC	Atyrau	Atyrau region	1
MDC NTMC	Semey	East Kazakhstan region	3
MDC NTMC	Ust-Kamenogorsk	East Kazakhstan region	
IDC	Ust-Kamenogorsk	East Kazakhstan region	
MDC NTMC	Taraz	Zhambyl region	2
IDC	Taraz	Zhambyl region	
IDC	Karaganda	Karaganda region	1
MDC NTMC	Kostanai	Kostanay region	1
IDC	Kyzylorda	Kyzylorda region	1
IDC	Aktau	Mangistau region	1
Data Centers (DC)	Pavlodar	Pavlodar region	1
IDC	Petropavlovsk	North Kazakhstan region	2
MDC NTMC	Petropavlovsk	North Kazakhstan region	
MDC NTMC	Shymkent	South Kazakhstan region	2
IDC	Shymkent	South Kazakhstan region	

The analysis of climate risks for key segments of the value chain identifies the physical climate risks that may impact the assets of Kazakhtelecom and assesses how these risks could affect the business. This analysis is based on an assessment of potential physical climate impacts.

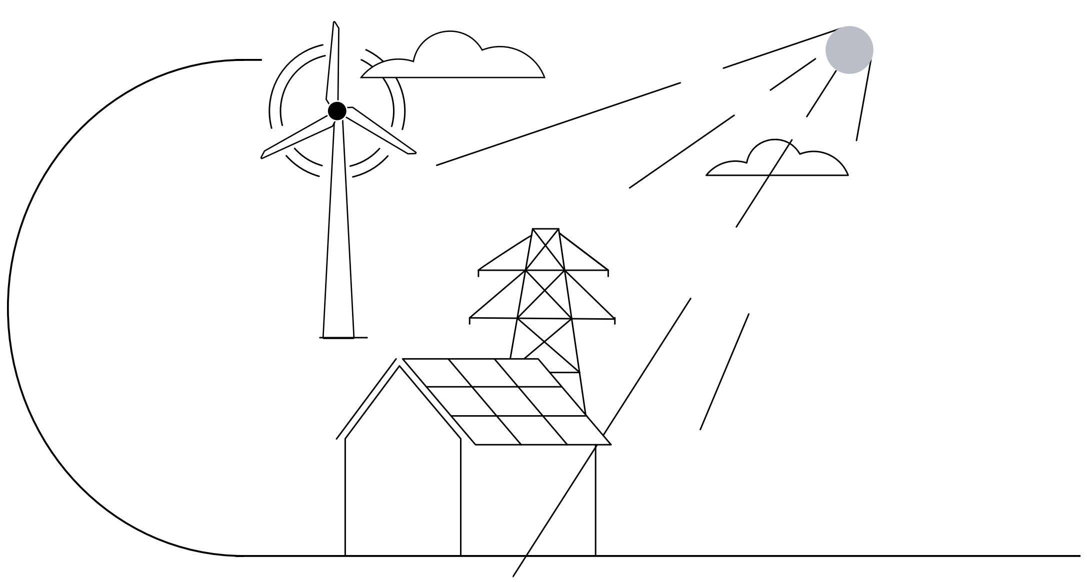


Table 2. Value chain and associated climate-related risks Kazakhtelecom JSC

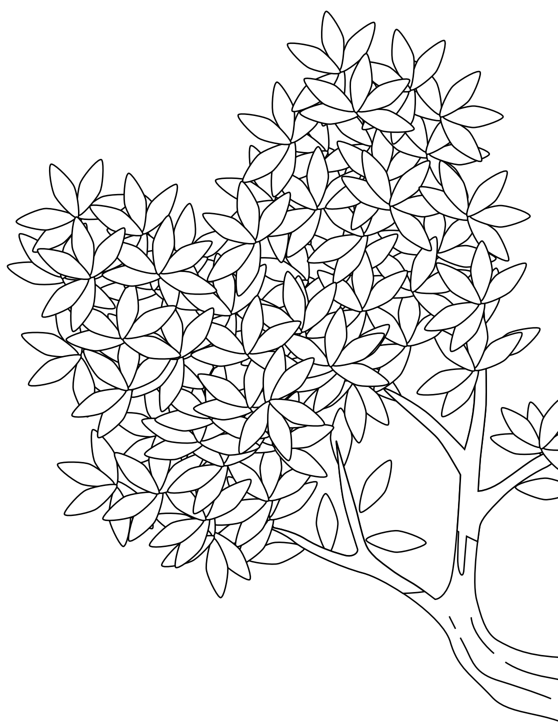
Name	Category	Subcategory	Detailed description of climate-related risk	Illustrative description of impact
Operations and Infrastructure	Chronic	Temperature	For operational facilities, many of them are exposed to multiple climate-related threats (air temperature, heat waves, annual maximum daily temperature, wet bulb temperature). These threats can also significantly impact the operability and safety of employees.	• Deterioration of production capacities. • Some equipment may not withstand high temperatures. • Additional costs (investments in cooling systems). • Impact on employee health: increased risk of heat-related illnesses and the risk of making incorrect decisions, which increases the likelihood of injuries, accidents, and reduces productivity.
Infrastructure	Chronic	Temperature	A decrease in temperature is a climate-related threat for which infrastructure assets are considered highly susceptible (in terms of the frequency of cold waves or the number of consecutive days, as well as the annual minimum daily temperature).	• Annual damage expressed as increased energy consumption costs related to heating. • Increased structural damage to physical infrastructure.

Name	Category	Subcategory	Detailed description of climate-related risk	Illustrative description of impact
Operations	Chronic	Increased humidity and precipitation	Humidity and precipitation can impact the reliability of equipment and cable networks, particularly in areas with highlevels of precipitation.	• Increased maintenance and equipment replacement costs. • Risk of corrosion of infrastructure components. • Disruptions in operations due to equipment damage and failures.
	Acute	Flooding	Flooding represents a significant climate-related risk to the assets of Kazakhtelecom, as it can lead to the inundation of infrastructure and serious damage to equipment.	• Flooding represents a significant climate-related risk to the assets of Kazakhtelecom, as it can lead to the inundation of infrastructure and serious damage to equipment.
	Chronic	Extreme weather (windload)	Assets in areas with high winds are exposed to risks of structural damage and operational disruptions.	• Increased repair and recovery costs. • Operational disruptions due to infrastructure damage. • Impact on employee safety.

Analysis of the Impact of Climate-related Physical Risks

To conduct a comprehensive analysis of climate-related physical risks, several data sources were utilized:

- risks with a highlevel of impact on average for 25 assets;
- climate-related risks identified by peer companies[5];
- climate-related risks identified by Kazakhtelecom JSC.

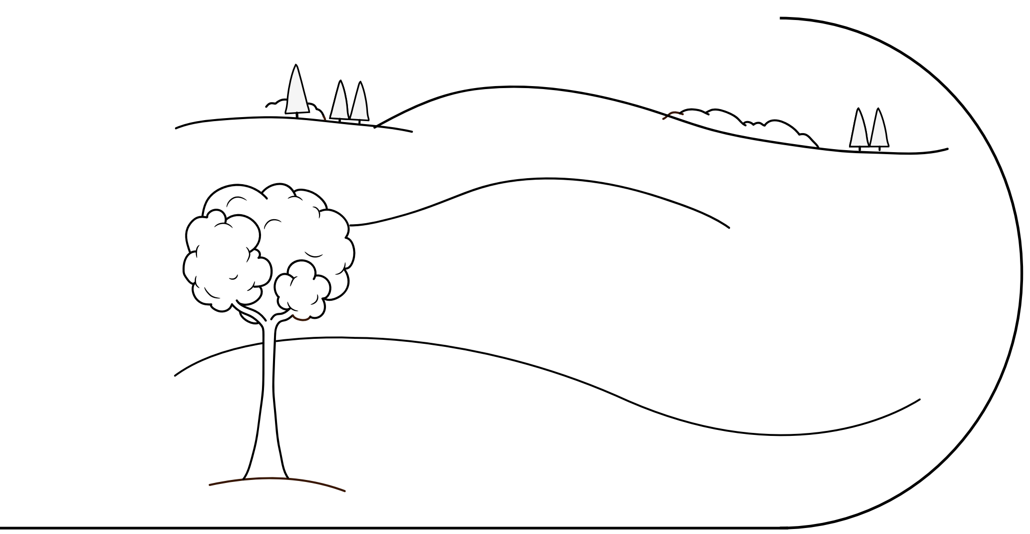


[5] For more details, see Appendix 1. Express Analysis of Climate Models Used by Peer Companies.

The finallist of indicators used in the analysis is presented below:

Table 3. List of indicators relevant for climate change analysis Kazakhtelecom JSC

Category	Type	Indicator/Unit of Measurement	Relevance for Risk Exposure Analysis
Temperature	Chronic	Annual minimum daily temperature (°C)	Relevant due to the threat of equipment and wire freezing.
	Chronic	Annual maximum daily temperature (°C)	Relevant for cooling equipment and preventing overheating.
Precipitation	Chronic	Annual precipitation (mm)	Operation of underground and above-ground cables, with risks of flooding and corrosion, especially in regions with high humidity and frequent precipitation.
Flooding	Acute	Flooding (m)	Increased structural damage to assets, which is important to consider when planning the placement of infrastructure in low-lying areas.
Extreme Weather	Acute	Maximum Wind Speed (m/s)	Protection of antennas and masts may lead to equipment destruction in steppe regions known for strong winds.



Dynamics of Physical Indicators Relative to the Baseline

The core concept of scenario modeling is to provide information on the projected changes in various climate impact indicators at different levels of global warming and how these changes may evolve over time under various greenhouse gas emission scenarios.

This information is provided at the regional level in the form of examined time series represented in charts that visualize the projected changes for characteristic levels of global warming (1.5°C, 2°C, and 2.5°C).

The information is based on climate impact models that participated in international initiatives. The models reflect the climate impact results for various emission scenarios and demonstrate the associated full ranges of uncertainty under global warming[6].

Below is a table showing the average value (across the initial 25 assets) and the change over time and across scenarios.

Table 4. Physical values of indicators for each scenario and their change compared to the baseline

Category	Physical hazards	Historical data	RCP2.6 - (2032)	Change (%)	RCP2.6 - (2060)	Change (%)	RCP4.5 (2032)	Change (%)	RCP4.5 - (2060)	Change (%)	RCP8.5 - (2032)	Change (%)	RCP8.5 - (2060)	Change (%)
Tem-perature	Air surface temperature (°C)	6.65	8.10	21.8	8.41	26.5	8.10	21.8	9.19	38,2	8.63	29.8	10.41	56.5
Tem-perature	Annual minimum daily temperature (°C)	0.92	2.42	163	2.89	214	2.42	163	3.53	284	2.90	215	4.72	413

[6] For more details on the range of uncertainty in modeling, see Appendix 2. Range of Uncertainty in Model Construction.

Category	Physical hazards	Historical data	RCP2.6 - (2032)	Change (%)	RCP2.6 - (2060)	Change (%)	RCP4.5 (2032)	Change (%)	RCP4.5 - (2060)	Change (%)	RCP8.5 - (2032)	Change (%)	RCP8.5 - (2060)	Change (%)
Tempera-ture	Annual Maximum Daily Temperature (°C)	12.40	13.84	11.6	14.16	14.2	13.91	12.2	15.05	21.4	14.38	15.9	16.25	31
Precipita-tion	Snow Depth (mm)	254	251.6	-0.9	247.2	-2.7	247.9	-2.4	231.5	-8.9	242.4	-4.6	209.3	-17.6
Precipita-tion	Annual Precipitation (mm/year)	432	457.8	5.9	464.9	7.6	457.8	5.9	465.8	7.8	464.9	7.6	458.9	6.2
Flooding[7]	River Flooding (m)	0.07	-	-	0.4	471	-	-	0.47	571	-	-	0.63	529
Extreme weather	Wind Speed (m/s)	19	18.7	-1.6	18.9	-0.5	18.8	-1.1	18.6	-2.1	18.8	-1.1	18.4	-3.2

Overall, the average values for physical risks for the assets of Kazakhtelecom JSC, including air temperature, precipitation, and extreme weather conditions, indicate that climate change will lead to changes in these indicators across all scenarios.

Temperature indicators demonstrate a consistent increase, confirming the overall trend of warming.

At the same time, there is an increase in total precipitation, which may lead to a rise in flood risks. In scenarios with high emission levels, such as RCP8.5, an increase in the frequency and intensity of flooding is anticipated.

The decrease in snow cover levels may also affect seasonal runoff in water bodies, increasing the uneven distribution of water and the risk of flooding during the spring period.

The maximum wind speed is generally decreasing, leading to a range of climate and ecological consequences. First, the reduction in wind activity may result in a natural decrease in cooling, exacerbating heat stress in hot regions. Second, the weakening of winds may reduce water evaporation, impacting humidity in key areas and increasing the risk of droughts.

Furthermore, the analysis results for each climate indicator, along with the identification of vulnerable regions for each climate factor, demonstrate the greatest susceptibility to climate change within the RCP8.5 scenarios. This data provides a more comprehensive understanding of the long-term risks associated with climate change.

[7] IPCC AR6 Synthesis Report: Climate Change 2023.

Results of the Physical Risk Analysis for the Assets of Kazakhtelecom JSC

This section presents the results of the analysis of physical climate-related risks for the assets of Kazakhtelecom JSC. The study covers key company facilities, including data centers, to assess their vulnerability to various climate scenarios. The analysis was conducted based on climate parameters such as temperature, precipitation, flooding, and extreme weather events, examining the potential impacts of these factors on the company's operations. Climate modeling for Kazakhtelecom extends to the year 2060. This modeling horizon was chosen inline with the Strategy for Achieving Carbon Neutrality of the Republic of Kazakhstan by 2060. The provisions of the Low-Carbon Development Program of Kazakhtelecom JSC for 2022–2032 were considered in the development of the models.

Temperature

This indicator encompasses three climate-related risks: increasing average temperatures, high temperatures, and low temperatures.

Table 5. Changes in physical temperature values relative to the baseline

Category	Physical hazards	Historical data	RCP2.6 - (2032)	Change (%)	RCP2.6 - (2060)	Change (%)	RCP4.5 (2032)	Change (%)	RCP4.5 - (2060)	Change (%)	RCP8.5 - (2032)	Change (%)	RCP8.5 - (2060)	Change (%)
Tempera-ture	Air Surface Temperature (°C)	6.65	8.10	21.8	8.41	26.5	8.10	21.8	9.19	38,2	8.63	29.8	10.41	56.5

Category	Physical hazards	Historical data	RCP2.6 - (2032)	Change (%)	RCP2.6 - (2060)	Change (%)	RCP4.5 (2032)	Change (%)	RCP4.5 - (2060)	Change (%)	RCP8.5 - (2032)	Change (%)	RCP8.5 - (2060)	Change (%)
Tempera-ture	Annual Min-imum Daily Temperature (°C)	0.92	2.42	163	2.89	214	2.42	163	3.53	284	2.90	215	4.72	413
Tempera-ture	Annual Maximum Daily Temperature (°C)	12.40	13.84	11.6	14.16	14.2	13.91	12.2	15.05	21.4	14.38	15.9	16.25	31

In all scenarios (RCP2.6, RCP4.5, RCP8.5), there is a consistent increase in temperature indicators, though the extent of this rise varies significantly depending on time horizons and emission levels.

By 2032, the average surface air temperature increases by 21.8% in the RCP2.6 and RCP4.5 scenarios, whereas in RCP8.5, this rise reaches 38.2%. Over the same period, the minimum daily temperature increases 1.6 times in the RCP2.6 scenario, nearly threefold in RCP4.5, and more than fourfold in RCP8.5, indicating a significant reduction in cold periods, especially under high-emission scenarios. The annual maximum of the daily maximum temperature also shows a marked rise: 11.6% in RCP2.6, 12.2% in RCP4.5, and 15.9% in RCP8.5, pointing to an intensification of extreme temperature events in the near future.

By 2060, the differences between the scenarios become even more pronounced. In the RCP2.6 scenario, the average surface air temperature increases by 26.5%, in RCP4.5 by 38.2%, and in RCP8.5 by 56.5%. By this time, the minimum daily temperature rises 3 to 4 times, significantly altering temperature conditions throughout the year. The annual maximum of the daily maximum temperature increases by 14.2% in RCP2.6, 21.4% in RCP4.5, and 31% in RCP8.5. Thus, the most significant changes occur in the RCP8.5 scenario, where the growth rates of all indicators reach peak levels, indicating an increased likelihood of extreme weather conditions in the future.

Temperature Increase

Overall Trend of Rising Temperatures

An analysis of all climate change scenarios (RCP2.6, RCP4.5, and RCP8.5) shows that a consistent increase in average, maximum, and minimum temperatures is projected across all regions of Kazakhstan. This change affects both medium-term and long-term time horizons (2032 and 2060), creating significant climate-related risks for infrastructure, especially in regions with high asset density.

Most Vulnerable Regions

Regions with a higher concentration of telecommunications assets, such as Akmola, Almaty, and East Kazakhstan , are particularly vulnerable to climate change. The significant number of telecommunications assets in these regions amplifies the risks, as a large number of facilities, including data centers (DCs) and communication hubs, are simultaneously exposed to rising temperatures. This increases the strain on operational processes and heightens potential economic impacts.

An analysis of the three climate change scenarios (RCP2.6, RCP4.5, and RCP8.5) for the Akmola, Almaty, and East Kazakhstan regions demonstrates a consistent rise in temperature indicators. However, the rate of this increase varies depending on the selected scenario.

In the RCP2.6 scenario, the most moderate changes are projected: by 2060, the average annual temperatures are expected to reach 5.44°C in Akmola, 9.34°C in Almaty, and 5.28°C in East Kazakhstan. The RCP4.5 scenario shows a more pronounced temperature rise, while the RCP8.5 scenario presents significantly higher averages – up to 9.64°C in Almaty and 7.64°C in Akmola by 2060, indicating more aggressive warming trends in these scenarios compared to RCP2.6.

Maximum temperatures in all scenarios also show the most significant increase in the RCP8.5 scenario, particularly for the Almaty region, where the maximum temperature is projected to reach up to 17.59°C by 2060. In the RCP2.6 scenario, the maximum temperature for this region is expected to be 14.99°C by 2032 and 15.29°C by 2060. The Akmola and East Kazakhstan regions display similar changes in maximum temperatures across all scenarios, but their growth is more moderate compared to the Almaty region.

Minimum temperatures exhibit the most substantial variations between the scenarios, especially in the Almaty region, where the minimum temperature could rise to 5.72°C by 2060 under the RCP8.5 scenario. This is significantly higher compared to the minimum temperatures projected for the Akmola and East Kazakhstan regions, where they are forecasted to reach 2.17°C and 1.55°C, respectively. In the RCP2.6 scenario, minimum temperatures remain closer to zero for the Akmola and East Kazakhstan regions, indicating colder winters in these regions under this scenario.

[8] See Table 1. Distribution of assets of Kazakhtelecom JSC by region.
[9] Temperature change diagrams based on scenario modeling results are presented in Appendix 3. Trends in Temperature Changes by Climate Impact Scenarios.

The analysis indicates that the most significant changes in temperature indicators are expected under the RCP8.5 scenario, particularly in the Almaty region, where a substantial increase in average, maximum, and minimum temperatures is projected. This scenario suggests the most pronounced warming trend. The RCP2.6 scenario exhibits more moderate changes, especially for the Akmola and East Kazakhstan regions, maintaining relatively cold winters and more limited growth in maximum temperatures.

Infrastructure Risks

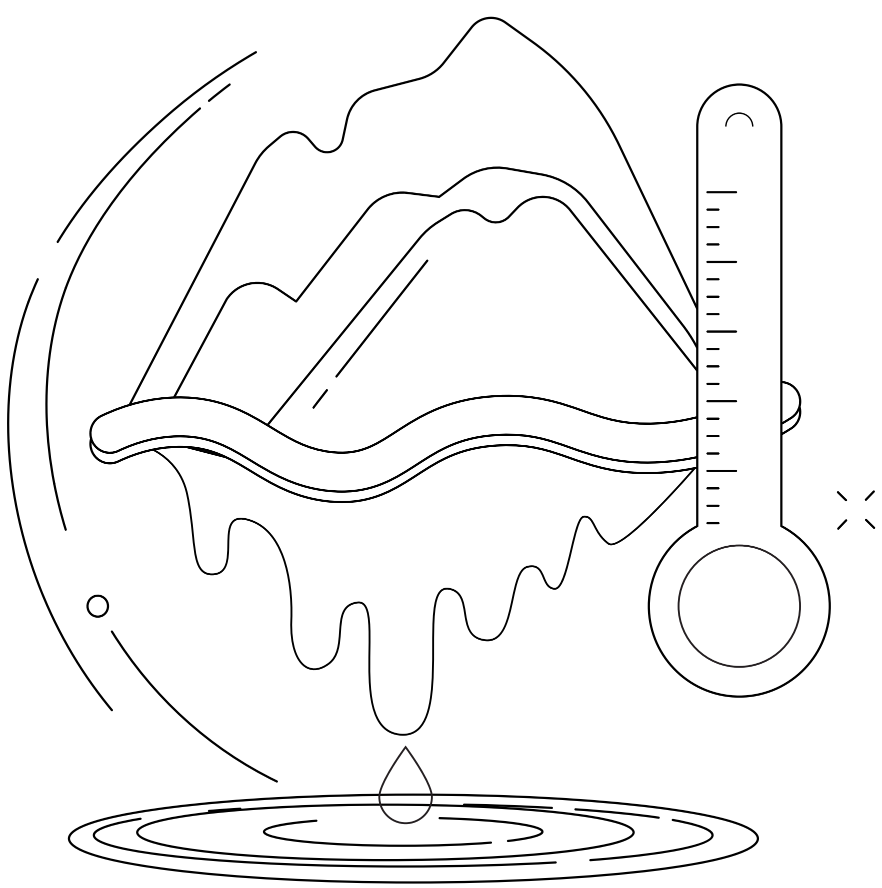
The rise in temperatures may be accompanied by more frequent and intense periods of hot weather, increasing the likelihood of heat stress for both people and ecosystems. There is also a potential for intensified droughts in traditionally arid regions, along with an increased risk of wildfires. Milder winters may lead to uneven snowmelt, which, in turn, could contribute to a heightened risk of flooding in certain areas. Increased precipitation may result in local floods and landslides. These phenomena are becoming more likely under the RCP8.5 scenario, which exhibits the most pronounced warming trends.

The rise in temperatures creates additional challenges for cooling systems and energy equipment. With the continuous increase in temperatures, operating costs for ventilation systems rise, as does the need for infrastructure upgrades to prevent overheating.

Increased temperatures can also adversely affect employee health, especially for those working in outdoor environments, raising the risk of heat-related illnesses and reducing productivity.

Long-term Consequences and Projections

The analysis of temperature changes for the Akmola, Almaty, and East Kazakhstan regions indicates that, regardless of the climate change scenario, temperature indicators are expected to continue to rise. This underscores the necessity for long-term adaptation measures to enhance infrastructure resilience to climate-related risks. The increase in temperatures necessitates a comprehensive approach to managing climate-related risks and preparing telecommunications systems for emerging climate challenges.



Precipitation

These indicators encompass two main climate-related risks: snowfall amounts and total annual precipitation.

Table 6. Changes in physical values of precipitation relative to the baseline level

Category	Physical hazards	Historical data	RCP2.6 - (2032)	Change (%)	RCP2.6 - (2060)	Change (%)	RCP4.5 (2032)	Change (%)	RCP4.5 - (2060)	Change (%)	RCP8.5 - (2032)	Change (%)	RCP8.5 - (2060)	Change (%)
Precipitation	Snow Depth (mm)	254	251.6	-0.9	247.2	-2.7	247.9	-2.4	231.5	-8.9	242.4	-4.6	209.3	-17.6
Precipitation	Annual Precipitation (mm/year)	432	457.8	5.9	464.9	7.6	457.8	5.9	465.8	7.8	464.9	7.6	458.9	6.2

Within the RCP2.6, RCP4.5, and RCP8.5 scenarios, there is a general trend of decreasing snow cover levels and a moderate increase in total precipitation for the time horizons of 2032 and 2060.

In the RCP2.6 scenario, the reduction in snow levels by 2032 is projected to be 0.9%, while by 2060, it is expected to reach 2.7%. The RCP4.5 scenario shows a more significant decline in snow cover, with a decrease of 2.4% by 2032 and 8.9% by 2060. The most substantial losses in snow levels are forecasted in the RCP8.5 scenario, where a reduction of 4.6% is anticipated by 2032, and up to 17.6% by 2060. This indicates a progressive decline in snow precipitation, especially under high-emission scenarios.

Regarding annual precipitation, all scenarios forecast an increase, although the rates of growth vary. In the RCP2.6 scenario, annual precipitation is expected to rise by 5.9% by 2032 and by 7.6% by 2060. In the RCP4.5 scenario, a similar increase is projected, with 5.9% by 2032 and 7.8% by 2060. In the RCP8.5 scenario, despite a rise in precipitation of 7.6% by 2032, the rate of increase slows down by 2060, with a gain of 6.2%.

Thus, the RCP8.5 scenario demonstrates the most pronounced decline in snow levels and a more moderate increase in precipitation, while the RCP2.6 and RCP4.5 scenarios are characterized by more balanced changes in precipitation with smaller losses in snow cover.

Overall Trend of Increasing Precipitation

Climate change in Kazakhstan, according to the three scenarios (RCP2.6, RCP4.5, and RCP8.5) up to 2060, indicates significant changes in the amount of annual precipitation and snow accumulation. The most noticeable changes are observed in the RCP8.5 scenario, which forecasts an increase in precipitation as well as active snowmelt in several regions of the country. This creates flooding risks, necessitating the implementation of measures to adapt infrastructure and enhance its resilience to changing weather conditions.

Most Vulnerable Regions

Scenario analysis has shown[10] that the regions facing the highest climate-related risks include the Atyrau, Mangistau, and South Kazakhstan regions. In these areas, a significant increase in annual precipitation and accelerated snowmelt are projected.

The analysis of the RCP2.6, RCP4.5, and RCP8.5 scenarios for the Atyrau, Mangistau, and South Kazakhstan regions reveals differences in precipitation growth trends, with the most significant changes observed in the RCP8.5 scenario. The South Kazakhstan region shows the largest absolute increase in precipitation among the studied regions. In 2032, under the RCP8.5 scenario, maximum precipitation in this region is projected to reach 716.5 mm, which is 16.7% higher than historical values. By 2060, this figure increases to 894.6 mm, or 45%, indicating a substantial rise compared to baseline levels. This increase in precipitation poses serious risks to the region's infrastructure, highlighting the need for measures to minimize flooding risks.

At the same time, the Atyrau and Mangistau regions demonstrate significant increases in precipitation. In the Atyrau region, under the RCP8.5 scenario, maximum precipitation is projected to rise by 18% (218 mm) by 2032 and by 30% (240 mm) by 2060 compared to historical data. This increase places additional pressure on existing infrastructure, especially considering the region's limited drainage capacity. In the Mangistau region, precipitation is expected to increase by 15.4% (195 mm) under the RCP8.5 scenario by 2032 and by 39% (234 mm) by 2060, posing a serious risk for a region traditionally characterized by low precipitation levels. The sharp rise in precipitation could overwhelm drainage systems and increase the likelihood of flooding.

Thus, all three regions face heightened climate-related risks associated with increased precipitation. The South Kazakhstan region experiences the most significant rise in precipitation. In the Atyrau and Mangistau regions, the sharp increase in precipitation poses a threat to infrastructure, particularly if it is not adapted to such changes in climatic conditions.

Risks Associated with Decreasing Snowfall

Despite the overall increase in precipitation, a long-term decline in snowfall is expected, especially under the RCP8.5 scenario. This shift will be accompanied by more frequent and intense rainfall, increasing the risk of flooding and soil erosion. As snowfall decreases and rain-related pressures rise, existing infrastructure may require enhanced protective systems and the adaptation of telecommunications facilities to new climatic conditions in order to minimize impacts on networks and equipment.

[10] Temperature change diagrams based on scenario modeling results are presented in Appendix 4. Trends in Precipitation Changes by Climate Impact Scenarios.

Recommendations for Infrastructure Adaptation

The growing climate-related risks from changes in precipitation and snowfall require a comprehensive approach to infrastructure modernization. This includes strengthening drainage systems, reinforcing water diversion infrastructure, and implementing technologies to protect assets from flooding and other weather anomalies. Investing in the adaptation of infrastructure to new climatic conditions will help minimize risks and ensure the stable operation of telecommunications systems in the long term.

Floods

This indicator encompasses one of the climate-related risks – floods.

Table 7. Changes in physical values related to floods compared to baseline levels.

Category	Physical hazards	Historical data	RCP2.6 - (2032)	Change (%)	RCP2.6 - (2060)	Change (%)	RCP4.5 (2032)	Change (%)	RCP4.5 - (2060)	Change (%)	RCP8.5 - (2032)	Change (%)	RCP8.5 - (2060)	Change (%)
Floods[11]	River flooding (m)	0.07	-	-	0.4	471	-	-	0.47	571	-	-	0.63	529

To assess the exposure of Kazakhtelecom JSC assets to flood-related risks, the data were limited in both volume and scope. Due to the limited coverage of climate scenarios and regions, a comprehensive evaluation of the impact on all assets within this analysis is not feasible. Consequently, the results should be interpreted with these limitations in mind, and further adaptation and risk mitigation measures should be based on more detailed data.

Most Vulnerable Regions

According to the analysis conducted, an increase in the impact of climate risk is expected in the Atyrau and Mangistau regions[12] by 2060, particularly under the RCP8.5 scenario.

[11] IPCC report, 2023.

[12] The diagrams illustrating changes in flooding based on scenario modeling results are presented in Appendix 5. Flood Dynamics by Climate Impact Scenarios.

By 2060, similar forecasts for flood levels are observed in the Atyrau and Mangistau regions, with projections of up to 0.3 m under the RCP2.6 and RCP4.5 scenarios.

The RCP8.5 scenario suggests more significant changes. In the Atyrau region, the average flood level is projected to reach 0.31 m by 2032, while in the Mangistau region, the impact increases to 0.40 m during the same period. By 2060, a maximum increase in flood levels of 0.7 m is forecasted for the Mangistau region, making it more vulnerable to flooding-related risks.

Thus, the greatest flood risk in the Mangistau region is predicted under the RCP8.5 scenario. These scenarios demonstrate a moderate increase in flood levels in the regions under consideration, indicating the need to prepare assets for potential water-related risks.

Extreme weather conditions

This indicator includes one climate risk, specifically the maximum wind speed (m/s). It represents the annual value of the daily maximum wind speed.

Table 8. Changes in physical values of maximum wind speed relative to baseline levels

Category	Physical hazards	Historical data	RCP2.6 - (2032)	Change (%)	RCP2.6 - (2060)	Change (%)	RCP4.5 (2032)	Change (%)	RCP4.5 - (2060)	Change (%)	RCP8.5 - (2032)	Change (%)	RCP8.5 - (2060)	Change. (%)
Extreme weather	Maximum wind speed (m/s)	19	18.7	-1.6	18.9	-0.5	18.8	-1.1	18.6	-2.1	18.8	-1.1	18.4	-3.2

When assessing changes in the maximum wind speed according to the RCP2.6, RCP4.5, and RCP8.5 scenarios, a consistent trend of decreasing wind speed is observed across all scenarios.

In the RCP2.6 scenario, the maximum wind speed will decrease by 1.6% by 2032 compared to historical data, but by 2060, it will nearly recover, reaching a level close to the baseline with a 1% increase.

The RCP4.5 scenario shows similar changes: by 2032, the wind speed will decrease by 1.1%, and by 2060, this decline will intensify to 2.1%. In the RCP8.5 scenario, the wind speed will decrease by 1.1% by 2032, but by 2060, the reduction will be more pronounced, reaching 3.2%.

Thus, in the long term (by 2060), the greatest reduction in wind speed is projected under the RCP8.5 scenario, indicating a potential decrease in extreme weather events related to strong winds.

General Trend of Decreasing Maximum Wind Speed

Climate changes in Kazakhstan, according to the three scenarios (RCP2.6, RCP4.5, and RCP8.5) up to 2060, show an overall trend of decreasing maximum wind speed. The most significant reduction is observed in the RCP8.5 scenario, where a 3.2% decrease in wind speed is projected. This may affect wind flow dynamics, reducing the likelihood of extreme weather events related to strong winds, while simultaneously impacting air quality.

Most Vulnerable Regions

To assess changes in maximum wind speed under various climate scenarios (RCP2.6, RCP4.5, and RCP8.5) by 2032 and 2060, an analysis was conducted across several regions where the assets of JSC «Kazakhtelecom» are located. Three key regions were selected to assess the impact of climate-related changes on wind speed – the Zhambyl, South Kazakhstan, and Akmola regions – where maximum wind speeds remain high despite the overall trend of decline across different climate scenarios (RCP2.6, RCP4.5, and RCP8.5).

In the Zhambyl region, the highest wind speeds are observed among all three regions. Under the RCP8.5 scenario, the maximum wind speed reaches 27.78 m/s in 2032, with a slight decrease to 27.44 m/s by 2060, indicating significant wind loads in the long term. Even under the more moderate RCP2.6 scenario, the maximum wind speed reaches 28.17 m/s in 2060, highlighting the importance of this region for assessing climate-related risks associated with extreme weather conditions.

In the South Kazakhstan region, despite the overall decrease in wind speed across all scenarios, the maximum values remain high. Under the RCP4.5 scenario, the wind speed reaches 22.12 m/s in 2032 and decreases slightly to 21.78 m/s by 2060. The RCP8.5 scenario shows similar trends: the wind speed reaches 21.89 m/s in 2032 and 21.60 m/s by 2060, indicating sustained high wind loads in the region, though slightly lower compared to the Zhambyl region.

The Akmola region demonstrates consistently high maximum wind speeds across all scenarios. Under both the RCP2.6 and RCP4.5 scenarios, the maximum wind speed remains at 24 m/s in 2032 and 2060. Despite these stable values, the Akmola region remains an area of high wind activity, underscoring the need for reinforcing the company's infrastructure and assets to withstand potential wind loads in the region.

Thus, the highest wind loads are observed in the Zhambyl region; however, the South Kazakhstan and Akmola regions also continue to experience strong winds in the long term.

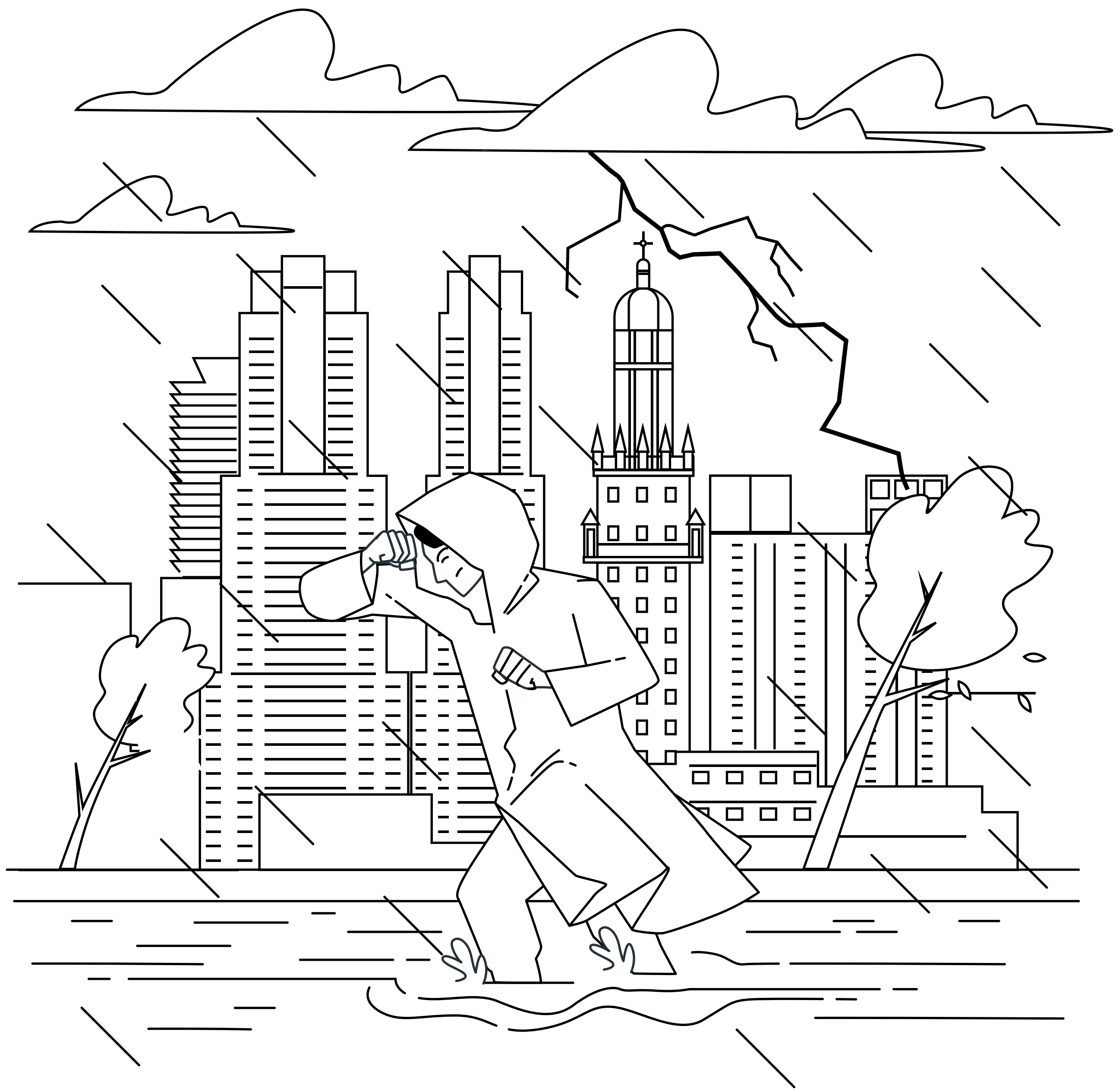
[13] The temperature change diagrams based on scenario modeling results are presented in Appendix 6. Dynamics of Maximum Wind Speed According to Climate Impact Scenarios.

Risks Related to Extreme Winds

The overall decrease in wind speed may negatively affect air quality, reduce the performance of wind energy generation, and alter the microclimate, which could impact infrastructure and the resilience of telecommunications networks. On the other hand, extreme winds can increase wind loads on infrastructure, necessitating consideration during the design and operation of communication facilities.

Recommendations for Infrastructure Adaptation

To adapt to changes in wind speed, it is recommended to consider the potential decrease in wind activity, which may require revising energy infrastructure. In areas with persistently high wind speeds, the resilience of critical assets such as buildings and telecommunications towers should be strengthened. Although the overall risk is not high, these measures will help mitigate potential negative impacts and ensure the stable operation of the company's assets.



Analysis of the Impact of Transition Climate-Related Risks

The TCFD Task Force has developed a structured approach that enables organizations to effectively assess and disclose climate-related risks and opportunities within their financial reporting. Given the growing demand from investors, creditors, insurance companies, and other stakeholders for climate-related financial information, the TCFD and the International Sustainability Standards Board (ISSB) provide metrics and data essential for conducting a robust analysis of the potential financial implications of climate change.

The TCFD recommendations and the IFRS S1 and S2 requirements aim to encourage companies to assess and disclose information on climate-related risks and opportunities in their annual financial reports. The focus is primarily on two types of risks:

Transition risks associated with the shift toward a low-carbon economy: These risks include changes in policy, regulation, technology, market conditions, and reputation related to climate change mitigation and adaptation efforts.

Physical risks linked to the physical impacts of climate change: These risks are driven by direct climate changes, such as rising temperatures, altered precipitation patterns, and extreme weather events.

Additionally, the standards recommend conducting scenario analysis to assess the resilience of companies' strategies under different climate conditions. This approach enables a better understanding of potential risks and opportunities, allowing companies to adapt their strategies in response to changing circumstances.

For Kazakhtelecom, the following transition risks have been identified based on the TCFD recommendations and the requirements of the IFRS S1 and S2 standards:

Legal risks

Political and regulatory measures regarding climate change continue to evolve, and their objectives are generally divided into two areas: mitigating processes that contribute to the adverse effects of climate change and stimulating adaptation to climate change. For example, this includes the implementation of carbon pricing mechanisms and the transition to low-carbon energy sources. For Kazakhtelecom, this implies the need to monitor and comply with new requirements, which may increase operational costs and necessitate significant investments in infrastructure modernization.

Litigation and legal risks also play a significant role. An increase in climate-related lawsuits may create additional financial liabilities for the company. This necessitates heightened attention from Kazakhtelecom to information disclosure and compliance with all regulatory requirements to minimize legal risks.

Technological risks

Technological innovations that support the transition to a low-carbon economy can significantly impact Kazakhtelecom's operations. The development and implementation of renewable energy sources, energy storage systems, and other energy-efficient solutions will require substantial investments. The company must modernize its infrastructure to meet new technological standards and remain competitive in the market.

The uncertainty associated with the timelines for the development and deployment of new technologies also poses a risk, as it affects how effectively the company can adapt to market changes.

Market risks

Climate change affects market conditions, which can manifest as changes in the demand and supply for telecommunications services and equipment. For Kazakhtelecom, this means the need to adapt its business model and products to new conditions, where sustainability becomes a key factor for customers and partners.

The demand for more energy-efficient and sustainable solutions is expected to rise, which may require the company to develop new products and services focused on reducing the carbon footprint and addressing emerging market needs.

These three categories of risks have been selected for analysis and inclusion in Kazakhtelecom's report due to their significant impact on the company's operations and the necessity for adaptation to changing conditions. Based on the TCFD recommendations and the requirements of IFRS S1 and S2, Kazakhtelecom should analyze and integrate these risks into its management strategy to ensure long-term resilience and competitiveness in the market.

Results of the Analysis of Transition Risks for the Assets of Kazakhtelecom JSC

Climate modeling for Kazakhtelecom extends to the year 2060. This modeling horizon was chosen in alignment with Kazakhstan's Strategy for Achieving Carbon Neutrality by 2060. In developing the models, the provisions of the Low-Carbon Development Program of Kazakhtelecom JSC for 2022–2032 were taken into account.

For Kazakhtelecom, financial modeling of climate risks was conducted across four scenarios (RCP2.6, RCP4.5, RCP8.5, and NZE2050)[14], which help evaluate how various climate changes and corresponding regulatory measures may impact Kazakhtelecom's financial performance in the long term. The modeling encompasses key aspects such as revenue, operating expenses (OPEX), capital expenditures (CAPEX), EBITDA, and operating profit.

The analysis examined scenarios with different levels of carbon emissions, allowing for the assessment of the company's impact under changing legislation, rising temperatures, and increased frequency of extreme weather events. The models also considered potential changes in electricity prices and the need for infrastructure modernization to comply with new environmental standards.

The results of the climate modeling indicated that, overall, Kazakhtelecom is not expected to experience significant impacts on its financial performance from climate-related risks. Despite potential changes in legislation, rising temperatures, and increased frequency of extreme weather events, the company is prepared to adapt to these changes. Financial metrics such as revenue, operating expenses, and capital expenditures remain stable across various scenarios, indicating a high level of resilience for Kazakhtelecom to climate-related challenges.

[14] The financial modeling of climate risks across four scenarios (RCP2.6, RCP4.5, RCP8.5, and NZE2050) is presented in Appendix 7. Potential Impact of Climate Change on the Financial Performance of Kazakhtelecom JSC under Climate Impact Scenarios.

Brief description of the most significant risk: For Kazakhtelecom JSC, regulatory risks are primarily associated with increasing energy efficiency standards and the potential rise in electricity prices. However, given the nature of the company's operations, the impact of regulatory changes is less significant compared to sectors such as oil or metallurgy. The greatest financial risk lies in the rising cost of electricity, which could directly affect the company's operating expenses.

At the same time, significant investments in infrastructure modernization are not required, as existing technological solutions can adapt to new standards with minimal adjustments. Investments in upgrading equipment to comply with new energy efficiency standards are planned to refresh and enhance existing systems aimed at reducing energy consumption and improving overall energy efficiency. These capital expenditures (CAPEX) are intended for system upgrades in the early years following the implementation of the new standards.

Assessment of financial implications before mitigation measures: Over $10 million

Assessment of time horizon: Impacts starting from 2028

Assessment of risk management action costs: Over $15 million through 2060

Risks arising from changes in physical climate parameters or other climate-related changes.

Brief description of the most significant risk: Physical climate risks for Kazakhtelecom JSC include rising temperatures, extreme weather events (such as flooding and strong winds), and increased precipitation. These changes can affect the company's infrastructure, particularly data centers and telecommunications networks. Rising temperatures will necessitate additional investments in cooling systems to prevent equipment overheating, which also raises health risks for employees working on-site. Flooding can cause significant damage to infrastructure, especially in low-lying areas, requiring capital expenditures for recovery and fortification of facilities.

Assessment of financial implications before mitigation measures: Over $1 billion

Assessment of time horizon: Impacts starting from 2050

Assessment of risk management action costs: Over $40 million, from 2030 to 2060

Brief description of the most significant opportunity: One of the key opportunities for Kazakhtelecom JSC is the implementation of energy-efficient solutions and the transition to renewable energy sources (RES). The company is actively working to reduce its carbon footprint by replacing copper lines with more energy-efficient solutions, as well as integrating IoT technologies and digital modelling. Additionally, the purchase of green certificates and the commercialisation of carbon offsets could provide significant benefits, both through emissions reductions and the monetisation of climate-related projects.

Time horizon assessment: Benefits starting from 2030

Benefits assessment: More than USD 10 million by 2060

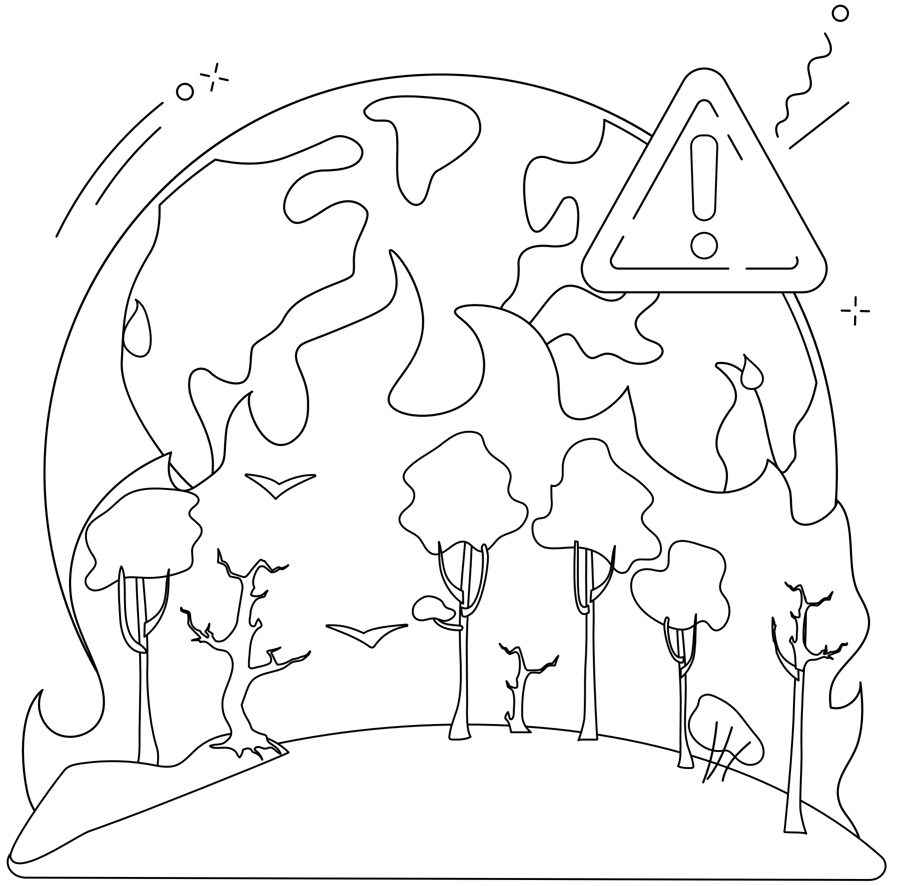
The analysis of all four scenarios demonstrates how climate change could impact Kazakhtelecom's financial performance in the long term, up to 2060. In the low and moderate emissions scenarios (RCP2.6 and RCP4.5), the company exhibits steady growth in EBITDA and operating profit, indicating its ability to maintain financial stability in a more favorable climate with moderate emissions. Operating expenses remain under control, and the company shows successful adaptation to changes, as evidenced by positive profit trends.

However, in the high emissions scenario (RCP8.5), there is a significant decline in both EBITDA and operating profit after 2050. This is attributed to the intensification of climate risks, leading to increased operating costs and reduced profitability. The emerging financial difficulties highlight the company's vulnerability in the face of escalating climate changes.

The NZE2050 scenario envisions significant investments in renewable energy sources and «green» technologies. This scenario requires substantial capital expenditures for infrastructure modernization and the implementation of energy-efficient solutions to achieve carbon neutrality by 2050. Investments are aimed at reducing the company's carbon footprint and complying with new environmental standards, which in the long term may decrease dependence on traditional energy sources and enhance the company's resilience to changes in the energy market.

However, such investments come with financial challenges. Despite an initial increase in financial performance, there is stabilization by 2050, followed by a decline in EBITDA and operating profit. This indicates that while the implementation of «green» technologies supports the achievement of environmental goals, it also leads to higher operating costs and may exert pressure on profitability in the long term. Nevertheless, investments in «green» technologies and renewable energy are necessary measures for adapting to changing climate conditions and meeting global and national commitments to reduce greenhouse gas emissions.

Overall, the analysis shows that Kazakhtelecom maintains stability and financial resilience in most climate scenarios. In low and moderate emissions conditions, the company demonstrates steady growth and the ability to adapt to changes. However, in the high emissions scenario (RCP8.5), serious financial challenges arise due to increased operating costs and declining profitability. It is important to note that these risks manifest closer to 2060 and, despite their seriousness, do not have an immediate impact on the company's current financial stability.



Climate Opportunities

Kazakhstan is actively implementing measures to reduce its carbon footprint and promote sustainable development. These efforts are reflected in the national climate policy, supported by key documents such as the Environmental Code of the Republic of Kazakhstan, the Paris Agreement on climate, the Strategy for achieving carbon neutrality by 2060, and the Updated Nationally Determined Contribution of the Republic of Kazakhstan to global climate response (NDC).

The Environmental Code of the Republic of Kazakhstan, adopted in 2021, aims to establish a legal framework for the country's sustainable development. It includes measures to reduce greenhouse gas emissions, stimulate the use of renewable energy sources, and improve environmental safety. The Code also provides for the implementation of mechanisms such as emissions trading systems, support for green technologies, and the promotion of energy-saving practices.

The Paris Agreement on climate is a key international commitment of Kazakhstan aimed at limiting global warming. Under this agreement, the country has undertaken obligations to reduce greenhouse gas emissions and achieve carbon neutrality by 2060. These goals are reflected in the Strategy for Achieving Carbon Neutrality of the Republic of Kazakhstan by 2060, which focuses on gradually phasing out coal energy, increasing the share of renewable energy sources, and promoting green technologies.

For Kazakhtelecom, these changes in national climate policy present new opportunities to integrate sustainable practices into its operations. As part of the Low-Carbon Development Program for 2022–2032, Kazakhtelecom plans to implement energy-efficient solutions and decarbonize its infrastructure.

Moreover, the ESG strategy for 2024–2032 aims to integrate climate and social aspects into the company's activities, enabling it to align with international sustainable development standards and enhance its competitiveness in the market. This strategy also envisions the company's active participation in implementing national climate initiatives, which, in the long term, contributes to increasing Kazakhtelecom's environmental and economic sustainability.

Thus, Kazakhstan's national climate policy and Kazakhtelecom's initiatives to implement sustainable practices create a platform for achieving carbon footprint reduction goals, which enhances the company's market position and improves its environmental reputation.

Kazakhtelecom is implementing several projects that are carried out both independently and under partnership agreements. These projects have been selected to assess their potential for mitigating transition and climate risks across various scenarios. The tightening of climate policy in the country stimulates a more active launch of projects and the implementation of the Low-Carbon Development Program of the company.

In the framework of the Low-Carbon Development Program of Kazakhtelecom JSC for 2022–2032, the possibility of purchasing green certificates is being considered. The purchase of green certificates will allow for a reduction in indirect greenhouse gas emissions under Scope 2 by replacing imported electricity generated from fossil fuels with «green» electricity from renewable energy sources. The company is developing measures to minimize the consumption of imported electrical and thermal energy and fuel resources while operating its own energy-generating facilities. Additionally, plans are in place to promote projects and new technologies, including IoT, that contribute to reducing the carbon footprint and improving energy efficiency.

Kazakhtelecom will contribute to the development and promotion of a wide range of digital and telecommunications services and products that will positively impact the intensity and pace of greenhouse gas emissions reduction by our clients and the economy of the Republic of Kazakhstan as a whole. In the context of developing the renewable energy market in Kazakhstan, the company will strive to procure alternative energy and transition to environmentally friendly fuels.

Opportunities in the Field of Digitalization

Digitalization plays a key role in reducing greenhouse gas emissions and improving climate resilience. As part of its strategy, Kazakhtelecom focuses on the following areas:

- Energy efficiency and process optimization:
  - Implementation of intelligent management systems to reduce energy consumption and greenhouse gas emissions.
  - Optimization of network and data center operations to lower carbon footprints and enhance overall efficiency.
- Smart grids and renewable energy:
  - Development of smart grids that facilitate efficient energy consumption management and integration of renewable energy sources (RES).
  - Support for initiatives to incorporate renewable energy sources into telecommunications networks, thereby reducing dependence on fossil fuels.
- Digital modeling:
  - Utilization of digital technologies to optimize the design and operation of telecommunications infrastructure with the aim of reducing carbon footprints.
- Commercialization of carbon offsets:
  - One area where Kazakhtelecom can gain additional benefits is the commercialization of carbon offsets. Carbon offsets represent a mechanism for compensating greenhouse gas emissions through the implementation of climate projects.

This mechanism allows Kazakhtelecom not only to reduce its emissions but also to monetize its climate efforts in the market.

Kazakhtelecom is actively developing projects that promote sustainable development and improve the quality of life in Kazakhstan.

Table 9. Key opportunities of Kazakhtelecom JSC

Company initiatives	Type of energy/resources	Implementation timeline
Deduplication of copper communication lines and replacement with LED light sources	Electricity	In progress
Purchase of green certificates	Renewable energy electricity	Year 2032
Measures to minimize the consumption of imported electricity, thermal energy, and fuel resources	Electricity, thermal energy, fuel	In progress
Promotion of IoT projects and technologies to enhance energy efficiency	Electricity	In progress
Development and promotion of digital and telecommunications services and products to reduce the carbon footprint	Energy resources	In progress
Procurement of alternative energy and transition to environmentally friendly fuels	Alternative energy (RES)	In progress
Reduction of fossil fuel consumption in stationary and mobile sources	Fossil fuel	In progress

The assessment also considered the following potential opportunities:

- opportunity for business activity diversification;
- access to new markets;
- development and/or expansion of low-carbon telecommunications products and services;
- development of new products or services through research and development (R&D) and innovation.

Conclusion

The analysis conducted assessed the physical climate risks for the priority assets of Kazakhtelecom JSC. Based on internationally recognised climate models and scenarios, physical risks related to changes in climate conditions were identified. Special attention was given to regions with heightened vulnerability to climate change. Climate models facilitated the assessment of the likelihood of climate events and their potential impact on the company's financial performance.

The analysis evaluating the vulnerability of Kazakhtelecom JSC assets to physical climate risks indicated that certain assets are particularly susceptible to the influence of several climate factors, as listed in Table 10 below.

Table 10. Kazakhtelecom JSC assets most exposed to physical climate risks

Category	Type	Indicator/Unit	Potentially vulnerable assets of Kazakhtelecom		Number of assets
Temperature	Chronic	Average daily temperature (°C)	Regions: Akmola, Almaty, and East Kazakhstan	Cities: Astana, Kokshetau, Almaty, Taldykorgan, Ust-Kamenogorsk, Semey	13
	Chronic	Annual minimum daily temperature (°C)			
	Chronic	Annual maximum daily temperature (°C)			
Precipitation	Acute	Snowfall (mm)	Regions: Atyrau, Mangystau, and South Kazakhstan	Cities: Atyrau, Aktau, Shymkent	4
	Chronic	Annual precipitation (mm)			
Flood	Acute	Flood (m)	Regions: Atyrau, Mangystau	Cities: Atyrau, Aktau	2
Extreme weather (wind load)	Acute	Maximum wind speed (m/s)	Regions: Zhambyl, South Kazakhstan, and Akmola	Cities: Taraz, Shymkent, Astana, Kokshetau	9

As part of the conducted climate risk assessment, no significant physical risks requiring immediate action were identified. The analysis of physical risks for the assets of Kazakhtelecom JSC demonstrates that under the RCP2.6 and RCP4.5 scenarios, current risks are minimal. However, under the RCP8.5 scenario, a negative potential is noted for certain regions, driven by the impact of climate factors such as flooding and other extreme weather events.

On the other hand, the analysis indicates that physical risks are more pronounced in Kazakhstan, primarily due to historically drier and hotter climatic conditions, which are projected to become more severe in the long term across all scenarios. This could lead to financial implications related to changes in climate indicators associated with rising temperatures. Consequently, a more detailed analysis in these areas is planned for a more accurate assessment of potential risks. Overall, Kazakhtelecom is not significantly affected by physical climate risks in the short term.

Transitional Risks: The analysis indicates that while transitional risks may have a financial impact on Kazakhtelecom's assets, they are relatively less significant compared to physical risks. The primary threat arises from changes in regulatory requirements that may affect the company's financial stability. One of the key aspects is the potential increase in electricity costs driven by the implementation of stringent environmental standards and carbon pricing. This could lead to a substantial rise in the company's operating expenses. Therefore, the development and implementation of new environmental standards will require investments in infrastructure modernisation and a transition to renewable energy sources.

Physical Risks: Physical risks, such as extreme weather conditions, rising temperatures, and increased precipitation, pose a more significant threat to Kazakhtelecom's infrastructure and operational activities. These conditions may lead to equipment overheating, data loss, and damage to telecommunications networks, necessitating additional costs for resilience and adaptation. Flooding and strong winds particularly threaten regions with a higher risk of these phenomena, requiring significant capital investments to protect and restore infrastructure.

Risk Reduction Potential and New Opportunities: Reducing carbon emissions and transitioning to new technologies will not only help mitigate the aforementioned risks but also create additional opportunities for Kazakhtelecom in the sustainable technology and telecommunications solutions market. This could enhance the company's competitive advantages and improve its market position.

Company Resilience and the Need for Adaptation: Financial modelling has shown that Kazakhtelecom possesses sufficient resilience to potential changes in legislation and climatic conditions. However, further development of adaptation strategies is needed, especially for vulnerable regions with a higher likelihood of extreme climatic impacts. Preparing for extreme weather events and strengthening the resilience of crisis systems are priority tasks to ensure the long-term stability and prosperity of the company.

Appendix 1. Express Analysis of Climate Models Used by Peer Companies

To conduct an express analysis of the climate models used by peer companies, the following companies were considered:

- OTE Group (Integrated Report 2022)
- Telenor (Annual Report 2022)
- Deutsche Telekom (Corporate Responsibility Report 2022)
- Elisa (Sustainability Report 2022)
- INWIT (Integrated Report 2022)
- Telefonica (Consolidated management report 2022)
- Swisscom (Sustainability Report 2022)
- Singtel (Sustainability Report 2023)
- Tele2 (Annual and Sustainability Report 2022)
- Telstra (Sustainability Report 2023)

The data on the climate scenarios used by the companies, obtained from the express analysis, is presented in Table 1.

Table 1. Climate scenarios of reference companies

Company/Source	Climate Scenario	
OTE Group (Integrated Report 2022)	• IEA NZE2050 • IEA 2DS • IEA B2DS • IEA 450 • IEA SDS • IEA APS or Nationally determined contributions (NDC) • Greenpeace	• RCP1.9 (or SSP1-1.9) • RCP2.6 (or SSP1-2,6) • RCP3.4 (or SSP4-3.4) • RCP4.5 for SSP2-4.5) • RCP6.0 (or SSP4-6.03) • RCP7.0 (or SSP3-7.0) • RCP8.5 (or SSP5-8.5)

Company/Source	Climate Scenario	
	• DDP • IRENA • BNEF NEO • NGFS (2°C and below scenarios) • Above 2°C • IEA STEPS (previously IEA NPS) • IEA CPS • NGFS (Above 2°C scenarios)	
Telenor (Annual Report 2022)	• IEA NZE2050 • IEA 2DS • IEA B2DS • IEA 450 • IEA SDS • IEA APS or Nationally determined contributions (NDC) • Greenpeace • DDP • IRENA • BNEF NEO • NGFS (2°C and below scenarios) • Above 2°C • IEA STEPS (previously IEA NPS) • IEA CPS • NGFS (Above 2°C scenarios)	• RCP1.9 (or SSP1-1.9) • RCP2.6 (or SSP1-2,6) • RCP3.4 (or SSP4-3.4) • RCP4.5 for SSP2-4.5) • RCP6.0 (or SSP4-6.03) • RCP7.0 (or SSP3-7.0) • RCP8.5 (or SSP5-8.5)
Deutsche Telekom (Corporate Responsibility Report 2022)	• IEA NZE2050 • IEA 2DS • IEA B2DS • IEA 450 • IEA SDS • IEA APS or Nationally determined contributions (NDC) • Greenpeace • DDP • IRENA • BNEF NEO • NGFS (2°C and below scenarios)	• RCP1.9 (or SSP1-1.9) • RCP2.6 (or SSP1-2.6) + • RCP3.4 (or SSP4-3.4) • RCP4.5 for SSP2-4.5) + • RCP6.0 (or SSP4-6.03) • RCP7.0 (or SSP3-7.0) • RCP8.5 (or SSP5-8.5) +

Company/Source	Climate Scenario	
	• Above 2°C • IEA STEPS (previously IEA NPS) • IEA CPS • NGFS (Above 2°C scenarios)	
Elisa (Sustainability Report 2022)	• IEA NZE2050 • IEA 2DS • IEA B2DS • IEA 450 • IEA SDS • IEA APS or Nationally determined contributions (NDC) • Greenpeace • DDP • IRENA • BNEF NEO • NGFS (2°C and below scenarios) • Above 2°C • IEA STEPS (previously IEA NPS) • IEA CPS • NGFS (Above 2°C scenarios)	• RCP1.9 (or SSP1-1.9) • RCP2.6 (or SSP1-2,6) • RCP3.4 (or SSP4-3.4) • RCP4.5 for SSP2-4.5) • RCP6.0 (or SSP4-6.03) • RCP7.0 (or SSP3-7.0) • RCP8.5 (or SSP5-8.5)
INWIT (Integrated Report 2022)	• IEA NZE2050 • IEA 2DS • IEA B2DS • IEA 450 • IEA SDS • IEA APS or Nationally determined contributions (NDC) • Greenpeace • DDP • IRENA • BNEF NEO • NGFS (2°C and below scenarios) • Above 2°C • IEA STEPS (previously IEA NPS) • IEA CPS • NGFS (Above 2°C scenarios)	• RCP1.9 (or SSP1-1.9) • RCP2.6 (or SSP1-2,6) • RCP3.4 (or SSP4-3.4) • RCP4.5 for SSP2-4.5) • RCP6.0 (or SSP4-6.03) • RCP7.0 (or SSP3-7.0) • RCP8.5 (or SSP5-8.5)

Company/Source	Climate Scenario	
Telefonica (Consolidated management report 2022)	• IEA NZE2050 + • IEA 2DS • IEA B2DS • IEA 450 • IEA SDS • IEA APS or Nationally determined contributions (NDC) • Greenpeace • DDP • IRENA • BNEF NEO • NGFS (2°C and below scenarios) • Above 2°C • IEA STEPS (previously IEA NPS) • IEA CPS • NGFS (Above 2°C scenarios)	• RCP1.9 (or SSP1-1.9) • RCP2.6 (or SSP1-2,6) + • RCP3.4 (or SSP4-3.4) • RCP4.5 for SSP2-4.5) • RCP6.0 (or SSP4-6,03 • RCP7.0 (or SSP3-7.0) • RCP8.5 (or SSP5-8.5) +
Swisscom (Sustainability Report 2022)	• IEA NZE2050 • IEA 2DS • IEA B2DS • IEA 450 • IEA SDS • IEA APS or Nationally determined contributions (NDC) • Greenpeace • DDP • IRENA • BNEF NEO • NGFS (2°C and below scenarios) • Above 2°C • IEA STEPS (previously IEA NPS) • IEA CPS • NGFS (Above 2°C scenarios)	• RCP1.9 (or SSP1-1.9) • RCP2.6 (or SSP1-2,6) • RCP3.4 (or SSP4-3.4) • RCP4.5 for SSP2-4.5) • RCP6.0 (or SSP4-6.03) • RCP7.0 (or SSP3-7.0) • RCP8.5 (or SSP5-8.5)
Singtel (Sustainability Report 2023)	• IEA NZE2050 • IEA 2DS • IEA B2DS • IEA 450 • IEA SDS • IEA APS or Nationally determined contributions (NDC) • Greenpeace	• RCP1.9 (or SSP1-1.9) • RCP2.6 (or SSP1-2,6) • RCP3.4 (or SSP4-3.4) • RCP4.5 for SSP2-4.5) • RCP6.0 (or SSP4-6.03) • RCP7.0 (or SSP3-7.0) • RCP8.5 (or SSP5-8.5)

Company/Source	Climate Scenario	
	• DDP • IRENA • BNEF NEO • NGFS (2°C and below scenarios) • Above 2°C • IEA STEPS (previously IEA NPS) • IEA CPS • NGFS (Above 2°C scenarios)	
Tele2 (Annual and Sustainability Report 2022)	• IEA NZE2050 • IEA 2DS • IEA B2DS • IEA 450 • IEA SDS • IEA APS or Nationally determined contributions (NDC) • Greenpeace • DDP • IRENA • BNEF NEO • NGFS (2°C and below scenarios) • Above 2°C • IEA STEPS (previously IEA NPS) • IEA CPS • NGFS (Above 2°C scenarios)	• RCP1.9 (or SSP1-1.9) • RCP2.6 (or SSP1-2,6) + • RCP3.4 (or SSP4-3.4) • RCP4.5 for SSP2-4.5) • RCP6.0 (or SSP4-6.03) • RCP7.0 (or SSP3-7.0) • RCP8.5 (or SSP5-8.5) +
Telstra (2023 Sustainability Report)	• IEA NZE2050 • IEA 2DS • IEA B2DS • IEA 450 • IEA SDS • IEA APS or Nationally determined contributions (NDC) • Greenpeace • DDP • IRENA • BNEF NEO • NGFS (2°C and below scenarios) • Above 2°C • IEA STEPS (previously IEA NPS) • IEA CPS • NGFS (Above 2°C scenarios)	• RCP1.9 (or SSP1-1.9) • RCP2.6 (or SSP1-2,6) • RCP3.4 (or SSP4-3.4) • RCP4.5 for SSP2-4.5) • RCP6.0 (or SSP4-6.03) • RCP7.0 (or SSP3-7.0) • RCP8.5 (or SSP5-8.5)

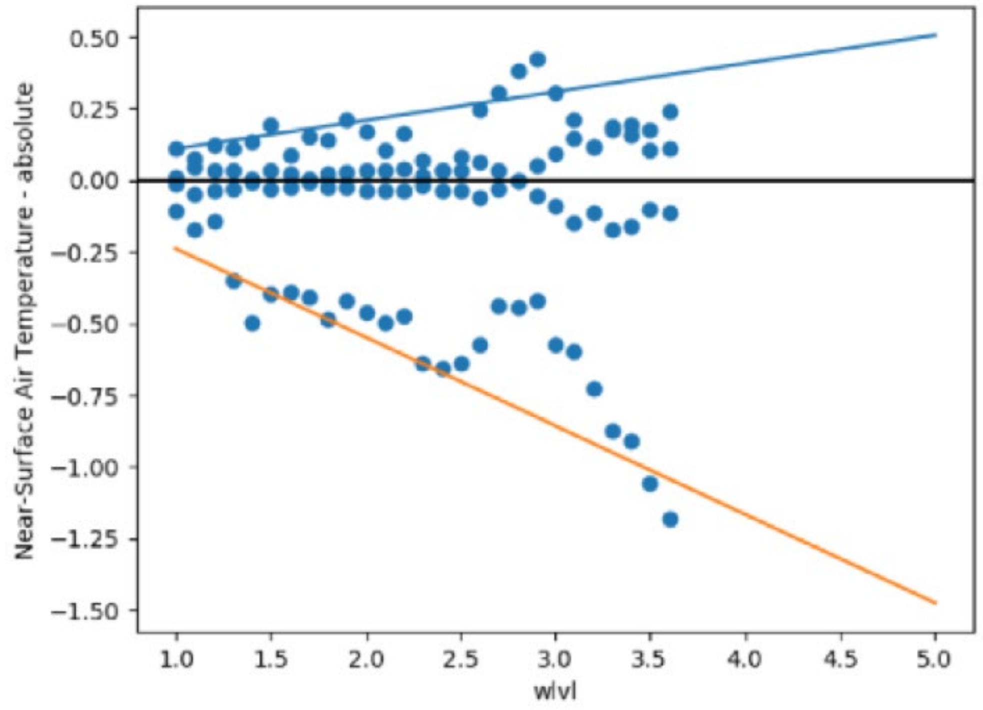
Appendix 2. Range of Uncertainty in Model Construction

Uncertainty in Climate Change Forecasts is assessed based on the variability of data from various General Circulation Models (GCMs) and their combinations with Impact Models (IM). These models consider how the global mean temperature (GMT) will change under different scenarios.

For each scenario, the level of warming is measured starting from 1°C, with increments of 0.1°C. Deviations of the forecasts from the average of all models are then calculated, and a statistical method of quantile regression is applied to understand how these deviations relate to levels of global warming.

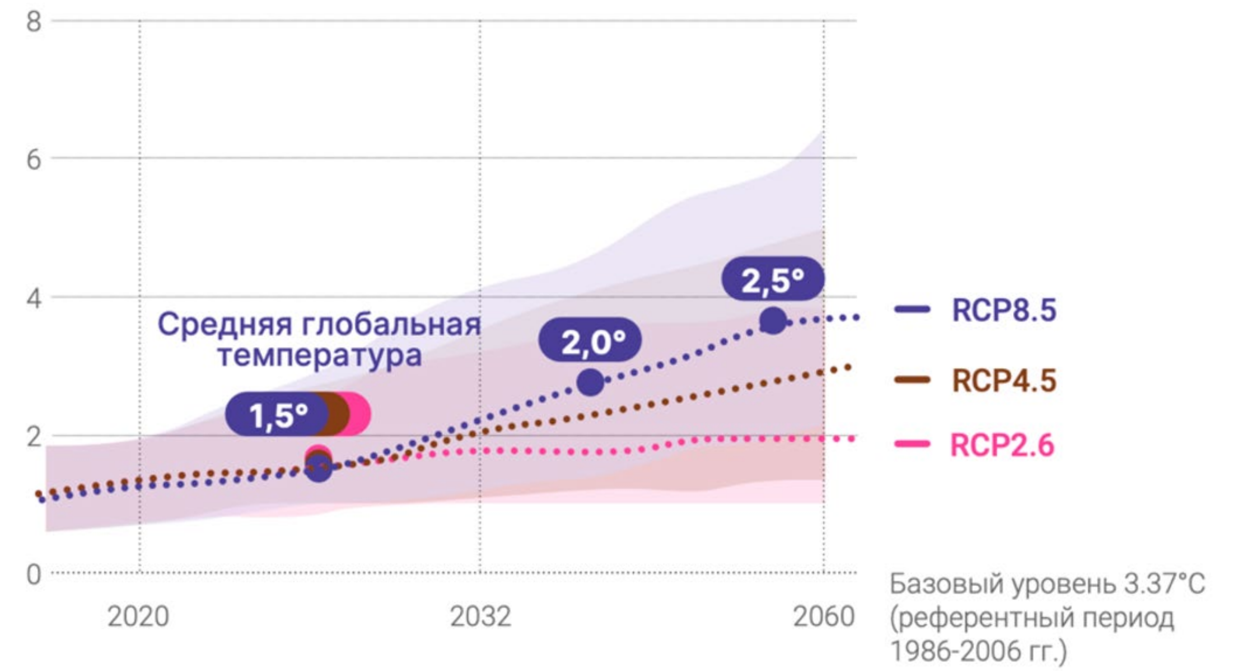
This approach helps determine ranges of uncertainty, illustrating how forecasts change based on the level of warming.

Example 1. Deviations in the mean annual air temperature at the Earth's surface for differentlevels of warming



In Example 1, deviations in the area-weighted mean annual air temperature at the Earth's surface are presented, based on the median value obtained from all Global Climate Models (GCMs) for different levels of warming (on the x-axis). The blue and orange lines display the quantile regressions for the 5th and 95th percentiles. If these lines do not intersect the x-axis within the range of 1° to 5°C, they are used to assess the uncertainty of impacts at each level of warming.

Example 2. Projected changes in regional average temperature under RCP8.5, RCP4.5, and RCP2.6 scenarios

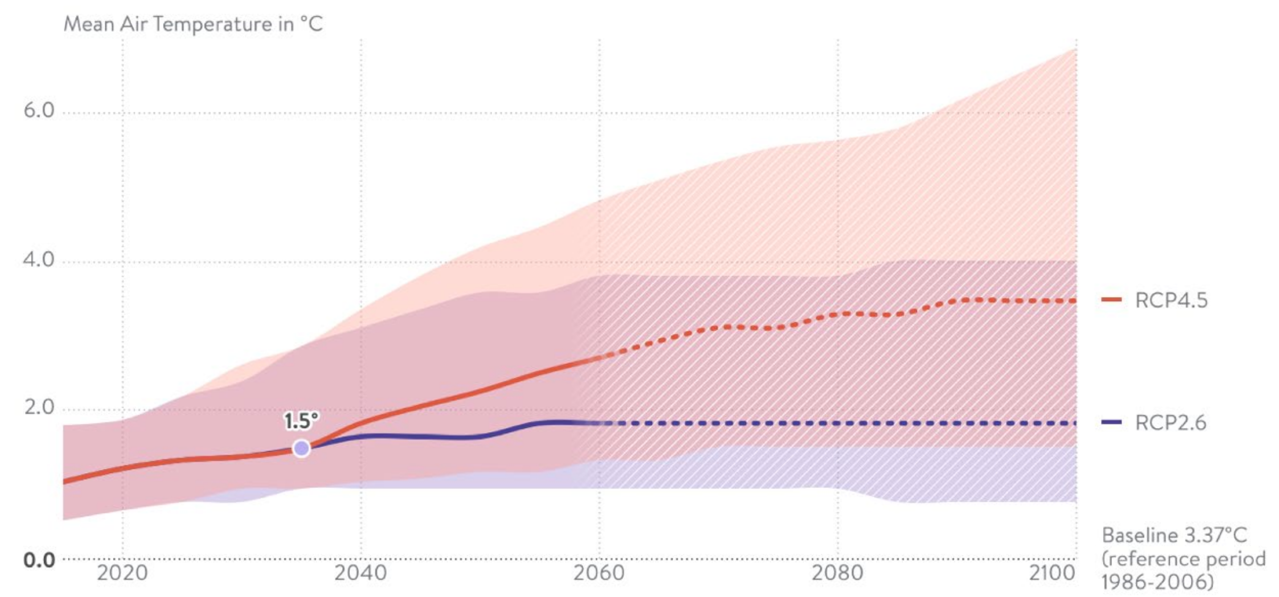


In the diagram of Example 2, projected changes in average temperature over time are presented according to the selected scenarios RCP8.5, RCP4.5, and RCP2.6. The Y-axis displays temperature changes in degrees Celsius, while the X-axis represents the time interval (2015–2060). The coloured lines illustrate the median values of changes for each scenario, while the shaded area around them indicates the range of uncertainty at the 5–95% level for the forecast over the corresponding time period. The uncertainty ranges are expressed in specific colours: purple for the RCP8.5 scenario, brown for RCP4.5, and pink for RCP2.6. When multiple scenarios overlap, additional colours are created to represent the intersection of the ranges.

Appendix 3. Trends in Temperature Changes by Climate Impact Scenarios

The presented diagrams[15] are curves that show how the change in average air temperature (expressed in degrees Celsius) will vary over time under different levels of global warming (1.5°C, 2°C, and 2.5°C) compared to the reference period of 1986–2006 based on various scenarios. Each scenario at each time interval is represented by a median line that displays these values for the examined periods and selected assets. The shaded areas indicate the range of uncertainty at the 5–95% level in the model's climate sensitivity for each scenario.

A) Dynamics of Average Temperature Changes by Scenarios

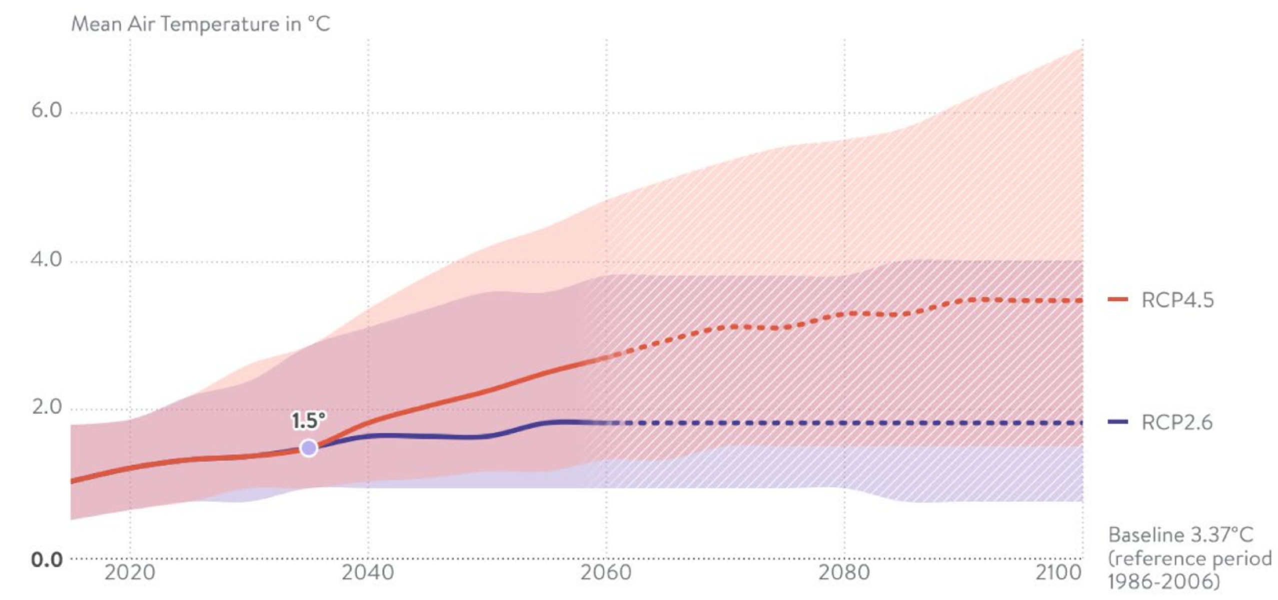


5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

Akmola Region

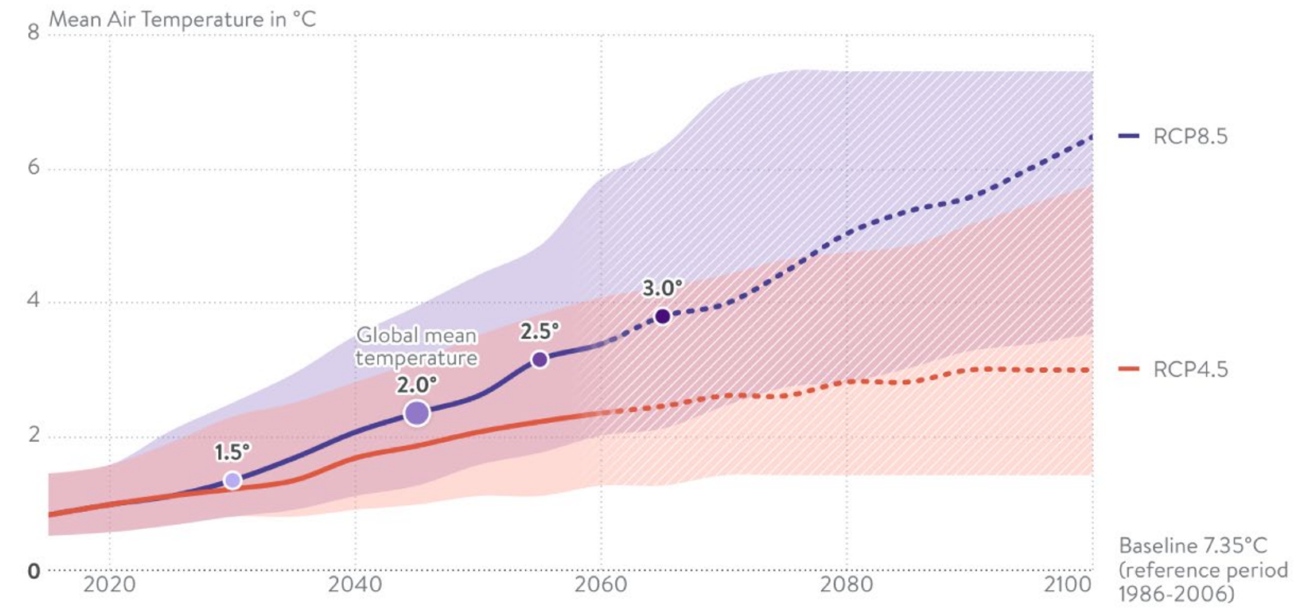
[15] On the diagrams, the points 1.5°C, 2°C, and 2.5°C represent the levels of global warming projected to be reached at a specific time period. These points denote the average global temperature, which, according to the warming scenarios, will increase by 1.5°C, 2°C, and 2.5°C compared to the baseline level. The diagrams also display the ranges of uncertainty (shaded areas), indicating that various scenarios of potential temperature changes exist.



5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

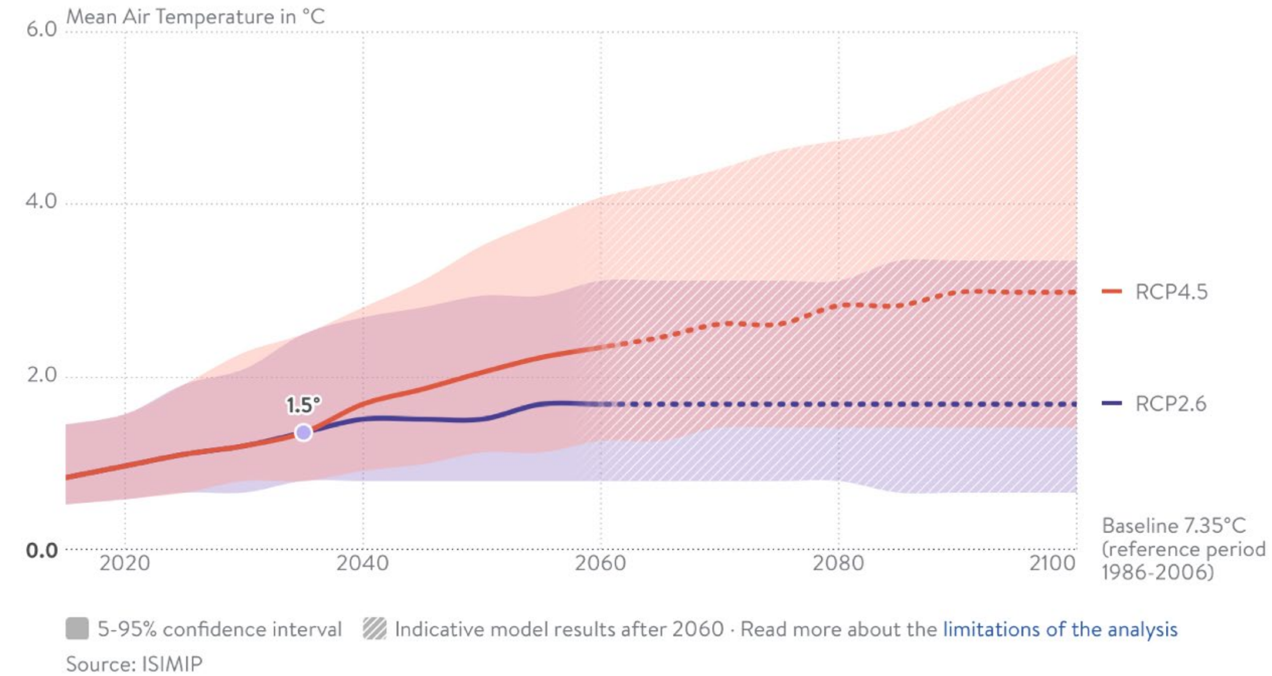
Akmola Region



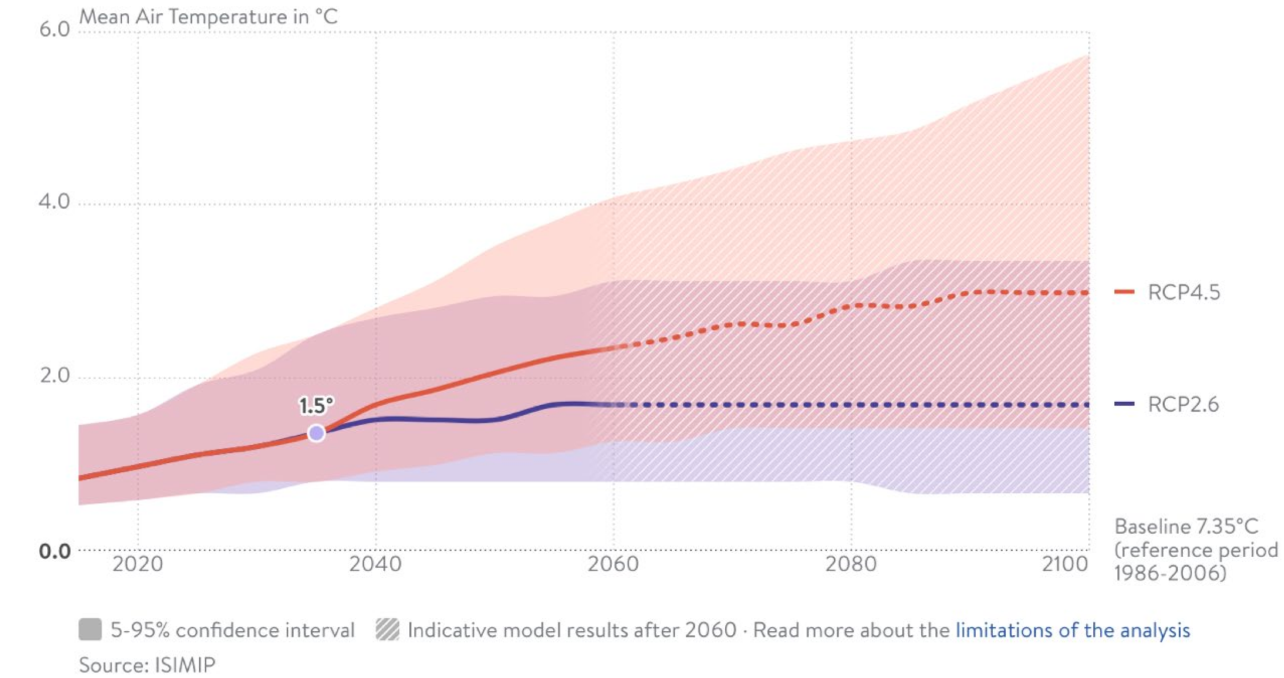
5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

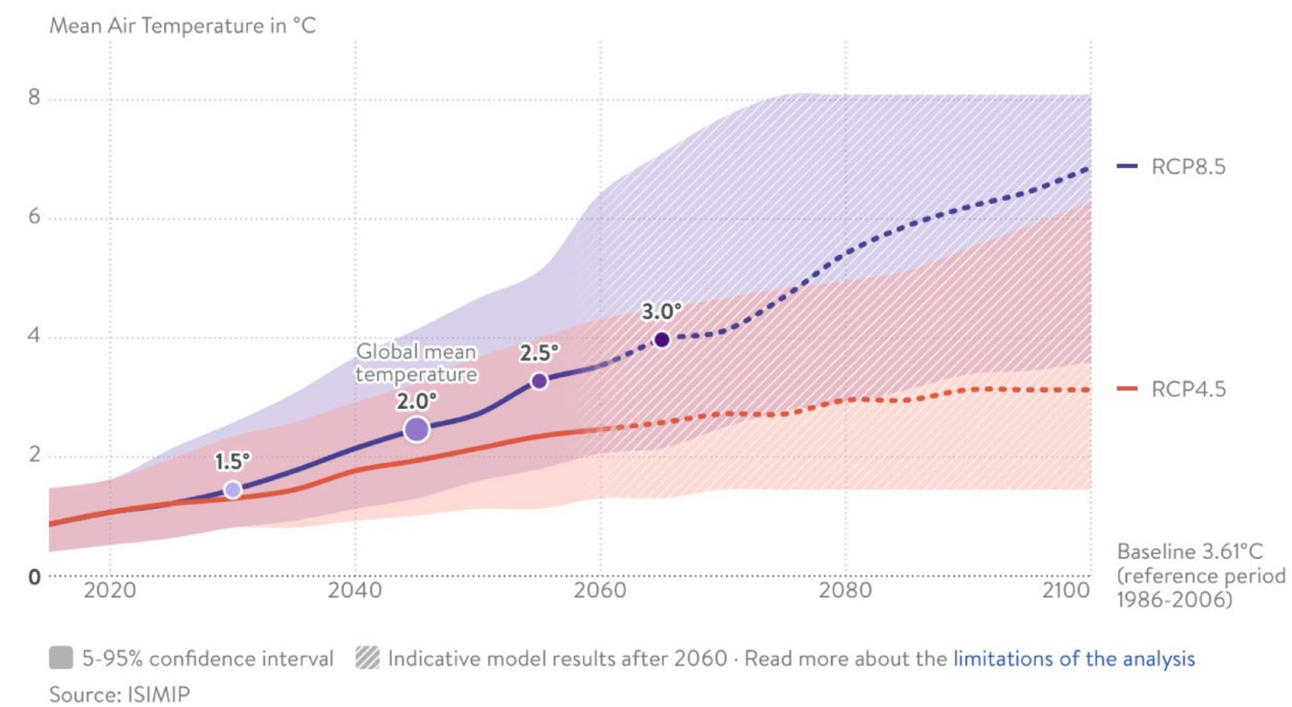
Almaty Region



Almaty Region

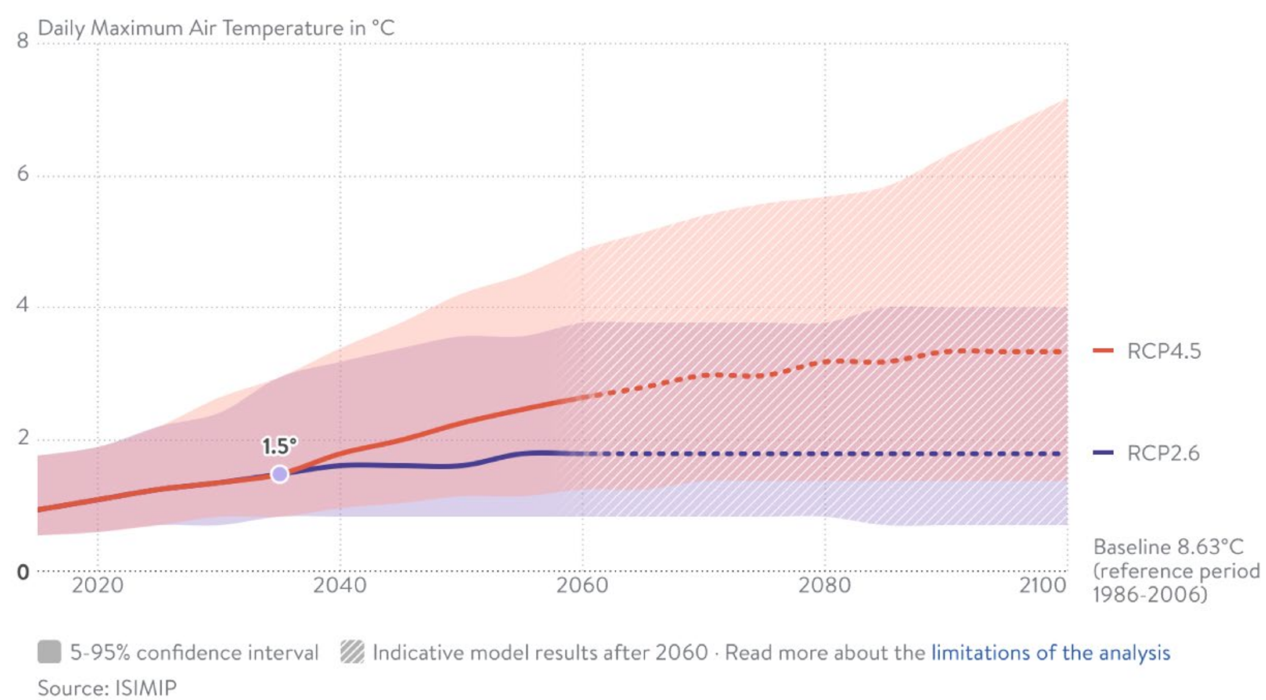


East Kazakhstan Region

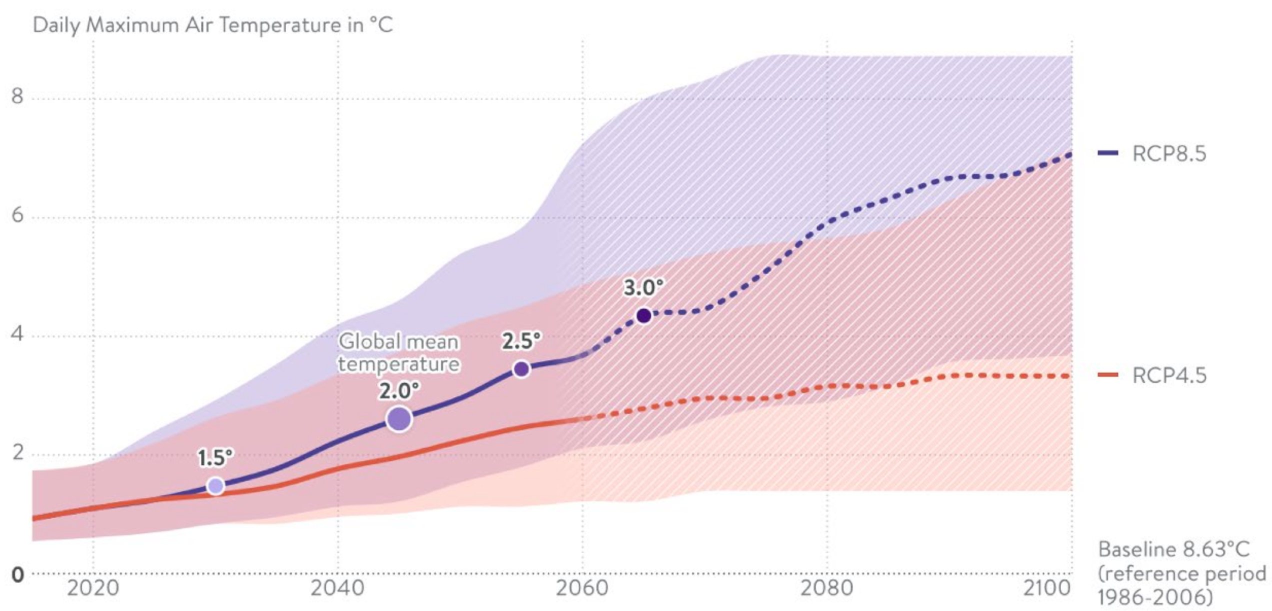


East Kazakhstan Region

B) Dynamics of Maximum Temperature Changes by Scenarios



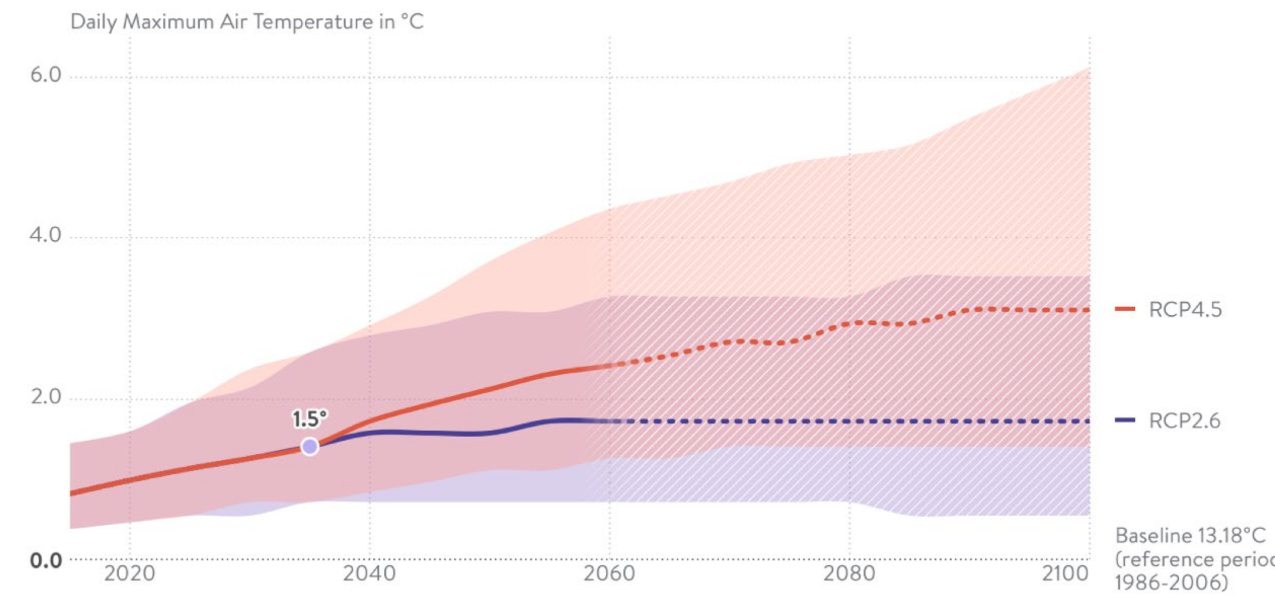
Akmola Region



5-95% confidence interval Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

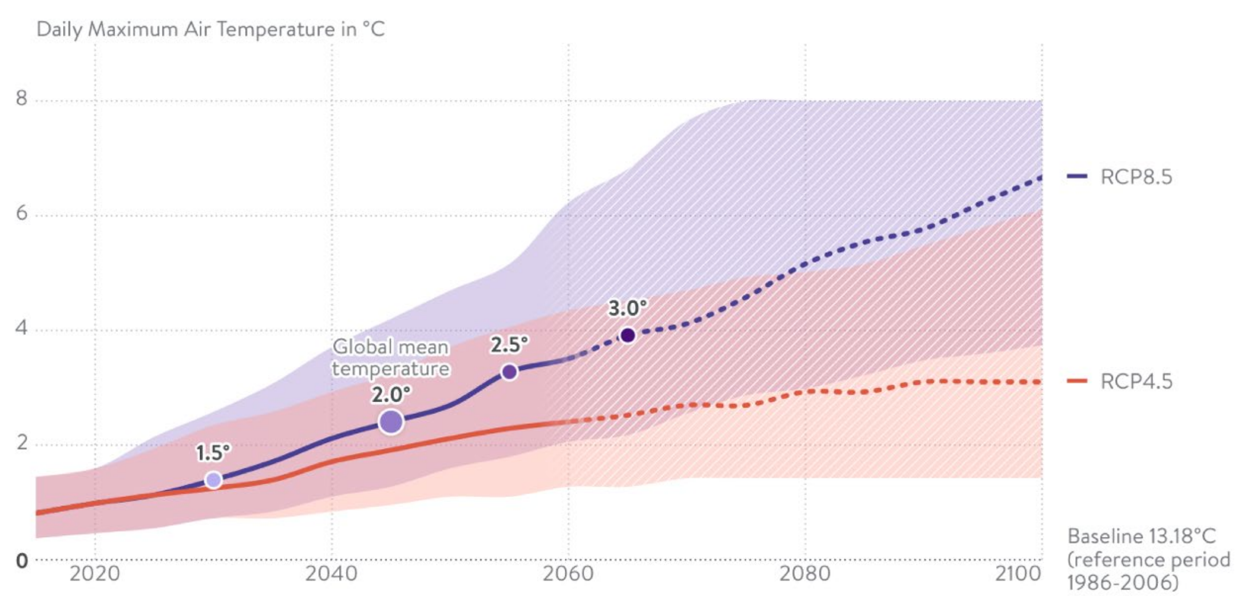
Akmola Region



5-95% confidence interval Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

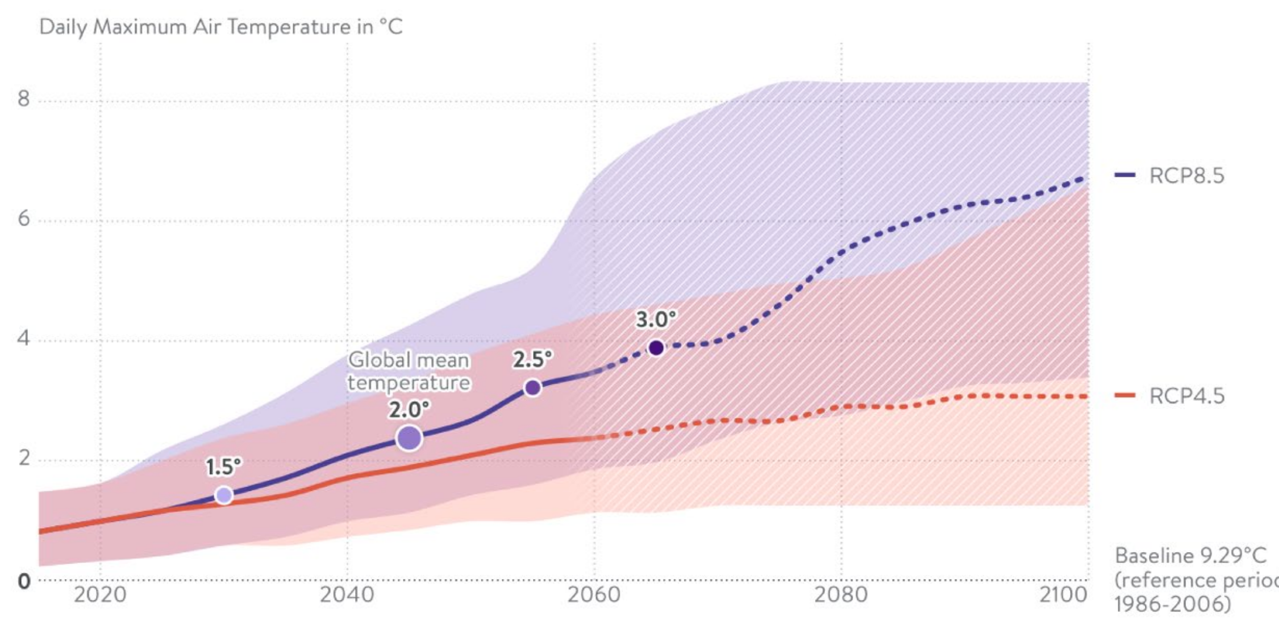
Almaty Region



5-95% confidence interval Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

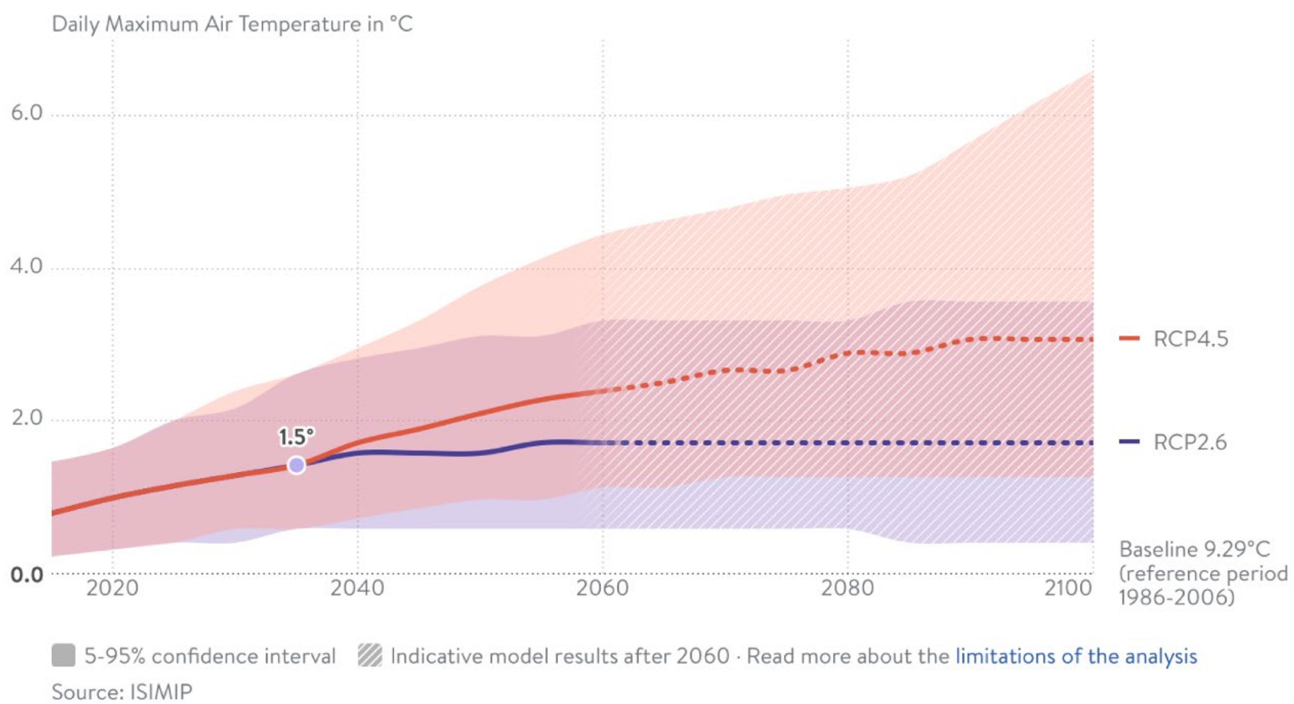
Almaty Region



5-95% confidence interval Indicative model results after 2060 · Read more about the limitations of the analysis

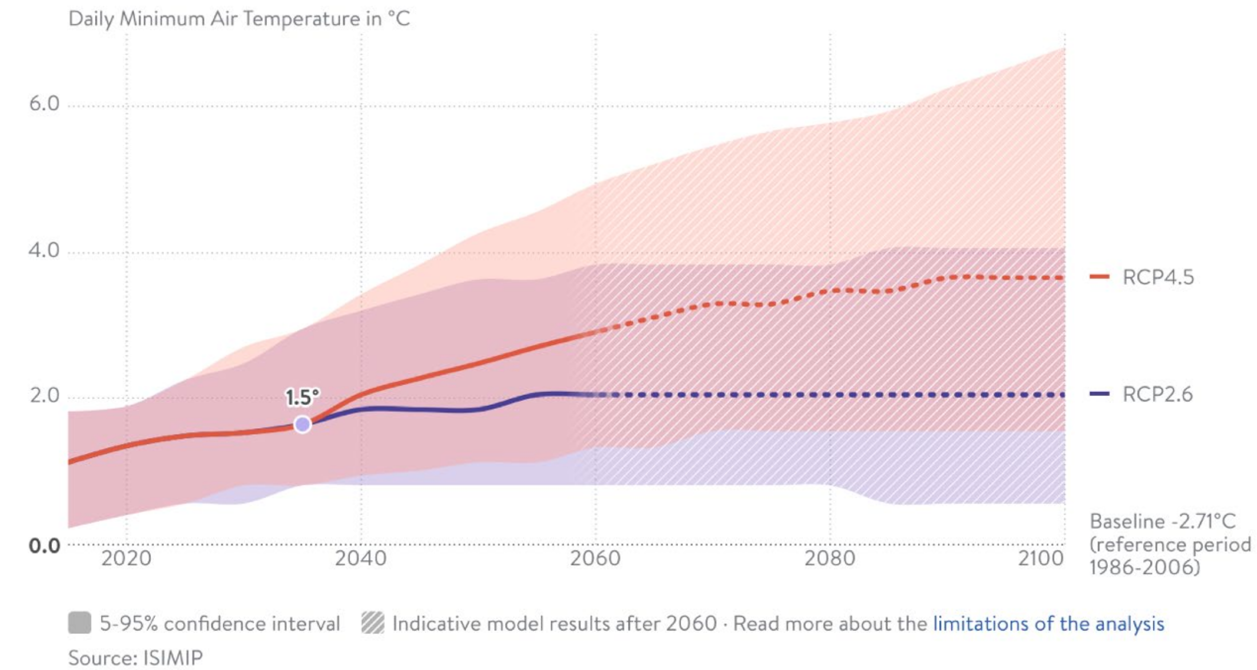
Source: ISIMIP

East Kazakhstan Region

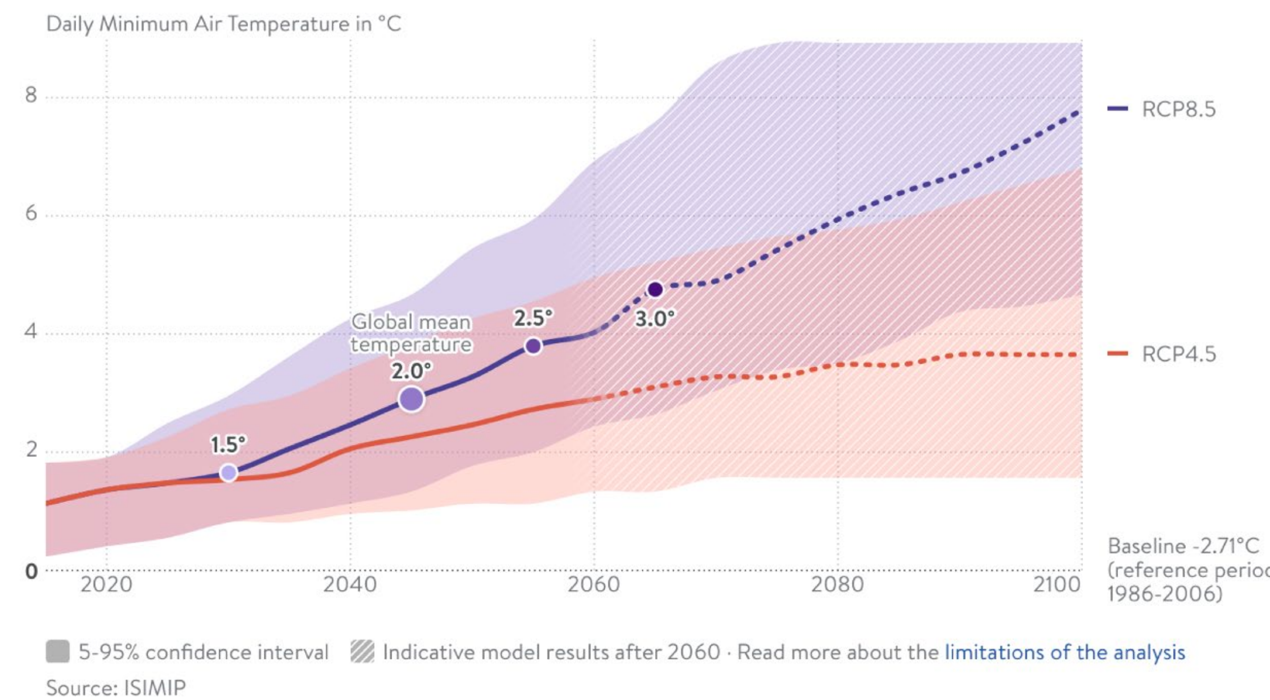


East Kazakhstan Region

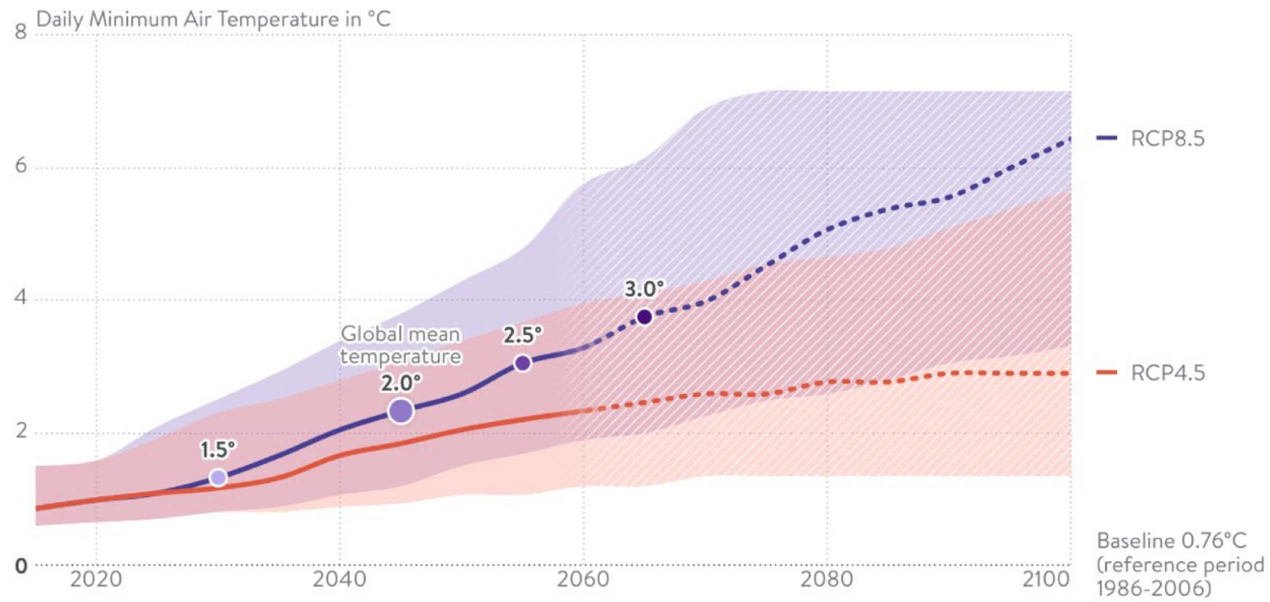
C) Dynamics of Minimum Temperature Changes by Scenarios



Akmola Region



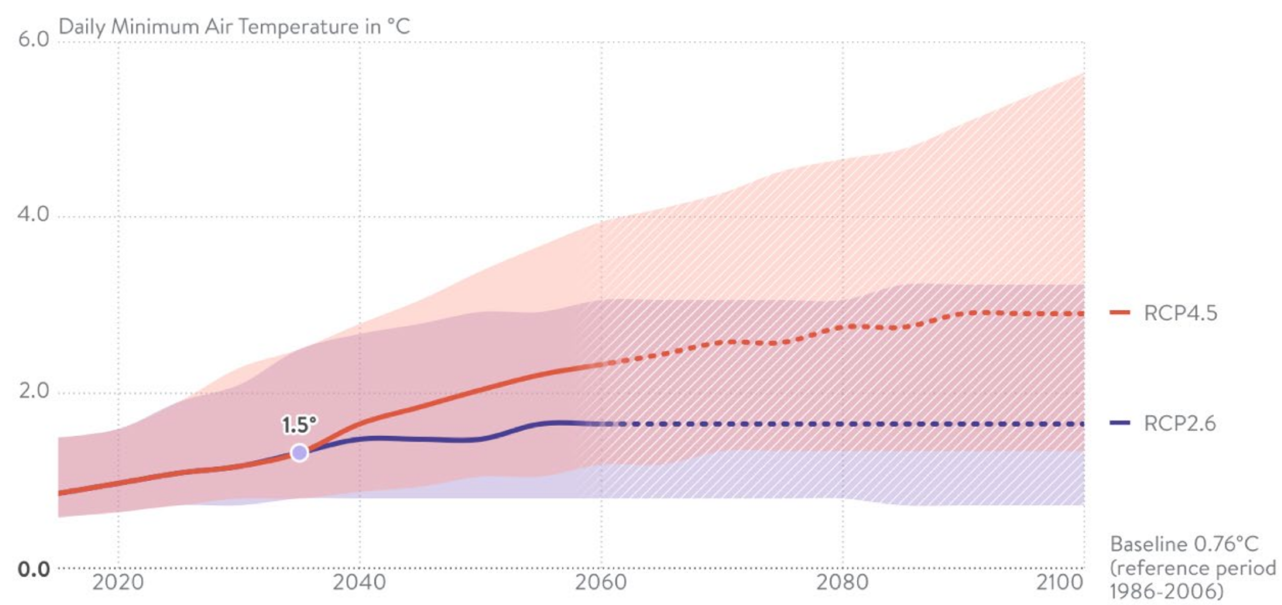
Akmola Region



5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

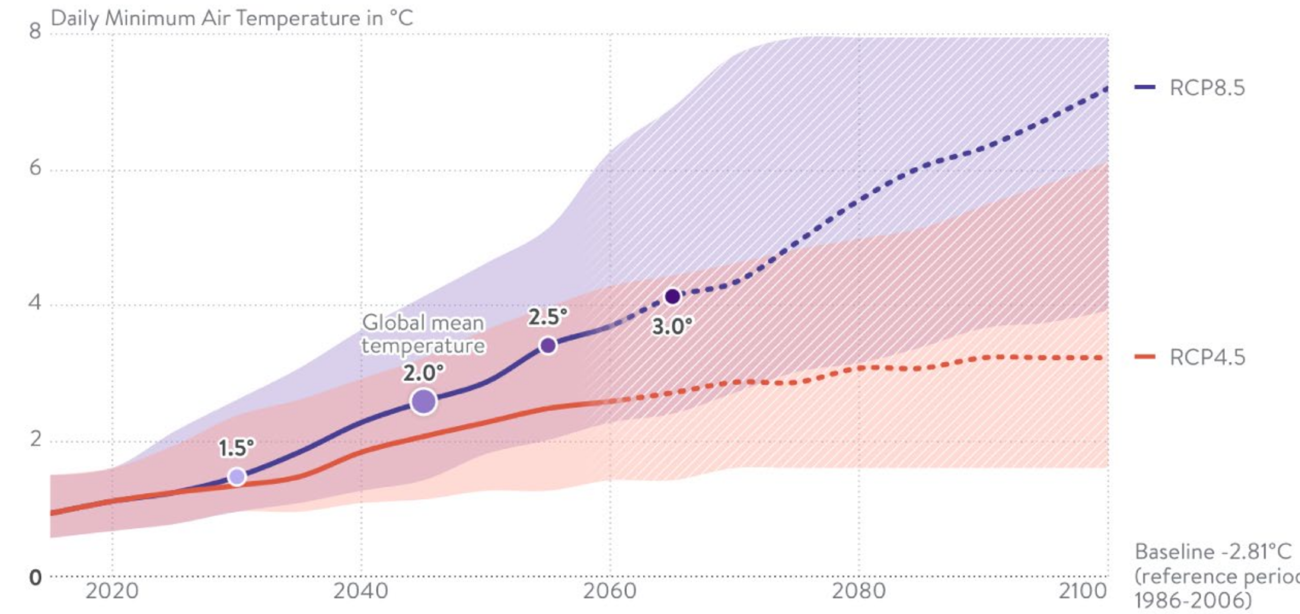
Almaty Region



5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

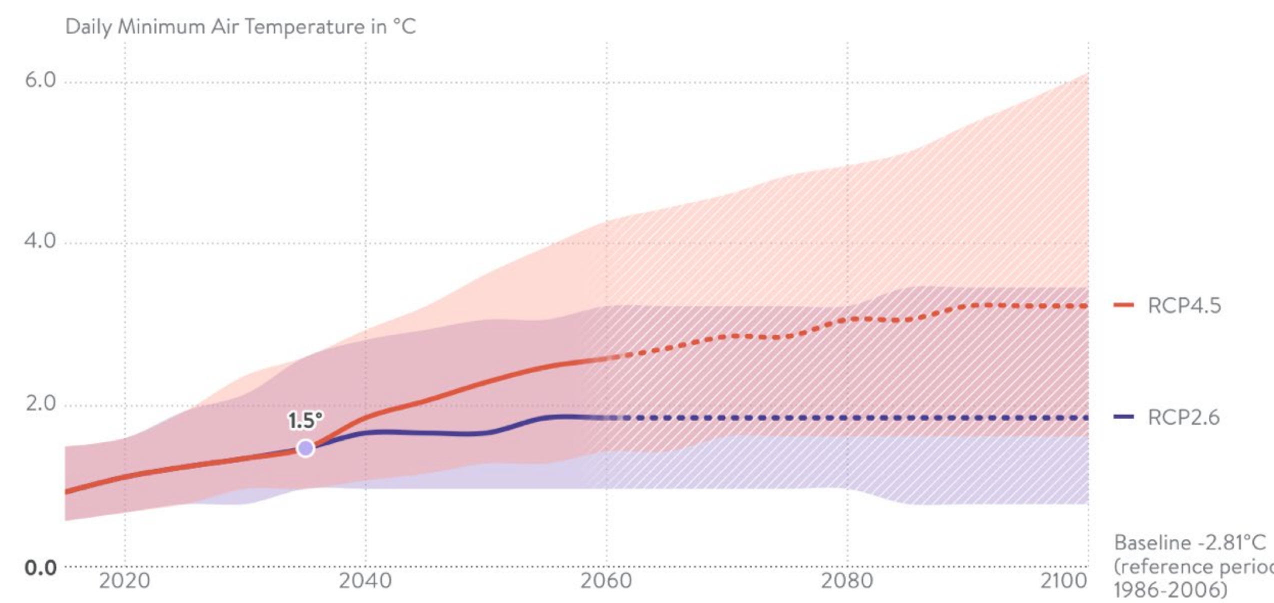
Almaty Region



5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

East Kazakhstan Region



5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

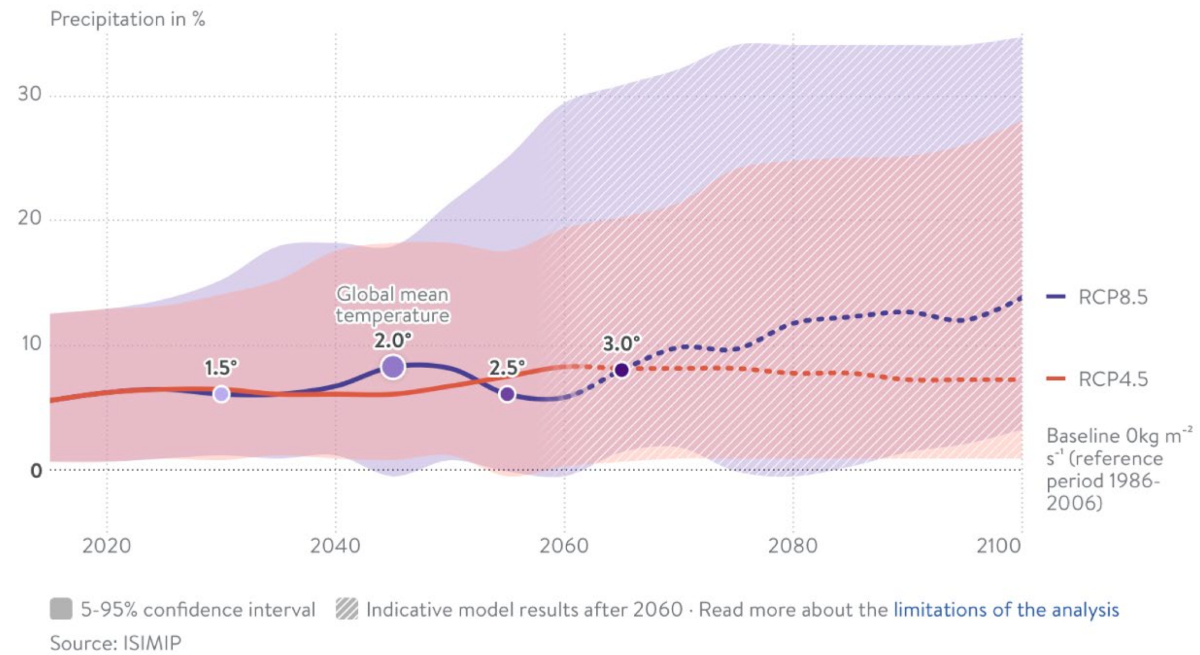
Source: ISIMIP

East Kazakhstan Region

Appendix 4. Trends in Precipitation Changes by Climate Impact Scenarios

A) The presented diagrams[16] are curves that illustrate how precipitation changes[17] over time at various levels of global warming (1.5°C, 2°C, and 2.5°C) compared to the reference period of 1986–2006 based on different scenarios. Each scenario at each time interval is represented by a median line displaying these values for the examined periods and selected assets. The shaded areas indicate the range of uncertainty at the 5–95% level in the model's climate sensitivity for each scenario.

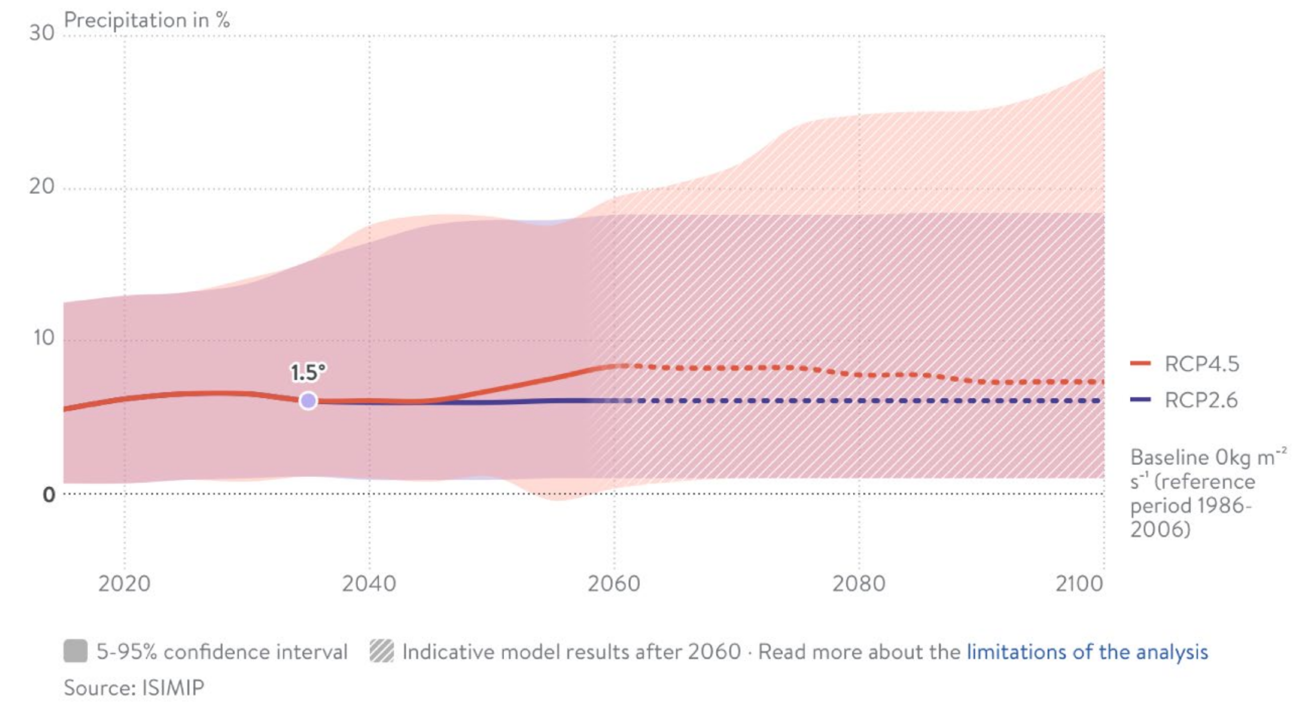
Dynamics of Total Precipitation Changes by Scenarios



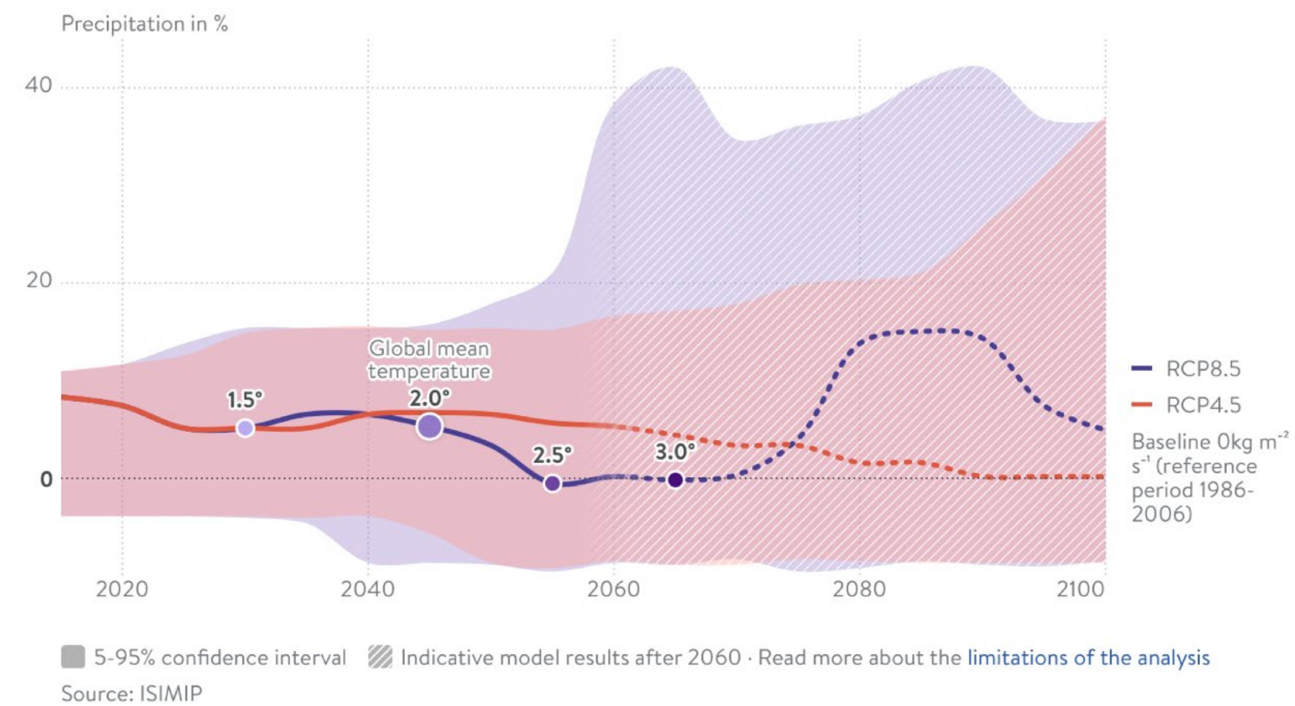
Atyrau Region

[16] On the diagrams, the points 1.5°C, 2°C, and 2.5°C represent the levels of global warming projected to be reached at a specific time period. These points denote the average global temperature, which, according to the warming scenarios, will increase by 1.5°C, 2°C, and 2.5°C compared to the baseline level. The baseline value serves as the starting point and is conditionally taken as zero. The diagrams also display the ranges of uncertainty (shaded areas), indicating that various scenarios of potential temperature changes exist.

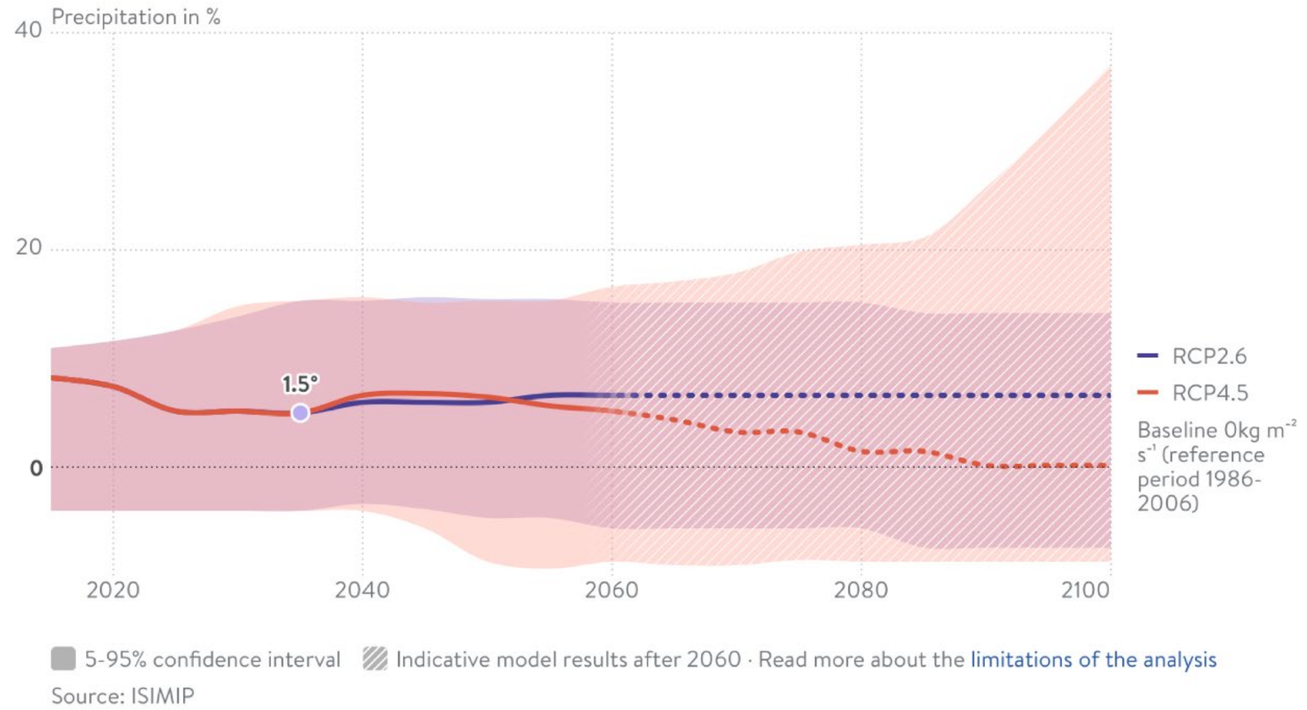
[17] Precipitation refers to the mass of water (including rain and snow) that falls to the Earth's surface per unit area over a unit of time.



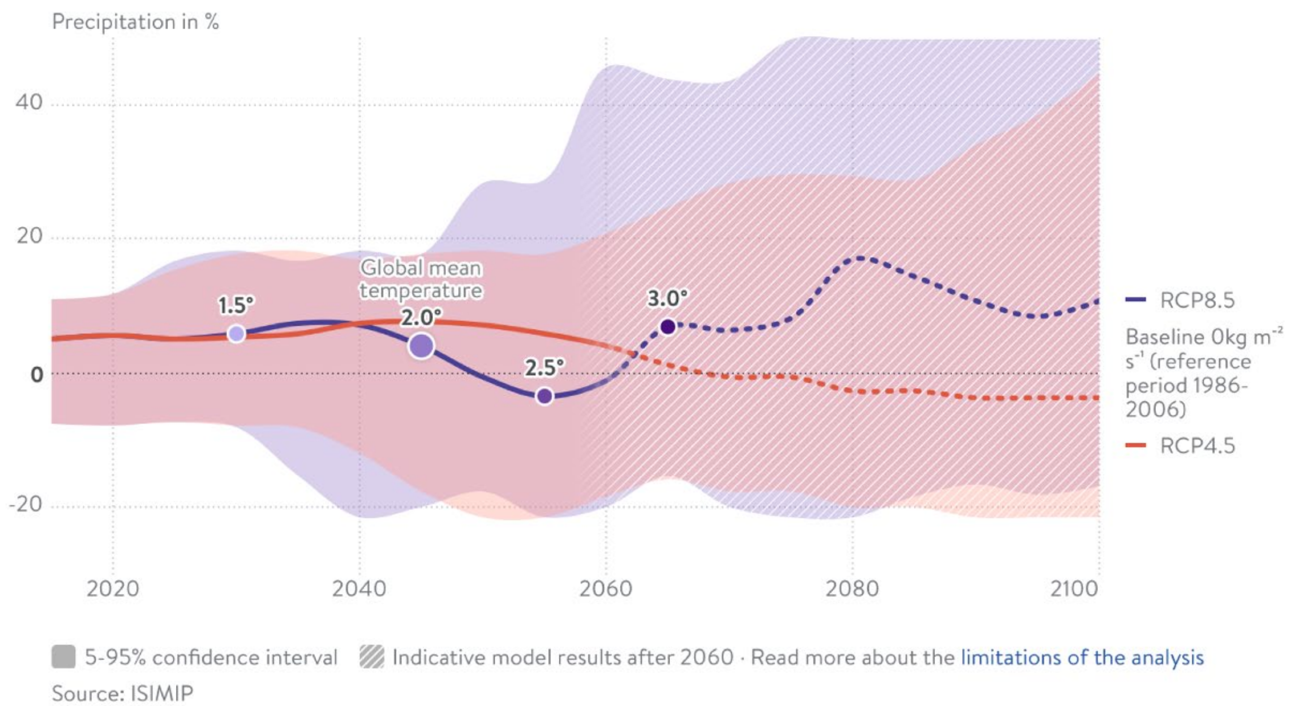
Atyrau Region



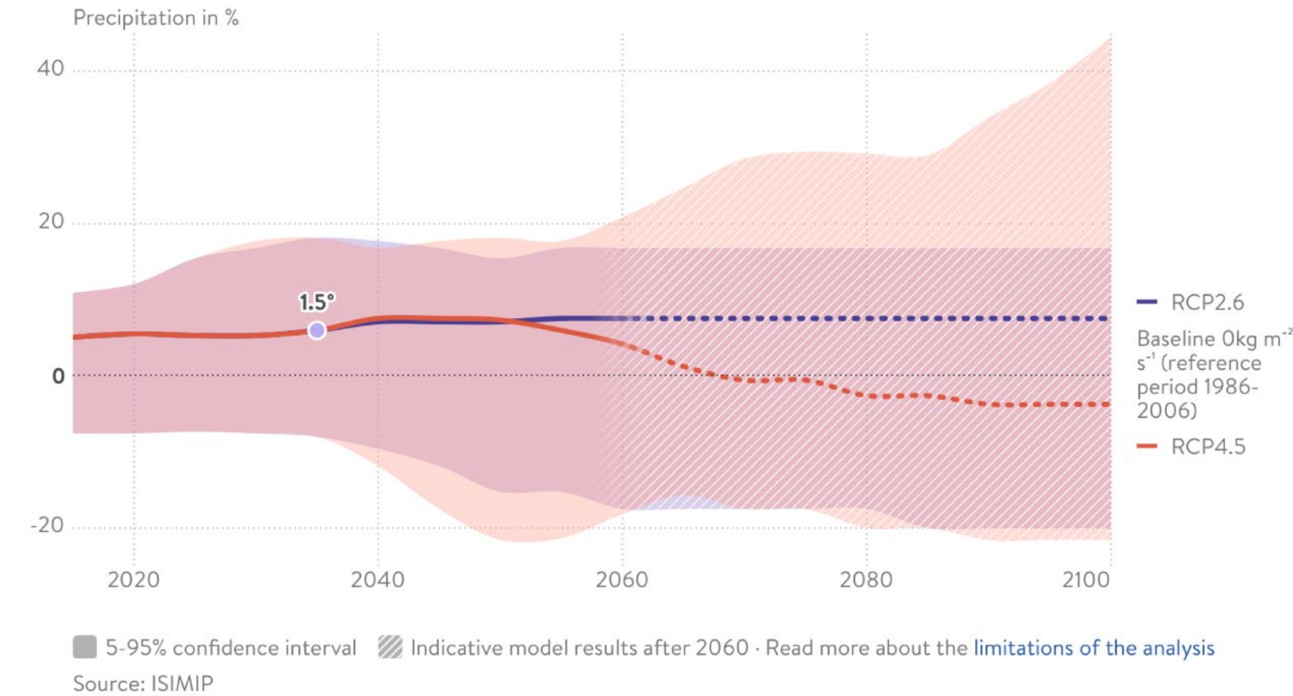
Mangystau Region



Mangystau Region

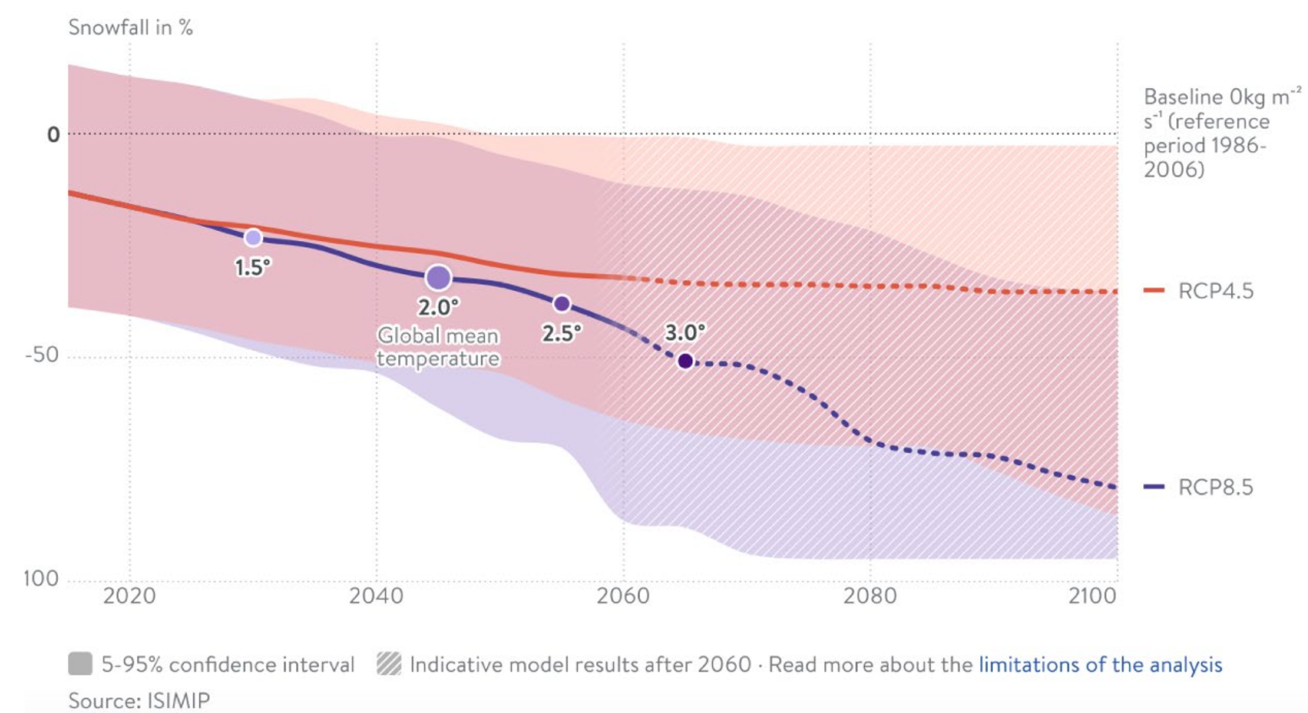


South Kazakhstan Region



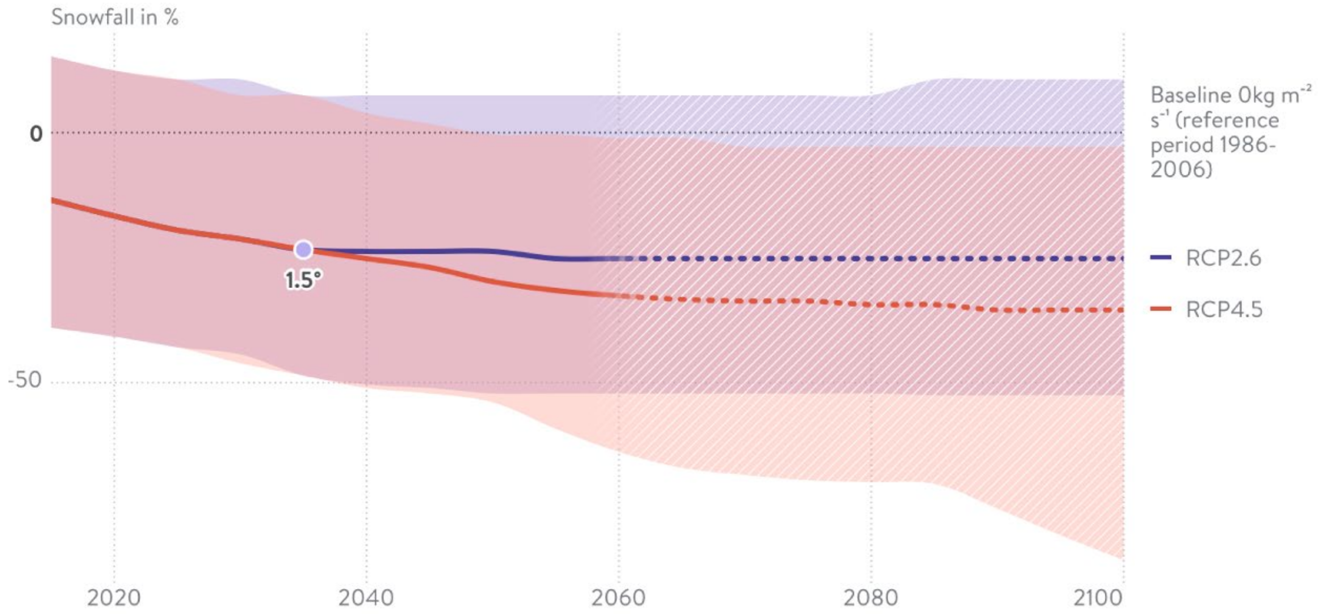
South Kazakhstan Region

The presented diagrams are curves that show how snowfall changes[18] over time at various levels of global warming (1.5°C, 2°C, and 2.5°C) compared to the reference period of 1986–2006 based on different scenarios. Each scenario at each time interval is represented by a median line displaying these values for the examined periods and selected assets. The shaded areas indicate the range of uncertainty at the 5–95% level in the model's climate sensitivity for each scenario.



Atyrau Region

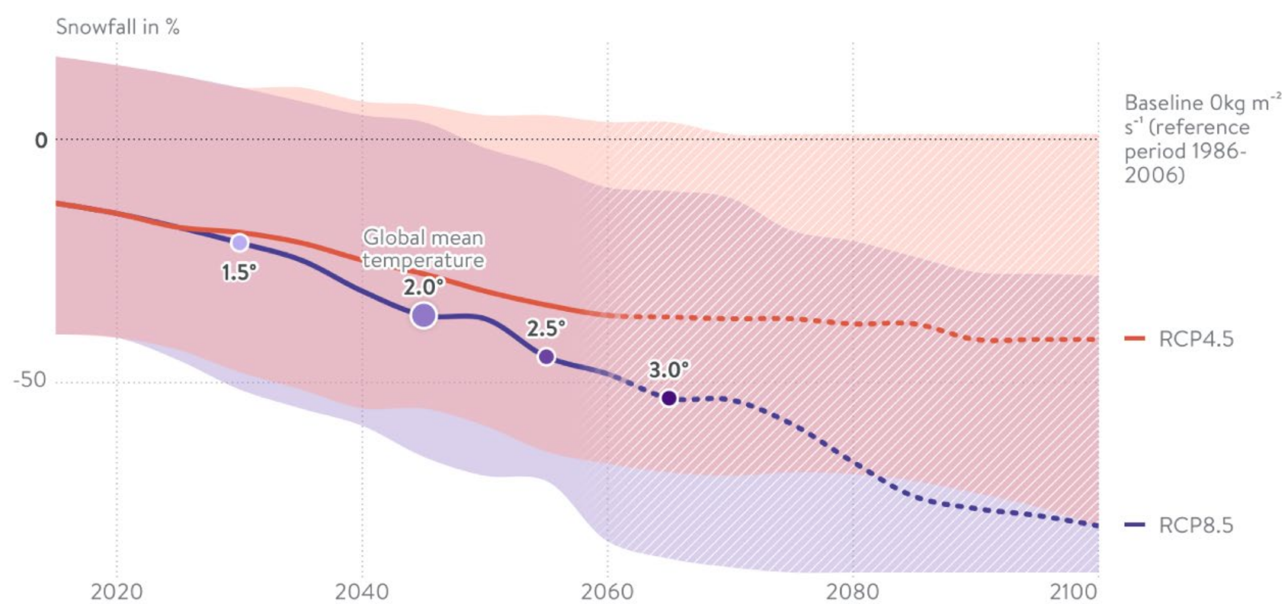
[18] Snowfall is the amount of water that falls to the Earth in the form of snow over a specified area during a specific time interval.



5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

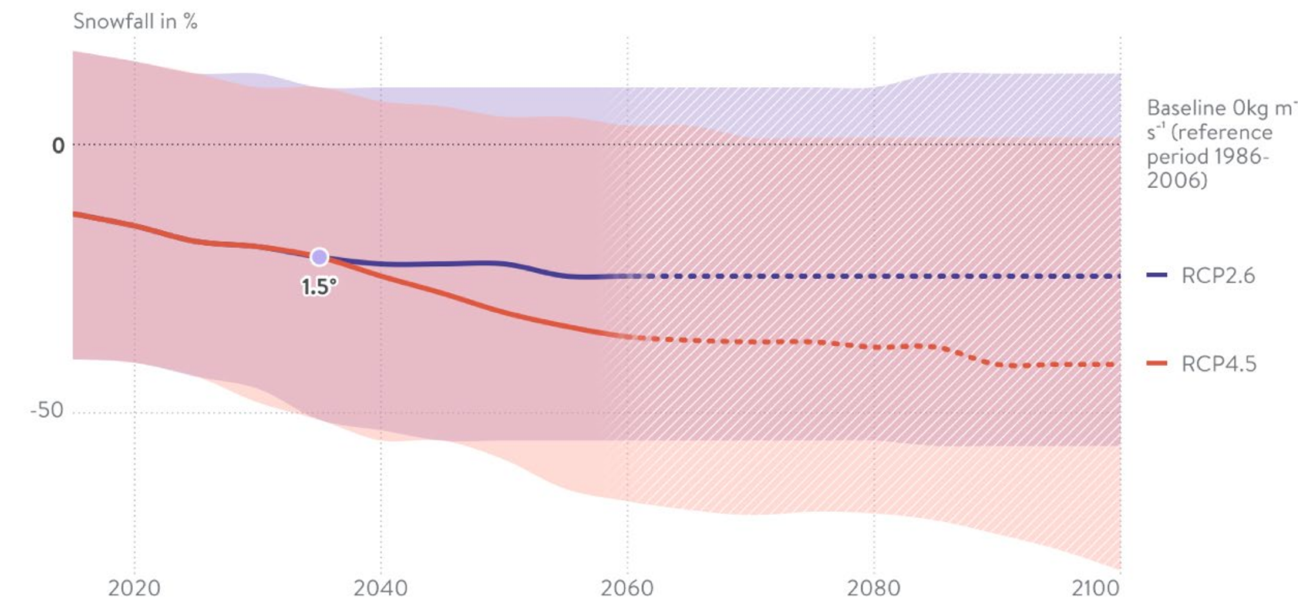
Atyrau Region



5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

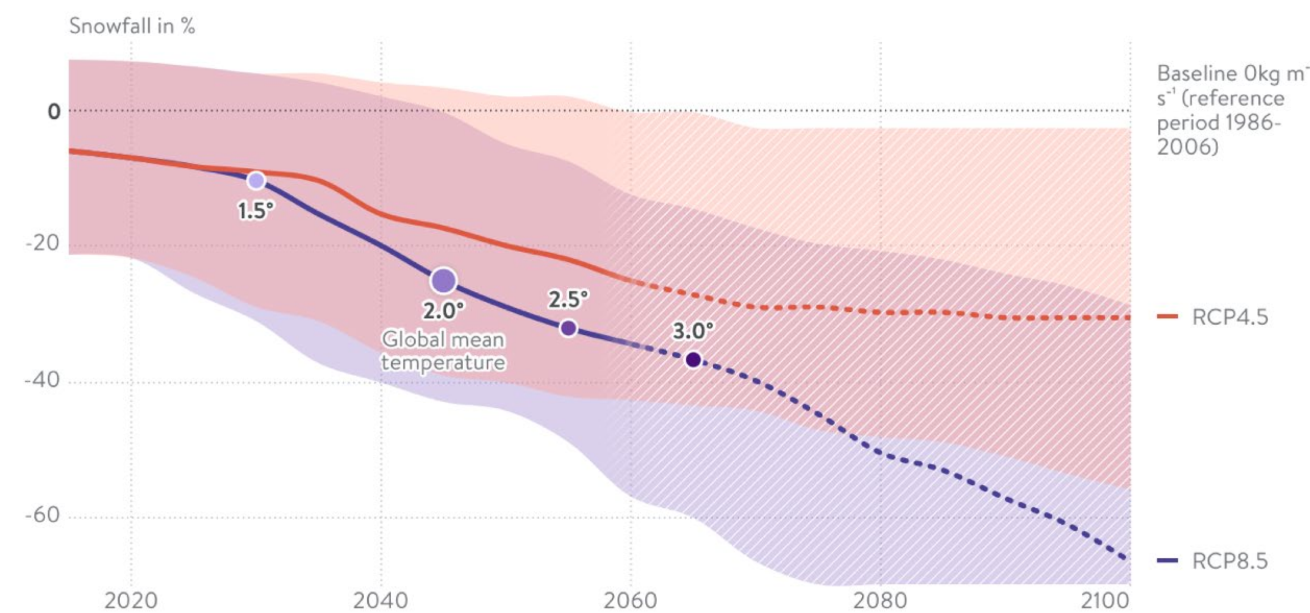
Mangystau Region



5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

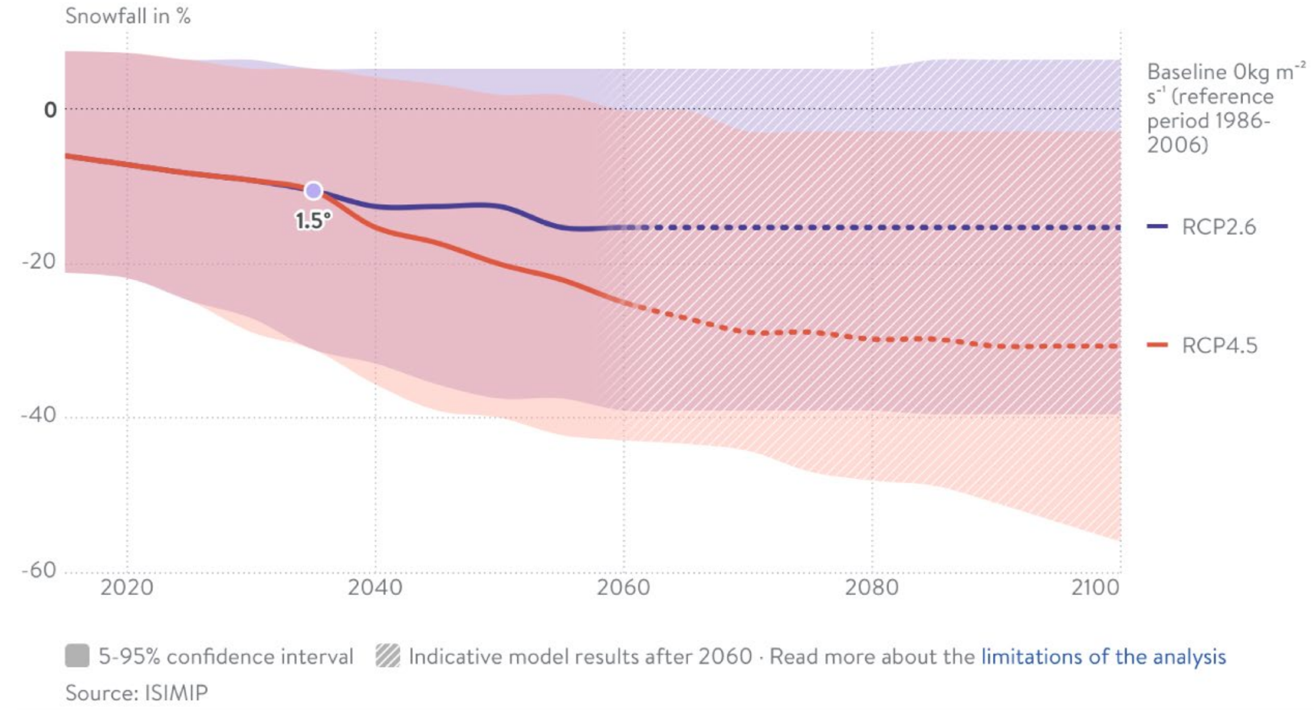
Mangystau Region



5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

South Kazakhstan region

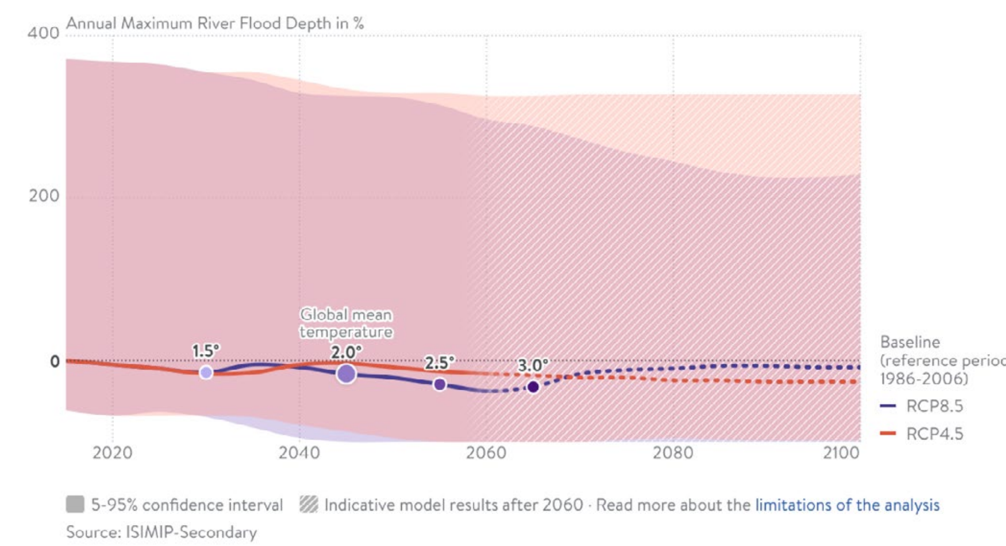


South Kazakhstan region

Appendix 5. Flood Dynamics by Climate Impact Scenarios

The presented diagrams[19] are curves that illustrate how flood levels change[20] over time at various levels of global warming (1.5°C, 2°C, and 2.5°C) compared to the reference period of 1986–2006 based on different scenarios. Each scenario at each time interval is represented by a median line displaying these values for the examined periods and selected assets. The shaded areas indicate the range of uncertainty at the 5–95% level in the model's climate sensitivity for each scenario.

Dynamics of Flood Level Changes by Scenarios

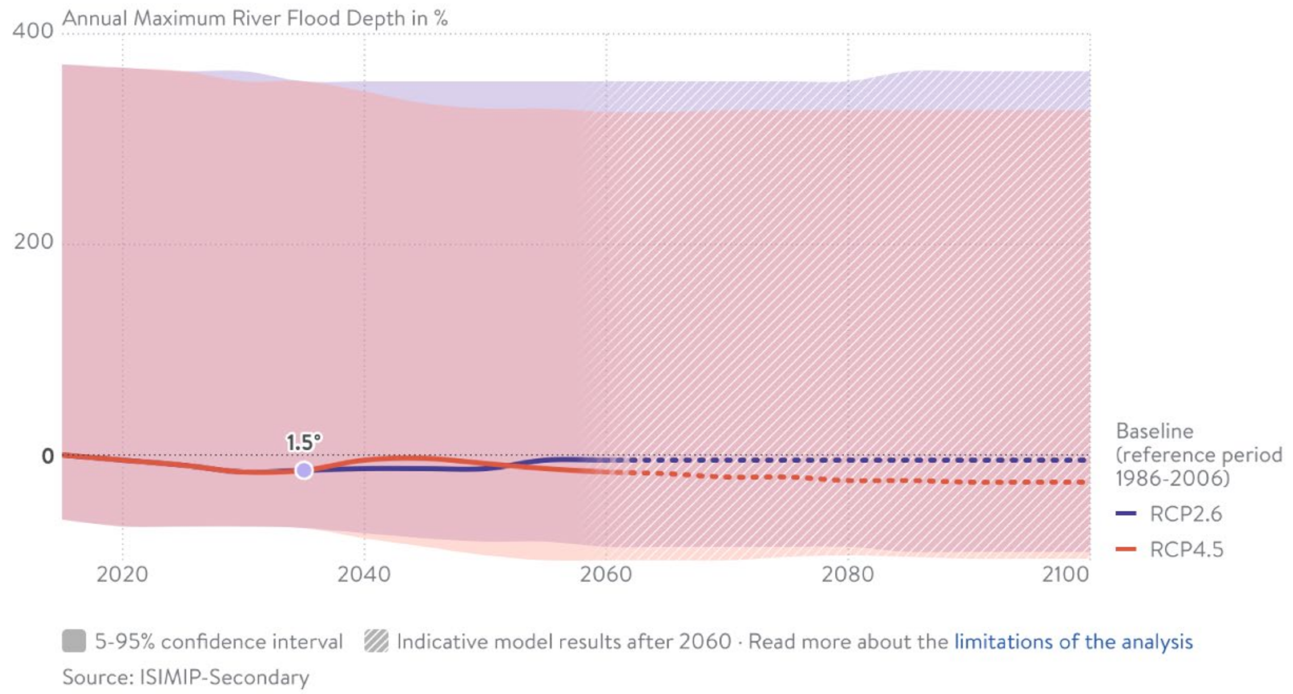


Note: No baseline values. Due to the quality of historical records, bias adjustment and validation of the absolute values simulated by the models used for this indicator have not been completed for all locations. Therefore, we don't provide its baseline absolute values over the reference period 1986-2006.

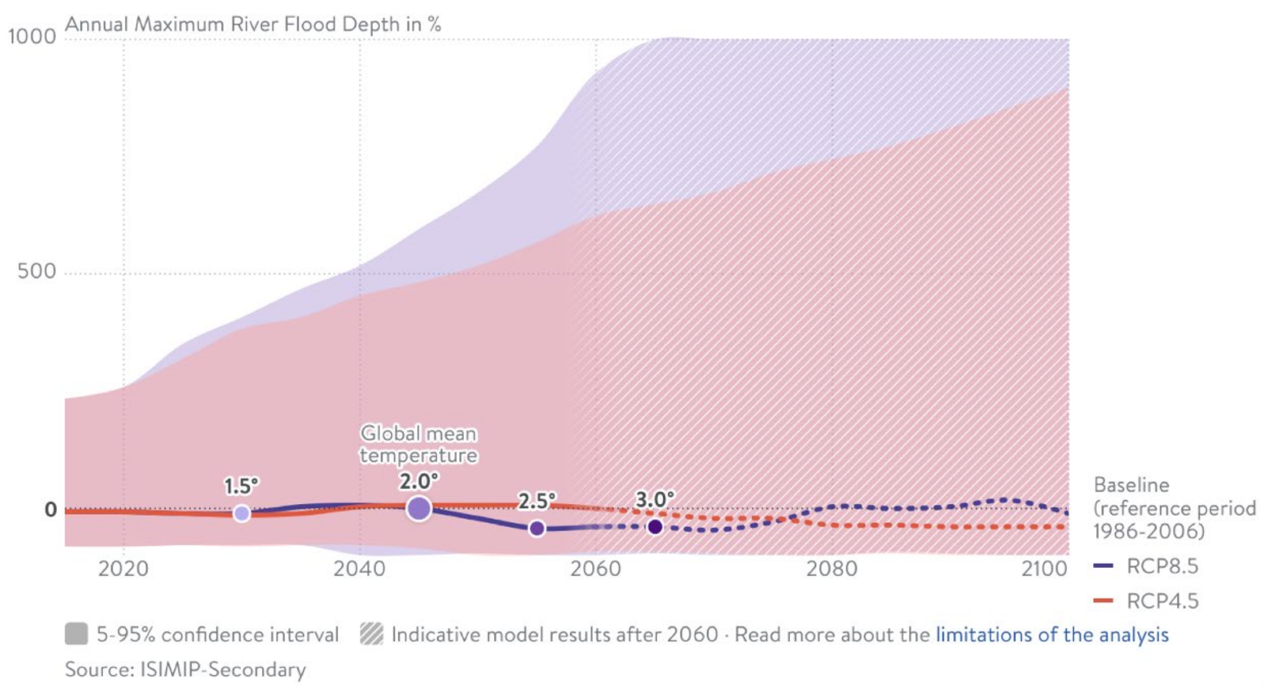
Atyrau Region

[19] In the diagrams, the points at 1.5°C, 2°C, and 2.5°C represent the levels of global warming projected to be reached at specific periods. These points indicate the average global temperature that, according to warming scenarios, will increase by 1.5°C, 2°C, and 2.5°C compared to the baseline level. The baseline value serves as the starting point and is conventionally set at zero. The diagrams also display ranges of uncertainty (shaded areas), indicating that there are various scenarios for possible temperature changes.

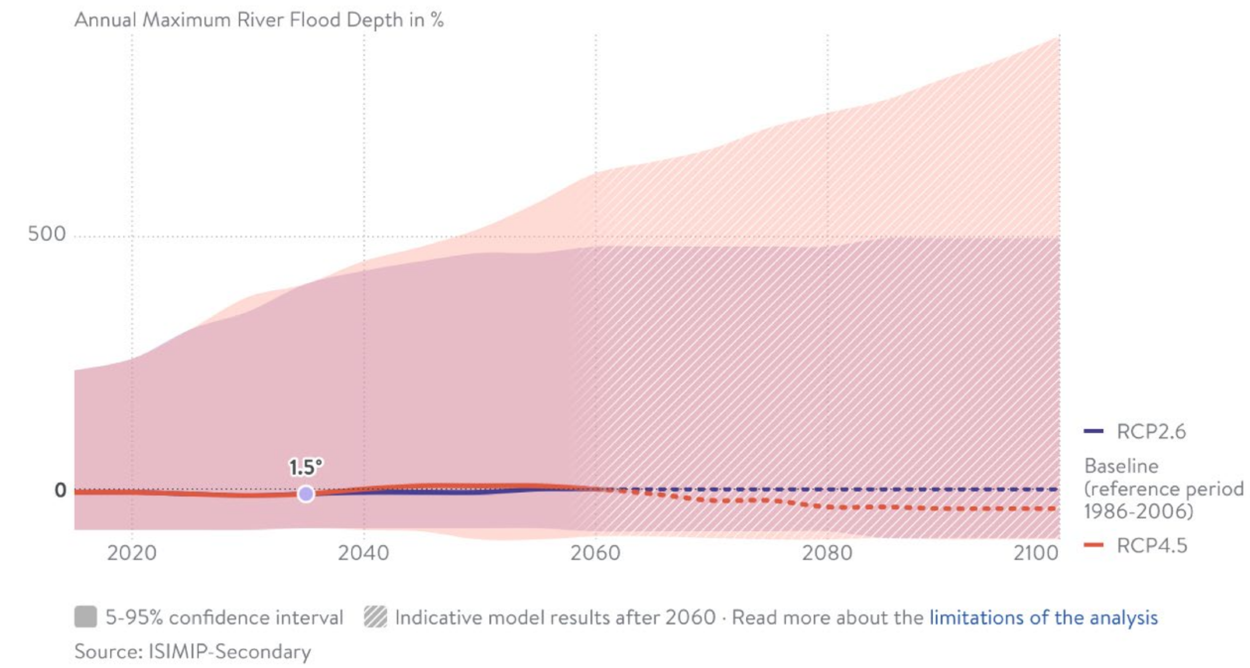
[20] The flood level of a river is defined as the maximum depth of flooding reached during the most intense flood of the year. A flood is recognized as having occurred at a specific point only if the annual maximum water discharge exceeds the local protection standard established in the FLOPROS database. The unit of measurement is meters.



Atyrau Region



Mangystau Region

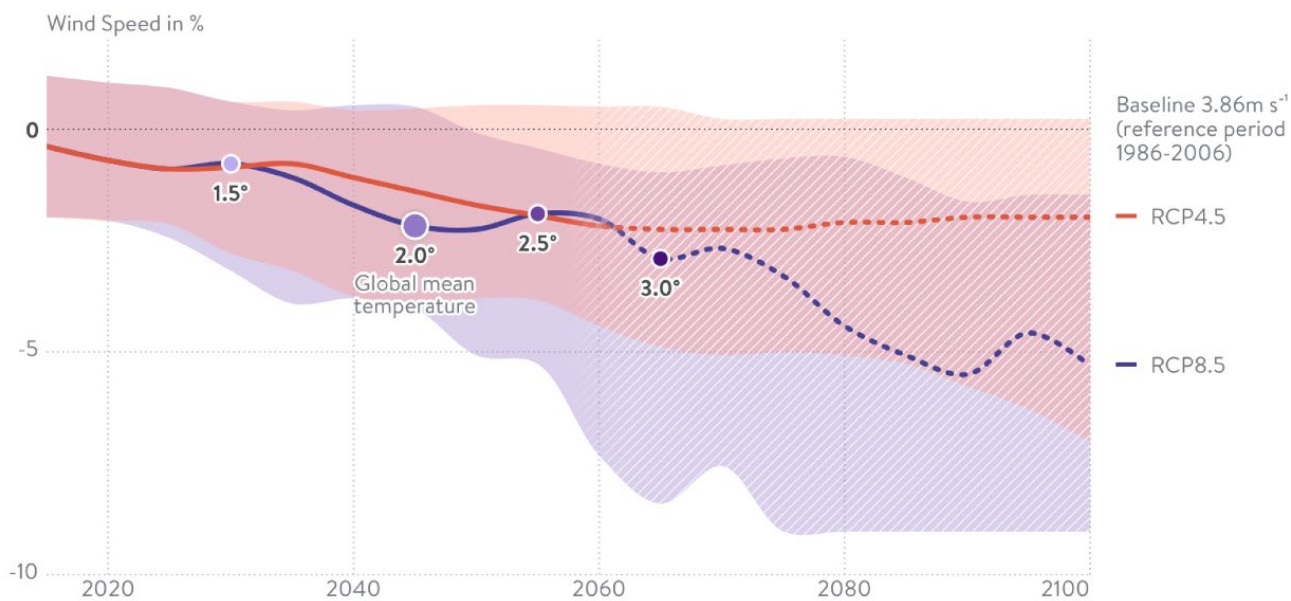


Mangystau Region

Appendix 6. Dynamics of Maximum Wind Speed According to Climate Impact Scenarios

The presented diagrams[21] are curves that illustrate how wind speed will change over time at various levels of global warming (1.5°C, 2°C, and 2.5°C) compared to the reference period of 1986–2006, based on different scenarios. Each scenario at each time interval is represented by a median (line) that reflects these values for the studied periods and selected assets. The shaded areas depict the range of uncertainty at the 5–95% level in the climate sensitivity model for each scenario.

Dynamics of Maximum Wind Speed According to Scenarios

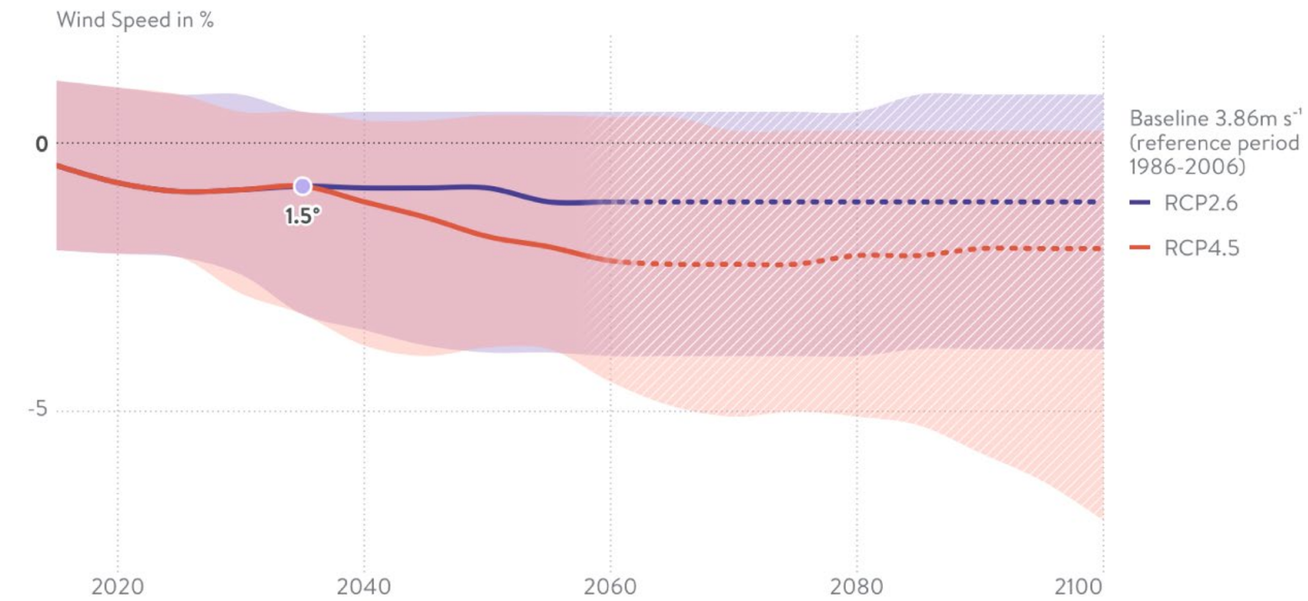


5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

Zhambyl Region

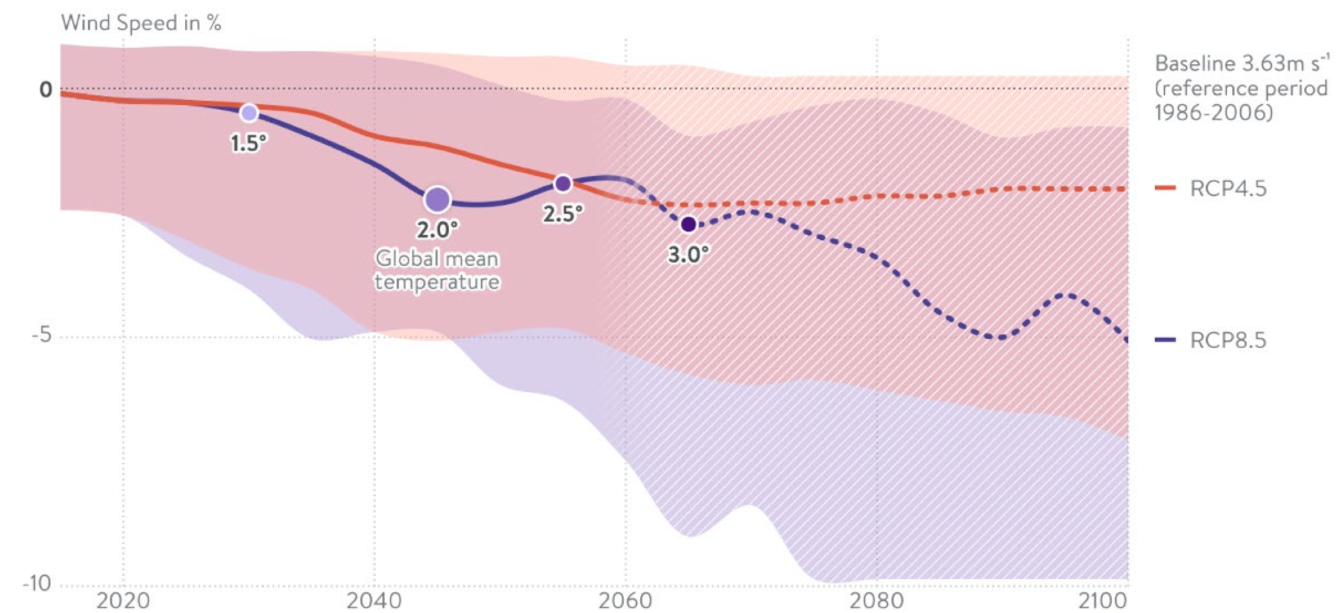
[21] On the diagrams, the points of 1.5°C, 2°C, and 2.5°C represent levels of global warming projected to be reached at a specific time. These points denote the average global temperature, which, according to the warming scenarios, will increase by 1.5°C, 2°C, and 2.5°C compared to the baseline level. The baseline value is the starting point and is conventionally taken as zero. The diagrams also show ranges of uncertainty (shaded areas), indicating that there are different scenarios of possible temperature changes.



5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

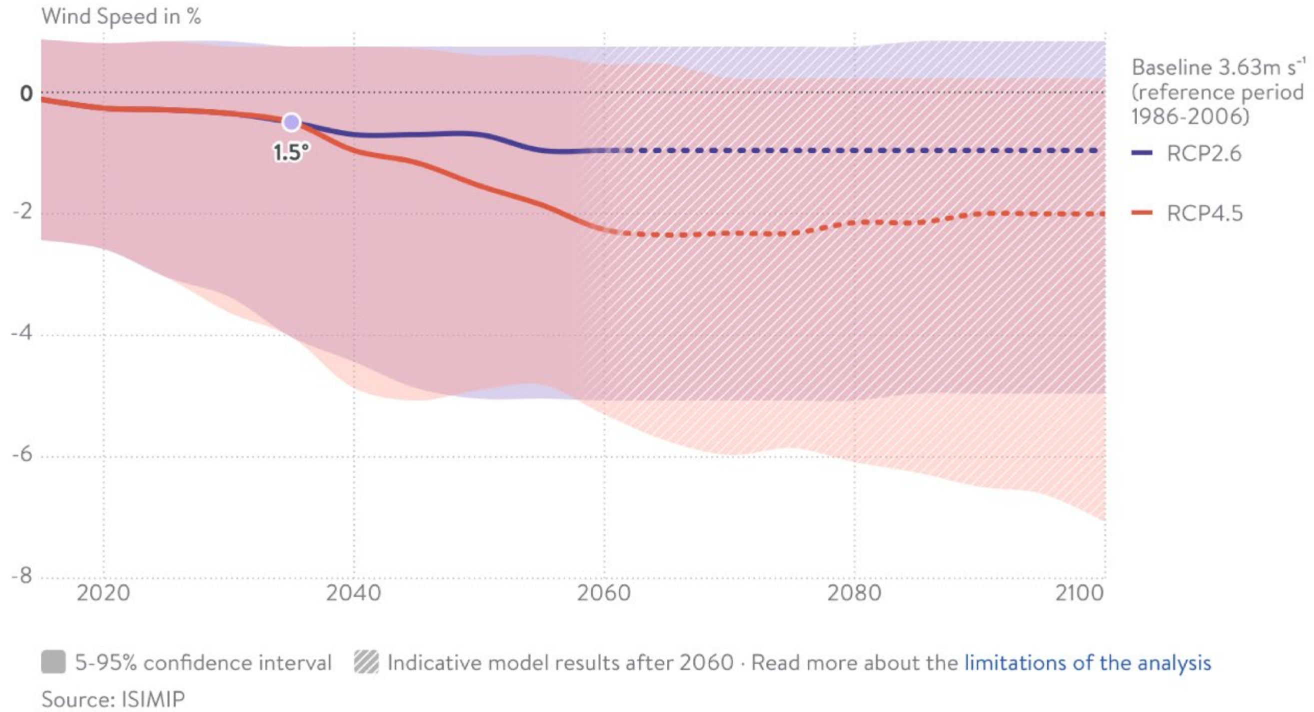
Zhambyl Region



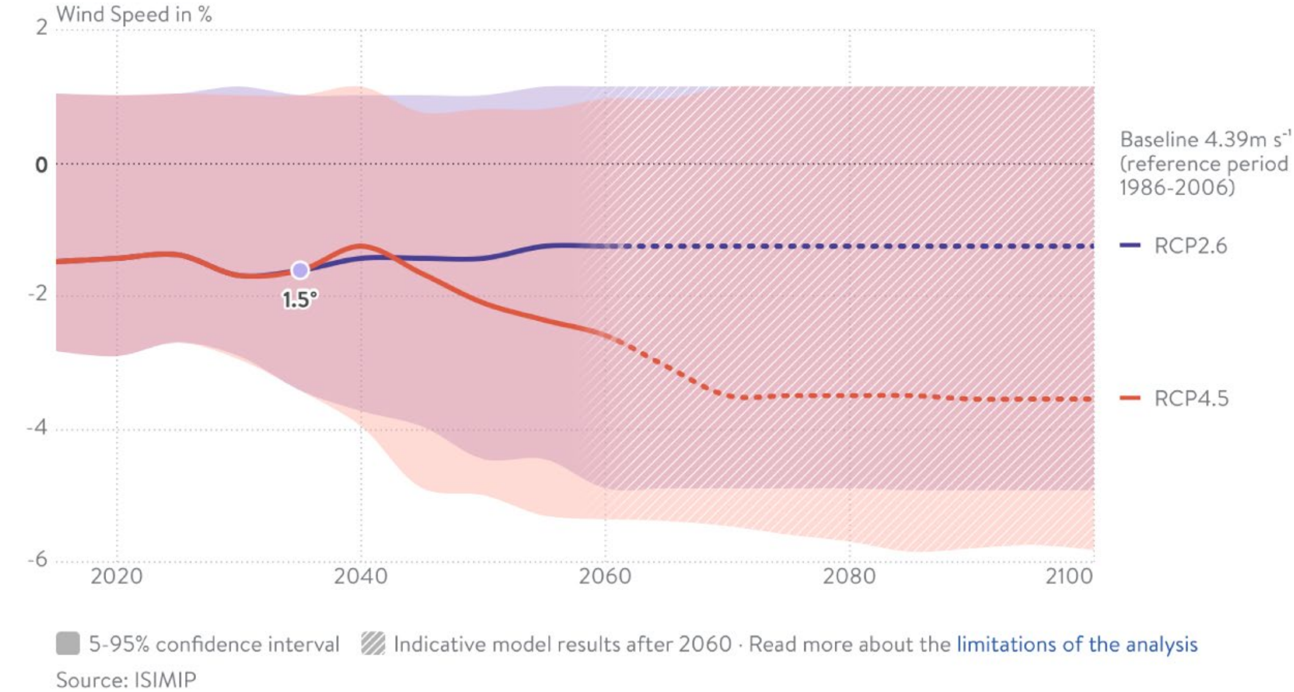
5-95% confidence interval · Indicative model results after 2060 · Read more about the limitations of the analysis

Source: ISIMIP

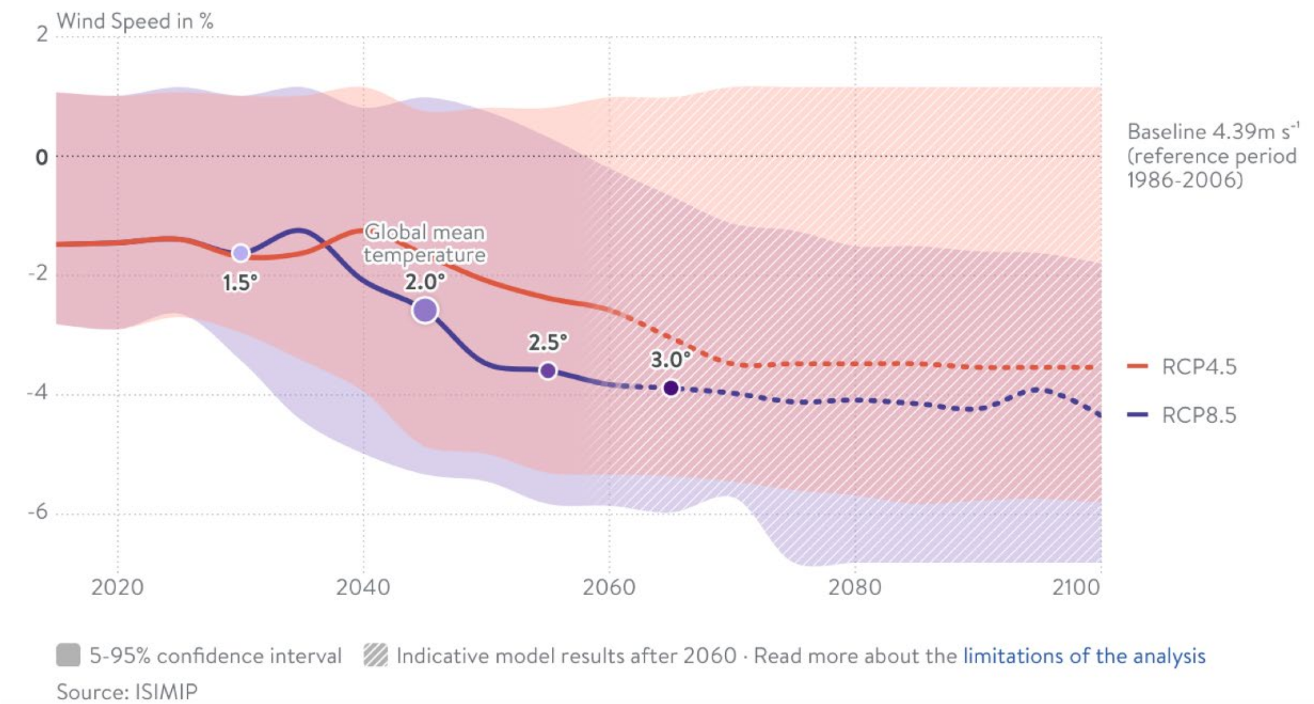
South Kazakhstan Region



South Kazakhstan Region

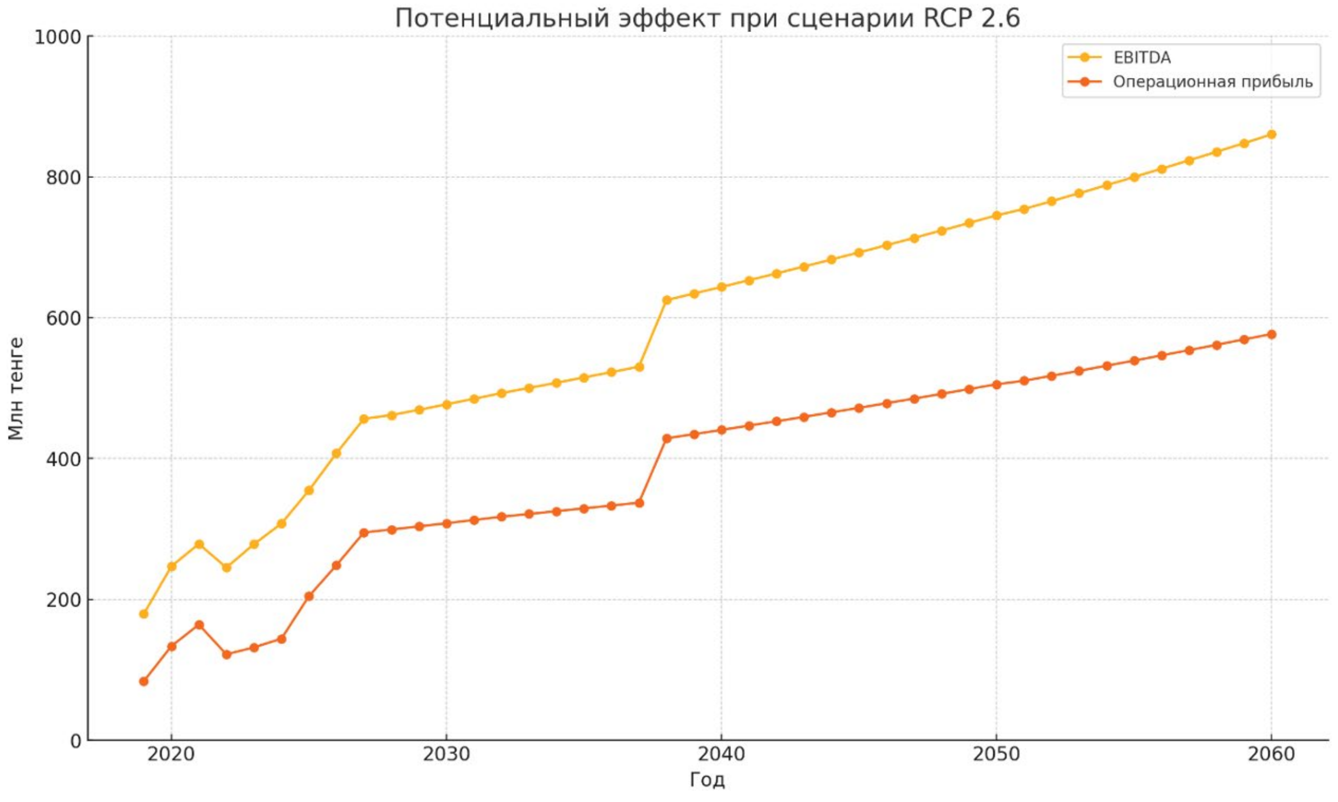


Aqmola Region

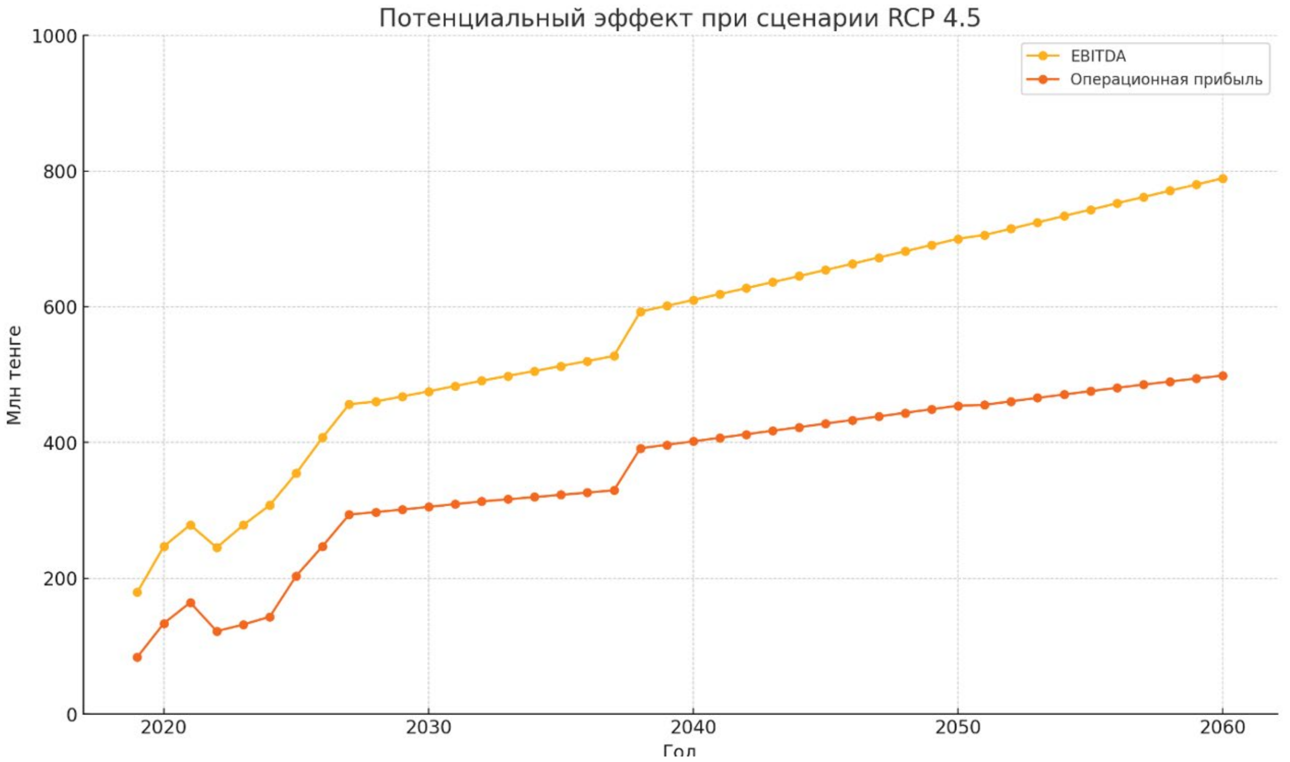


South Kazakhstan Region

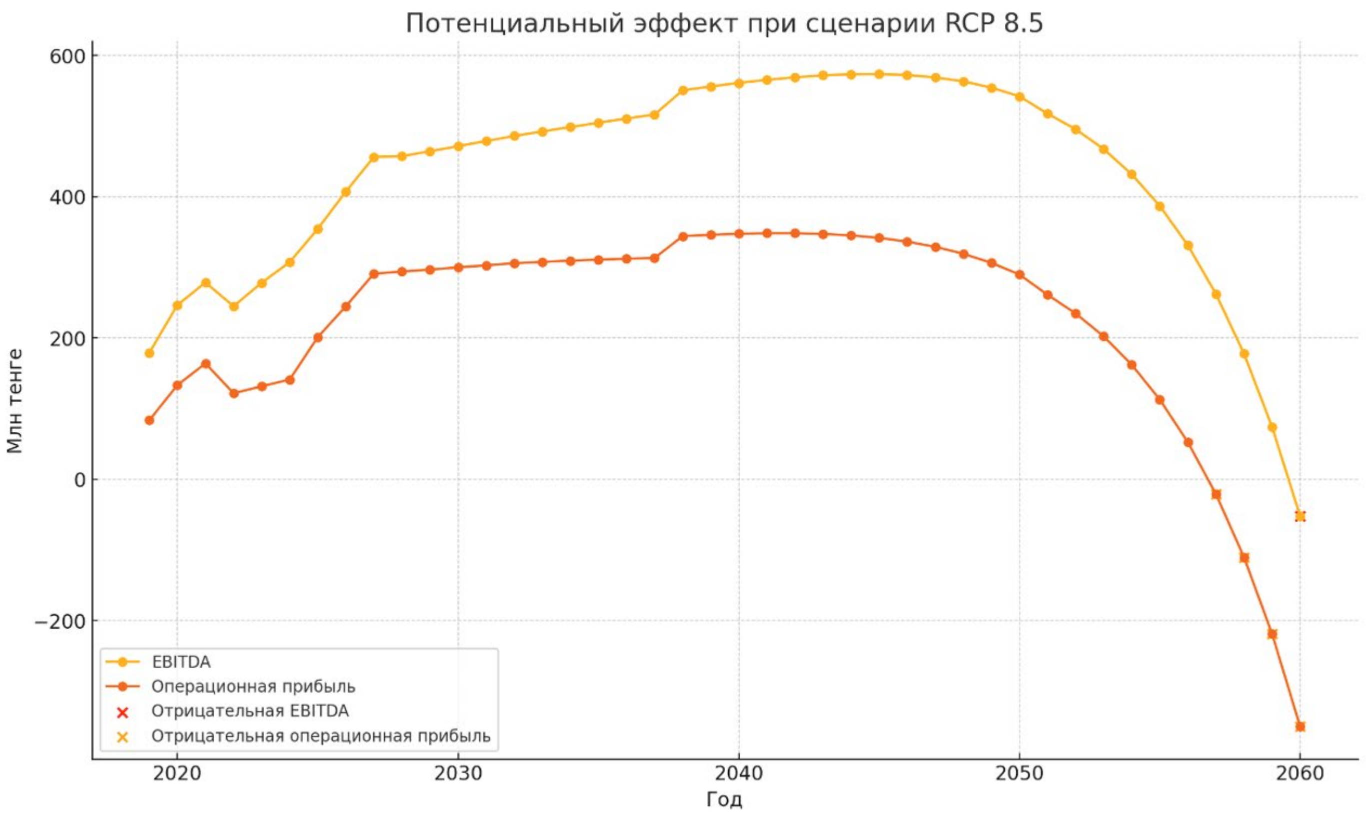
Appendix 7. Potential Impact of Climate Change on the Financial Performance of Kazakhtelecom JSC under Climate Impact Scenarios



The data analysis presented in the diagram indicates that climate change is unlikely to have a significant impact on Kazakhtelecom's financial performance under the RCP2.6 scenario until 2060. Both metrics, EBITDA and operating profit, demonstrate steady growth, reflecting the company's high resilience and profitability in a low-carbon emissions scenario. This trend supports the effectiveness of the current climate risk management strategy and the company's ability to adapt to changing conditions while maintaining long-term financial well-being.

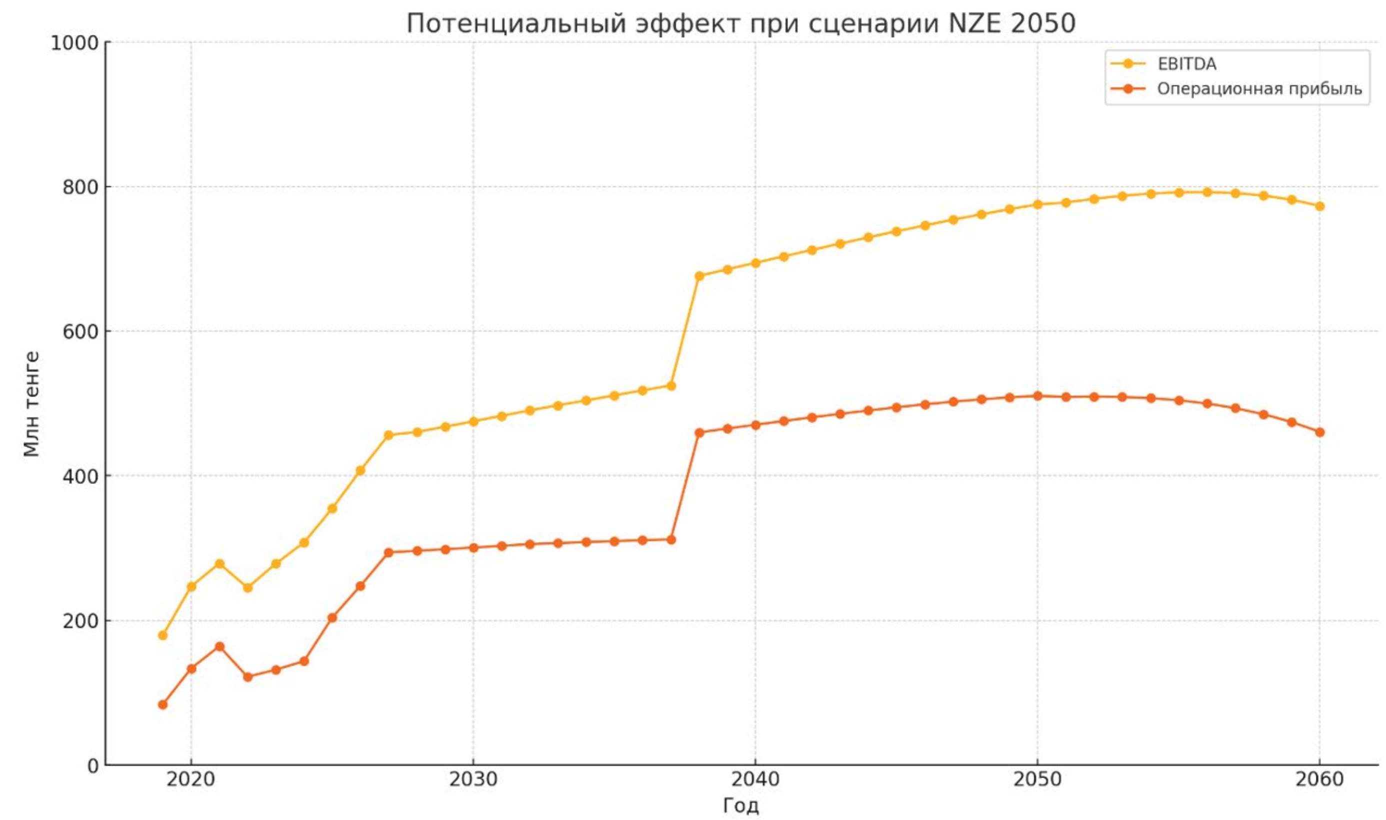


The data analysis presented in the diagram indicates that climate change is unlikely to have a significant impact on Kazakhtelecom's financial performance under the RCP4.5 scenario until 2060. Both metrics, EBITDA and operating profit, demonstrate steady growth, reflecting the company's high resilience and profitability in a moderate carbon emissions scenario. This trend supports the effectiveness of the current climate risk management strategy and the company's ability to adapt to changing conditions while maintaining long-term financial well-being.



The data analysis presented in the diagram illustrates the impact of climate change on Kazakhtelecom's financial performance under the RCP8.5 scenario. This scenario assumes a high level of carbon emissions, and the effects on the company's EBITDA and operating profit become noticeable after 2040. Initially, both metrics show growth; however, after peaking in the mid-century, they begin to decline sharply, indicating increasing climate risks and their impact on the company's operational activities and financial resilience.

By 2060, forecasts suggest that EBITDA and operating profit will fall into negative territory, highlighting the critical need for a reassessment of adaptation and mitigation strategies to ensure long-term sustainability and preserve Kazakhtelecom's financial stability.



The data presented in the diagram indicates that under the NZE2050 scenario (Net Zero Emissions by 2050), aimed at achieving net-zero carbon emissions by 2050, Kazakhtelecom's financial performance is not significantly affected by climate change. The company's EBITDA and operating profit exhibited steady growth until the mid-century, after which they entered a stabilization phase.

Appendix 8. Recommendations Based on the Climate Analysis for Kazakhtelecom JSC

We conducted a detailed assessment of the climate risks faced by Kazakhtelecom JSC and, based on this analysis, developed a series of recommendations for their mitigation and management. These measures aim to enhance resilience to climate change, improve the risk assessment and management process, and align with international climate goals. Below are key recommendations that will help the company effectively respond to the challenges posed by climate change and contribute to the reduction of greenhouse gas emissions.

1. Adaptation to Climate Risk Impacts

To effectively adapt to and mitigate physical and transitional climate risks, Kazakhtelecom JSC needs to implement a comprehensive set of measures, including the following:

- Public Reporting on Climate Risks: Implement a regular system for disclosing climate risks (as a mandatory element of the annual report or a separate climate report) to enhance the company's transparency, improve investment attractiveness, and build trust among stakeholders.
- Regular Review of Risk Assessment: Establish a process for monitoring and reviewing climate risk assessments at least every three years. This will help to timely account for changes in climate conditions, available scientific data, and forecasts, adjust risk management strategies, and meet the expectations of leading rating agencies.
- Plan for Monitoring Physical Risks: Develop an overall plan for monitoring climate risks that covers all divisions and assets of the company. This plan should include continuous monitoring and operational response mechanisms for identified threats.
- Adjustment of Investment Plans: In the event of identified changes in the financial and operational impacts of climate risks, adjust investment plans to minimize their effects. Special attention should be paid to measures aimed at reducing carbon footprints and improving the energy efficiency of data centers, as well as preparing related infrastructure for greater resilience to physical risks.
- Enhancing Energy Efficiency of Data Centers: Implement further measures to enhance the energy efficiency of data centers, which will reduce their vulnerability to climate risks. Ensure alternative energy sources through renewables, aiming for a complete replacement of traditional sources.
- Special Plans for High-Risk Regions: Due to the limitations imposed on this climate study by data center confidentiality requirements, it is recommended to develop separate targeted plans and conduct additional assessments of climate impacts (physical profiles) for regions identified in the analysis as most vulnerable to climate risks. Based on this analysis, if necessary, develop and implement measures to minimize damage and enhance infrastructure resilience, particularly against flooding, fire, and rising temperatures.
- Purchase of Carbon Credits: If feasible, within the next 5–7 years, develop a strategy for purchasing carbon credits to offset CO2 emissions, allowing the company to comply with international standards and mitigate its impact on the climate.

2. Further Improvement of Climate Analysis and Risk Management:

- Enhancing Forecast Accuracy: To improve the effectiveness of climate risk analysis, it is essential to update the data used. Both global and local climate changes should be taken into account to ensure that forecasts are as accurate as possible and tailored to the company's specific activities.
- Updating Analysis: Increase the frequency of climate risk reassessments to respond promptly to changes. Establish regular reviews of data and monitoring of key climate parameters (such as temperature, precipitation, etc.) to maintain the relevance of forecasts.
- Updating Data and Scenarios: Regularly monitor changes in global climate scenarios and incorporate them into assessments. Utilize data from international experts, such as the Intergovernmental Panel on Climate Change (IPCC), to adjust internal risk assessments and company plans.
- Regular Review of Plans: Review company plans at least once every five years, utilizing new data and research. Adjust the company's strategy in response to changes in global climate scenarios to effectively manage risks.

3. Calculation of Greenhouse Gas Emissions for Scope 3)

We recommend that Kazakhtelecom JSC implement an assessment for calculating carbon emissions under Scope 3. Scope 3 evaluation is crucial for obtaining a comprehensive picture of the company's climate risks and aids in making strategic decisions for their reduction.

The Scope 3 emissions assessment is closely linked to enhancing the accuracy and coverage of climate risk assessments, as it encompasses greenhouse gas (GHG) emissions throughout the entire value chain, including both direct and indirect emissions. The connection between them is as follows:

1. Defining the Scale of Impact: Scope 3 includes a wide range of emissions occurring outside the direct control of the company, such as those from suppliers, transportation, and product disposal. These emissions often represent the largest portion of a company's carbon footprint. Understanding and assessing these emissions are essential for a thorough climate impact analysis.

2. Climate Risks in the Supply Chain: Climate change and its impacts (e.g., extreme weather events, rising sea levels) can disrupt supply chains, logistics, and alter prices for raw materials, goods, and equipment. The Scope 3 emissions assessment helps identify potential vulnerabilities in the supply

chain and account for them in climate risk management.

3. Regulatory and Reputational Risks: Insufficient transparency or failure to account for Scope 3 emissions may lead to reputational losses and increased regulatory risks, as more regulators and investors demand the inclusion of total emissions across the supply chain.

4. Targets and Emission Reduction Strategies: To establish effective strategies for reducing carbon footprints and managing climate risks, companies must consider Scope 3, as a significant portion of emissions typically falls within this category. This allows for better adaptation to long-term climate threats.

Scope 3 emissions refer to all indirect greenhouse gas emissions associated with the supply chain and the lifecycle of a company's products and services. This can include emissions from the production and transportation of equipment, energy consumption by customer devices, and the disposal of equipment at the end of its life cycle. Since Scope 3 often constitutes a significant portion of the overall carbon footprint, managing it is a key step in reducing the company's environmental impact, achieving emission reduction goals, and enhancing trust among partners and customers.

Conducting a Scope 3 emissions assessment may involve the following steps:

- Assessment of Scope 3 Emissions: Analyze the entire value chain of the company to identify key sources of indirect emissions, including equipment suppliers, logistics, and disposal.
- Collaboration with Suppliers: Implement emission reduction requirements for equipment and service suppliers, focusing on the use of sustainable materials and renewable energy sources in production processes.
- Equipment Optimization: Improve the energy efficiency of customer devices and network equipment, minimizing energy consumption and extending the lifecycle of products.
- Disposal and Recycling: Develop and implement programs for the disposal and recycling of used equipment, with an emphasis on reducing emissions during disposal.
- Customer Awareness Raising: Encourage customers to reduce energy consumption when using telecommunications services through information campaigns and reward programs for lowering emissions.
- Reporting and Monitoring: Establish a system for regular monitoring and public reporting of Scope 3 emissions to ensure transparency and strengthen stakeholder trust.

<u>4. Participation in the Net-Zero Initiative</u>

- Consider Feasibility and Opportunity: Evaluate the feasibility and potential for the company to participate in the Net-Zero initiative. Joining the Net-Zero initiative demonstrates the company's responsible approach to climate change and strengthens its position and reputation among clients, investors, and other stakeholders, as well as enhancing the company's ESG rating.
- Analysis and Assessment of Current Emissions: The first step is to conduct a comprehensive analysis of all company emissions (Scope 1, 2, and 3). This provides accurate data for determining the next steps.
- Setting Emission Reduction Targets: Companies develop short-term and long-term goals based on Science-Based Targets (SBTs) to ensure their actions align with global climate commitments, such as limiting warming to 1.5°C.
- Action Plan for Emission Reduction: A comprehensive plan is developed, including measures to enhance energy efficiency, transition to renewable energy sources, reduce emissions in the supply chain, and upgrade equipment.
- Monitoring and Reporting: Regular progress monitoring and reporting on target achievements should be integrated into the company's annual sustainability reports.
- Investing in Offset Projects: To compensate for residual emissions, companies invest in carbon offsetting projects.
- Collaboration with Stakeholders: Maintaining transparency and collaborating with partners, suppliers, and clients is essential to collectively reduce the carbon footprint across the supply chain.

Appendix 9. Energy Efficiency of Kazakhtelecom JSC Data Centers

Energy efficiency in Kazakhtelecom JSC data centers

Avarage Energy Efficiency (EE)		2021	2022	2023	Energy efficiency target for 2023
		0 %	0.1 %	0.8 %[22]	Increasing energy efficiency through the modernization of data center climate control equipment
What percentage of the total ICT infrastructure is covered by this indicator?	Which components are included in the ICT infrastructure within your monitoring and efficiency assessment?	25–32% ICT infrastructure of the data center: computers, servers, data transmission equipment, telecommunications systems, climate control equipment.			

[22] The primary focus of the data center modernization is on the installation of new equipment, which involves adding additional capacity to the existing setup. Special attention is given to the summer months when the operating time of the climate control equipment significantly increases, necessitating enhanced energy efficiency and reliability to maintain optimal working conditions for the infrastructure.

Share of renewable energy sources (RES) in Kazakhtelecom JSC data centres

Energy consumption of data centers	2021	2022	2023	Target for 2023
Total energy consumption (MWh)	53.139	52.901	48.776	• Implementation of energy-saving programmes; • Modernisation of equipment and climate control systems.
Share of renewable energy sources used in data centers.	0%	0%	0%	As part of the ESG strategy, consideration should be given to implementing the following measures:: • increasing the share of renewable energy sources (RES) through the construction of new facilities based on RES, such as solar and wind power plants. The primary limiting factor in this regard is the instability of energy generation caused by variable weather conditions, including wind speed and sunlight availability; • purchasing green certificates to enhance the resilience of the company's energy balance and minimise its carbon footprint; • directly purchasing electricity from RES-generating installations, which will allow for an increased use of clean energy and a reduction in dependence on traditional sources of electricity.

Appendix 10.
Structure of Climate Management in Kazakhtelecom JSC

Board of Directors

The Board of Directors of Kazakhtelecom JSC oversees sustainability matters, including the management of climate risks and opportunities. The Board approves the ESG strategy, which outlines the key areas related to climate risks and opportunities.

Functions

- Determining the strategy for sustainable development and climate risks.
- Monitoring the process of integrating climate factors into the company's strategic and operational planning.
- Reviewing and approving reporting in this area.
- Overseeing the implementation of sustainability principles and low-carbon development.
- Managing sustainability-related risks, including climate risks.

Incentives for Managing Climate Risks:

- Defining incentive strategies related to climate goals for the Company's executives and staff.
- Approving a remuneration system based on the achievement of ESG targets, including climate-related targets.

Audit and Sustainable Development Committee

Since July 2022, the Audit Committee has been renamed the Audit and Sustainable Development Committee. This committee is responsible for managing sustainable development risks, including physical and transition climate risks.

Functions

- Preliminary approval of the Company's Annual Report regarding the quality of the presented non-financial information.
- Development of recommendations for the Board of Directors on topics related to sustainable development, as well as on the implementation of ESG principles and low-carbon development within the Company.
- Monitoring the transformation of business processes in accordance with the principles of sustainable development, ethical behaviour, and responsible investing.
- Development of recommendations for the Board of Directors regarding the approval of new policies and the evaluation of the effectiveness of existing policies, plans, and programmes in the field of sustainable development, as well as priority projects, key activities, and initiatives in the area of sustainable development and climate.
- Review of issues related to low-carbon development and the management of the Company's carbon footprint, including potential risks and limitations arising for the Company in relation to the global climate agenda.
- Development of recommendations for the Board of Directors regarding the compliance of activities, corporate reporting, and documents with the requirements of international ratings in the field of sustainable development, as well as monitoring the implementation of measures to improve the Company's positions in international sustainable development ratings. Monitoring the quality of the Company's public reporting in the areas of sustainable development and climate.

Incentives for Managing Climate Risks:

- Evaluation of the effectiveness of climate incentives aimed at achieving the Company's climate targets.
- Monitoring the implementation of incentive strategies and the integration of climate factors into employee motivation.

Executive Committee

Department of Corporate Governance and Sustainable Development

Functions: Responsible for the inventory of internal regulatory documents, managing sustainability risks, and regularly monitoring the achievement of the company's targets in this area.
Develops and updates policies related to climate risks and sustainable development, with regular presentations for discussion at the Audit and Sustainable Development Committee.

Compliance Department

Functions: Ensures compliance with norms and standards in the field of sustainable development and climate risk management.
Implements internal control to ensure adherence to sustainable development requirements.

Communications Department

Functions: Responsible for external communications, including informing the public and stakeholders about the company's actions in the field of sustainable development.
Coordinates engagement with external partners and the media on climate integration issues.

Structural Units Responsible for Human Resource Management, Occupational Health and Safety

Functions: Oversee specific aspects of sustainable development management, including compliance with occupational health and safety standards.
Implement measures to minimise environmental impact and enhance energy efficiency.

Head Office of Kazakhtelecom JSC

Functions: Is directly responsible for the coordination and oversight of the implementation of sustainable development initiatives within the company's structural units.
Ensures the execution of the company's climate and ESG strategies at all levels.

Branches:

The Chairman of the Management Board and the General Directors of the branches

Functions: Oversee the implementation of sustainability standards and policies within the company's branches.
Ensure the provision of accurate information regarding the execution of plans and activities related to climate initiatives.

Managing Director of Kazakhtelecom JSC for Sustainability

Functions: Coordinates the Company's efforts to achieve sustainable development goals.
Monitors the fulfilment of key performance indicators (KPIs) in the field of sustainable development and climate initiatives.

Incentives for Managing Climate Risks:

- Implementation of Strategies for Managing Climate Risks and Monitoring Their Progress.
- Establishment of a remuneration systemlinked to the achievement of the company's climate and ESG targets.