



Nornickel Scenarios for Climate-Related Risk Assessment

November 2022

Executive Summary

- Earth's climate will continue to change, driving the urgency of physical risks, while global decarbonisation pace and targets may change, with the impact of transition risks on the Company changing accordingly
- Despite geopolitical factors, climate-related risks remain relevant to international and Russian regulators and key stakeholders, as well as the industrial and strategic safety of the entire Company and its individual assets
- TCFD (Task Force on Climate-Related Financial Disclosures) is a generally accepted international framework that establishes the principles and approaches for businesses to build climate risk management systems
- The Company is implementing a TCFD roadmap to support one of the goals under its Environmental and Climate Change Strategy
- The Company has developed scenarios to assess the two key categories of climate risks – physical and transition risks, which will help design respective mitigation and adaptation measures

How Relevant is Climate Change for Nornickel?

Internal demand and objectives

- Prevention and adaptation to climate-related physical risks to ensure safety and continuity of operations (prevent accidents similar to the diesel spill at HPP-3¹)
- Mitigation of the transition risks related to the decarbonisation of the global economy (a risk of demand reduction for the Company's metals in the long run as Europe, for instance, is planning to phase out ICE vehicles by 2035)
- Monitoring of the changes in the global ambitions regarding the pace of energy transition and decarbonisation timeline and goals

External demand

- Customers (consumers of metals) and ESG ratings (EcoVadis, Sustainalytics and MSCI ESG) keep climate risk management on their radar screens
- Investors, banks and other international stakeholders remain a relevant option, but now in a longer-term

TCFD offers a framework on how to meet these objectives...

...and provides guidelines for a climate-related risk management system (Nornickel is currently implementing a roadmap to comply with TCFD)

Global Decarbonisation Ambitions Are Put to a Stress-test

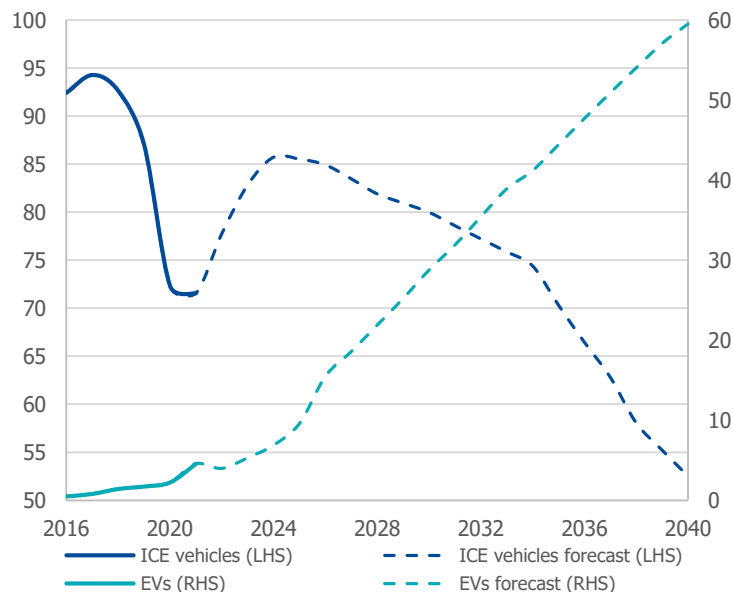
- **Coal consumption: record consumption levels in most countries...**
 - ✓ In 2022, an increase of 0.7% is expected globally, followed by a further increase in 2023¹
 - ✓ India – increase of 7% in 2022¹
 - ✓ China – decrease of 3% (largely due to COVID-19 restrictions)¹
 - ✓ EU – increase of 7% by 2022¹
- **...but so is the growth of renewable energy**
 - ✓ China – increase of 92%²
 - ✓ USA – increase of 81%²
 - ✓ India – increase of 23%²
- **Rule of thumb: sustainable economic growth is conditioned upon energy costs NOT exceeding 10% of GDP**
 - ✓ Energy costs expected to reach 13% of GDP globally in 2022³ and at 15% of GDP in Europe in 2023⁴

**Meeting the targets set by the Paris Agreement has become even more challenging
More uncertainty around transition risks emerged, while physical risks are likely to increase further**








Transition Risks & Opportunities: Phased-out Internal Combustion Engines to be Replaced with Electric Vehicles

Global Production Forecast for ICEs (including HEVs) and Electric Vehicles

[million units]



Announced Ambitions to Ban ICE Vehicles in Selected Key Markets

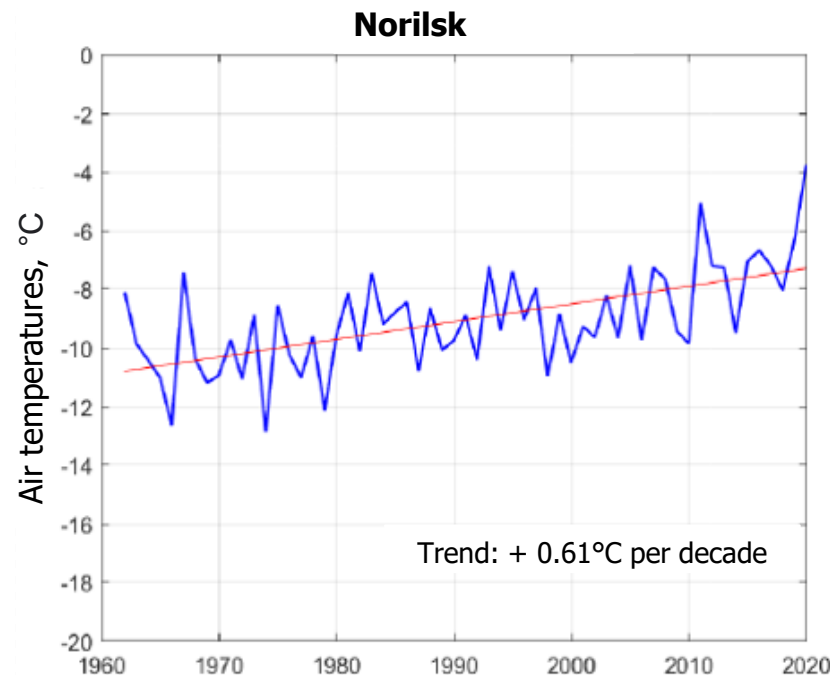
Country (vehicle sales in 2021)	Target year	Comment
 China (25.6 million)	2035	Partial ban: electric vehicles (including hydrogen vehicles) are to make up 50% of vehicle sales, with HEVs making up the other half
 USA (14.9 million)	2030- 2035	Ban in individual states: Washington, D.C. – sales ban on new ICE vehicles from 2030; California, Massachusetts, New York, New Jersey from 2035
 Japan (4.4 million)	2035	Sales ban on new ICE vehicles
 Germany (2.6 million)	2035	Sales ban on new ICE vehicles, except for synthetic fuel vehicles
 France (1.7 million)	2030- 2040	Sales ban on new ICE vehicles from 2040 (Paris from 2030)
 Canada (1.7 million)	2035	Sales ban on new ICE vehicles
 UK (1.6 million)	2030- 2035	Sales ban on new ICE vehicles, except for plug-in hybrids; sales ban on new HEVs from 2035

Historical Climate Change Trends in Norilsk: Paris Agreement Threshold Already Exceeded¹

Selected observations from a climate study of the Institute of the Atmospheric Physics (IFA):

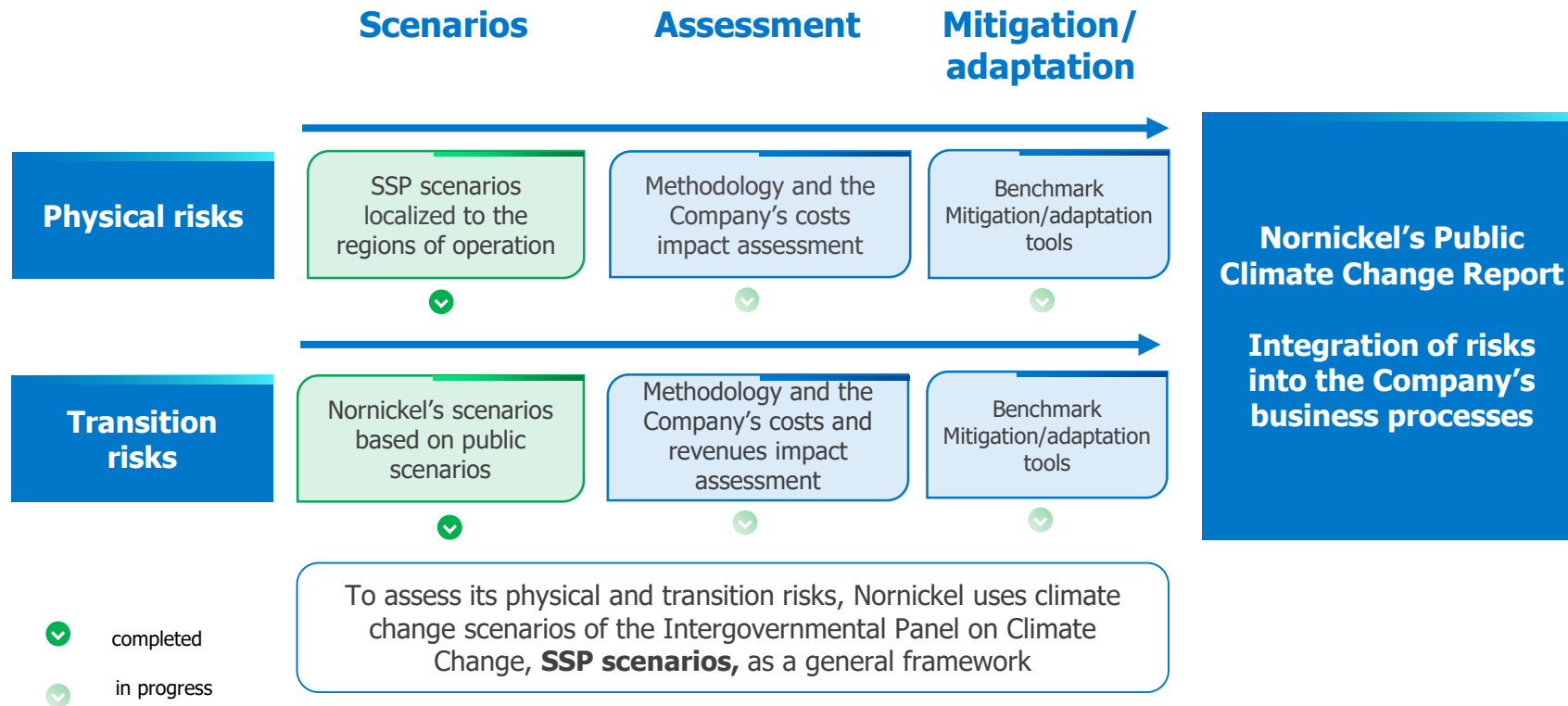
- Growth of temperature in Norilsk by 0.6°C per decade
- Longer periods of precipitation during the cold season and shorter periods of no precipitation
- Changes in the snow-covered period, with snow depth increasing
- The average depth of thaw increases (trending up to 15 cm per decade)
- Increase in average surface wind speeds
- Increase in number of cyclones
- Increase in fire risk
- Reduction of sea ice concentrations, elevation of sea level in the Kara Sea and at the mouth of Yenisei²

Thawing permafrost and low water availability are already included in Nornickel's key risk reporting



Notes: 1. The Paris Agreement seeks to limit the rise in global average air temperature to 2 °C by the end of the 21st century; 2. At the mouth of the Yenisei River, the ocean level has risen by 1.9 mm/year over the past 50 years

Climate-Related Risk Management System Based on Integrated Scenarios



Developing Climate Change and Social & Economic Long-term Scenarios

Climate-change Scenarios to Assess Physical Risks



- **Historical data:** 60-years of weather data analyzed
- **Baseline scenarios:** public scenarios by the IPCC¹
- **Selected scenarios:** SSP1-2.6, SSP2-4.5 and SSP5-8.5; all localized to the Company's regions of operations
- **Experts:** climatologists from the A.M. Obukhov Institute of Atmospheric Physics of the Russian Academy of Sciences (ИФА РАН)

Social-economic Scenarios to Assess Transition Risks and Opportunities



- **Scenarios universe:** various public scenarios, falling within the range of temperature change estimated by the IPCC scenarios
- **Customized scenarios:** Rapid Transition, Sustainable Palladium and Global Growth, corresponding to selected climate scenarios
- **Experts:** economists from the Institute of Economic Forecasting of the Russian Academy of Sciences (ИНП РАН/IEF)

Monitoring of Scenario Deviations



- **Monitoring external demands:** ESG and climate change standards and stakeholders
- **Monitoring deviations from the baseline scenario:** IEF has developed a tool to monitor deviations from the scenario parameters



Completed

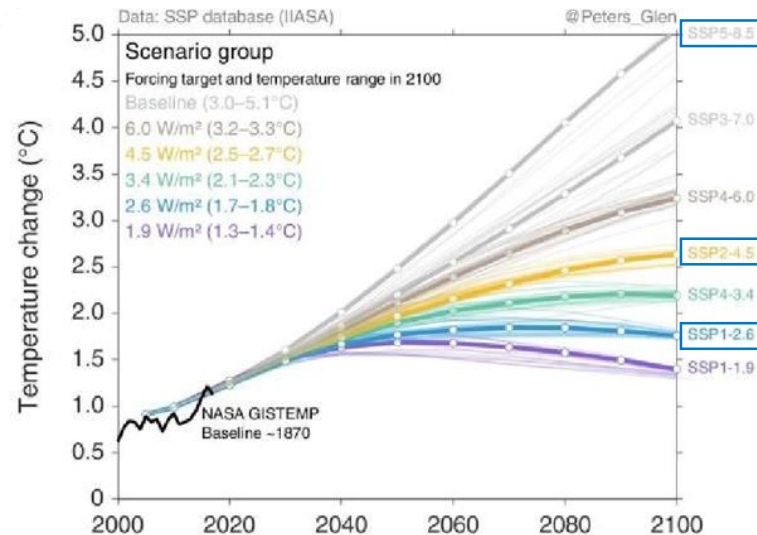


In progress

Notes: 1. The Intergovernmental Panel on Climate Change (IPCC) is an international organization established under the auspices of the United Nations and the World Meteorological Organization in 1988

Physical Risks Assessment: Nornickel Climate Change Scenarios until 2050¹

- Three global climate change scenarios (SSP 1-2.6, SSP 2-4.5 and SSP 5-8.5) have been selected and localized to the Norilsk Industrial District
 - ✓ By 2050, the annual average air temperatures are projected to further rise by 0.1 to 0.6 °C per decade (in various scenarios)
 - ✓ Precipitation is expected to increase, leading to a 20%–30% thicker snow cover during the cold season
 - ✓ Seasonal permafrost thaw depth is expected to increase, (including due to its transition to seasonally frozen ground and the formation of taliks), particularly in the southern part of Norilsk, where it reach up to 2m
 - ✓ The sea level at the mouth of the Yenisei River will continue rising
 - ✓ The risk of thunderstorms is growing



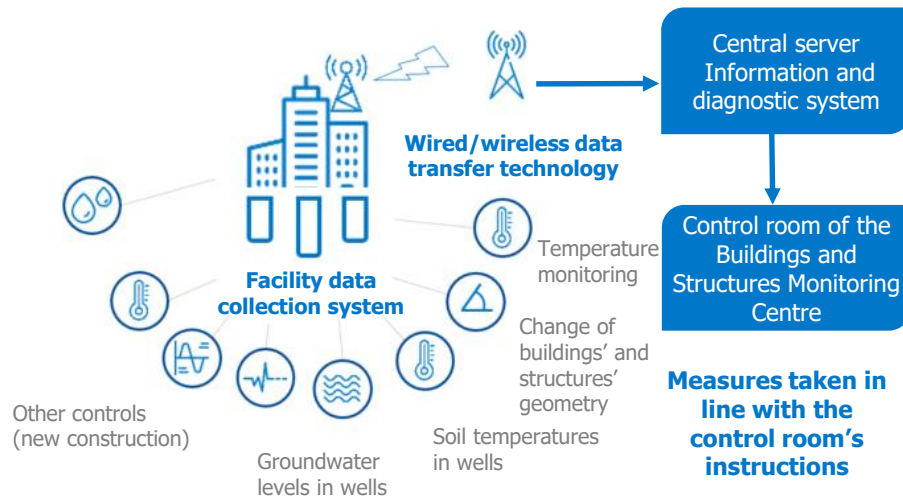
Similar analysis has been carried out in Nornickel's other regions of operations, such as the Kola Peninsula, Zabaykalsky Area and Finland²

Notes: 1. Modelling by the Institute of Atmospheric Physics of the Russian Academy of Sciences;

2. The common key risk factors identified for all regions include the following: increase of the average annual temperatures, more extremely hot days and more thunderstorms. In addition, the Zabaykalsky Area is expected to see fewer extremely cold days, and Finland (Harjavalta) will be exposed to increased precipitation, including anomalies.

Monitoring of Buildings and Structures in the Norilsk Industrial District: a Practical Tool to Manage Climate Risks

Geotechnical monitoring






- In 2020–2021, **satellite monitoring of physical assets located in 4 priority areas**: Norilsk, Dudinka, Snezhnogorsk, and Svetlogorsk was carried out **with the aim** to detect Earth surface displacements
- In 2021, a new information and diagnostic **system (IDS) for monitoring** buildings, structures and their foundations was launched:
 - ✓ **Monitoring**: carried out with the help of boreholes (with thermistor chains or water pressure sensors), incline detectors, humidity, ground temperature, water and other sensors
 - ✓ **Target**: 1,500 of assets, including fuel tanks, pipelines, production facilities and administrative buildings, to be equipped with real-time sensors, which will be plugged into the IDS system
 - ✓ 2021: **165 facilities** covered by monitoring
 - ✓ 2022: circa **700 facilities** covered by monitoring

Roll-Out of Online Permafrost-Based Foundations Monitoring at Emergency Fuel Tanks in Norilsk



Transition Risks Assessment: Nornickel Global Economic and Climate Change Scenarios until 2050¹

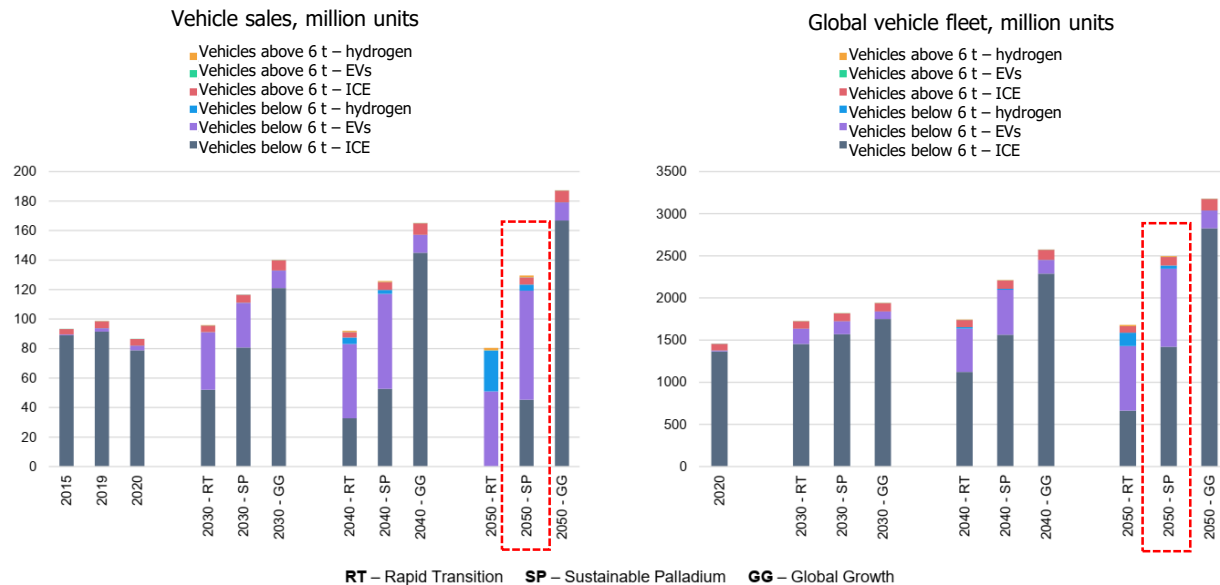
	Rapid Transition (SSP 1-2.6) Probability: 25%	Sustainable Palladium (SSP 2-4.5) Probability: 70%	Global Growth (SSP 5-8.5) Probability: 5%
Strategic focus	<i>Human and environmental well-being</i>	<i>Continuation of current socio-economic and technological trends</i>	<i>Rapid technological advancement and economic growth</i>
Inflation	High	Moderate	Low
Resource/Energy intensity	Low	Moderate reduction	High
Climate regulation	Strict	Moderate	Insignificant
CO ₂ prices	Major increase	Moderate increase	At 2021 levels
Temperature change by 2050 ²	+1.7 °C	+2.0 °C	+2.5 °C
Alignment with the Paris Agreement goals			

Changes in Global Indicators Across Economic and Climate Change Scenarios in 2019–2050

Indicator	Rapid Transition	Sustainable Palladium	Global Growth
Population	+15%	+26%	+37%
GDP (in 2017 prices, PPP)	+74%	2,1x	3,6x
Annual average consumer price index	104.2%	103.2%	102.6%
Energy intensity of GDP	-47%	-34%	-25%
Annual energy investment (in 2020 prices)	+44%	+37%	+56%
Price per t of CO ₂ equivalent (2050, in 2020 US dollars)	135	22	5
Energy-related CO ₂ emissions	-43%	+10%	2,8x
Proportion of oil, gas and coal in energy consumption (2050)	54%	67%	88%
Annual sales of passenger EVs, hydrogen vehicles, and hybrids	33x	34x	5,5x
Fleet of passenger EVs, hydrogen vehicles, and hybrids	121x	132x	29x
Annual renewable electricity production ¹	9x	8x	+70%
Annual carbon-capture volume	95x	32x	5x
Annual green hydrogen production	126 Mt	14 Mt	1 Mt

Automotive Industry is the Key Driver of Palladium Consumption

- The size of the global vehicle fleet is projected based on population size and estimated¹ dependence of the motorization rate on the per capita GDP
- Fleet breakdown by vehicle type corresponds to the scenarios developed by leading organisations and expert groups



Notes: 1. Estimated by IEF RAS

A scenic view of a winding river, likely the Bow River, flowing through a mountainous landscape. The mountains are covered in snow and have distinct horizontal geological strata. The sky is a clear, pale blue. A semi-transparent blue geometric pattern, consisting of interlocking diamond shapes, is overlaid on the left side of the image. The text "Thank you for your attention" is written in a white, sans-serif font across the middle of the image.

Thank you for
your attention