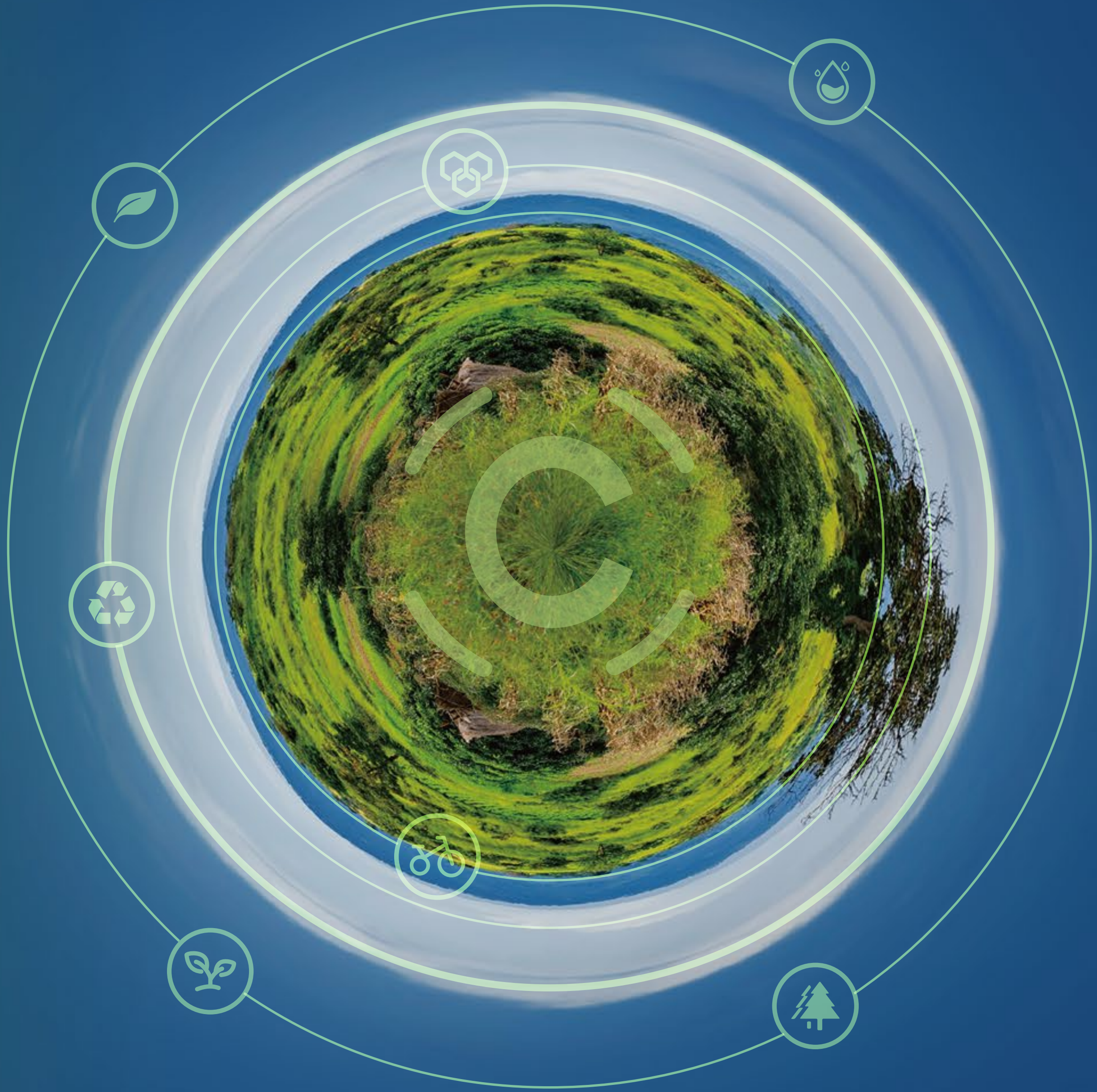
CMOC 洛阳钼业

Carbon Neutral Roadmap and Action Plan

2022



CONTENTS

About CMOC

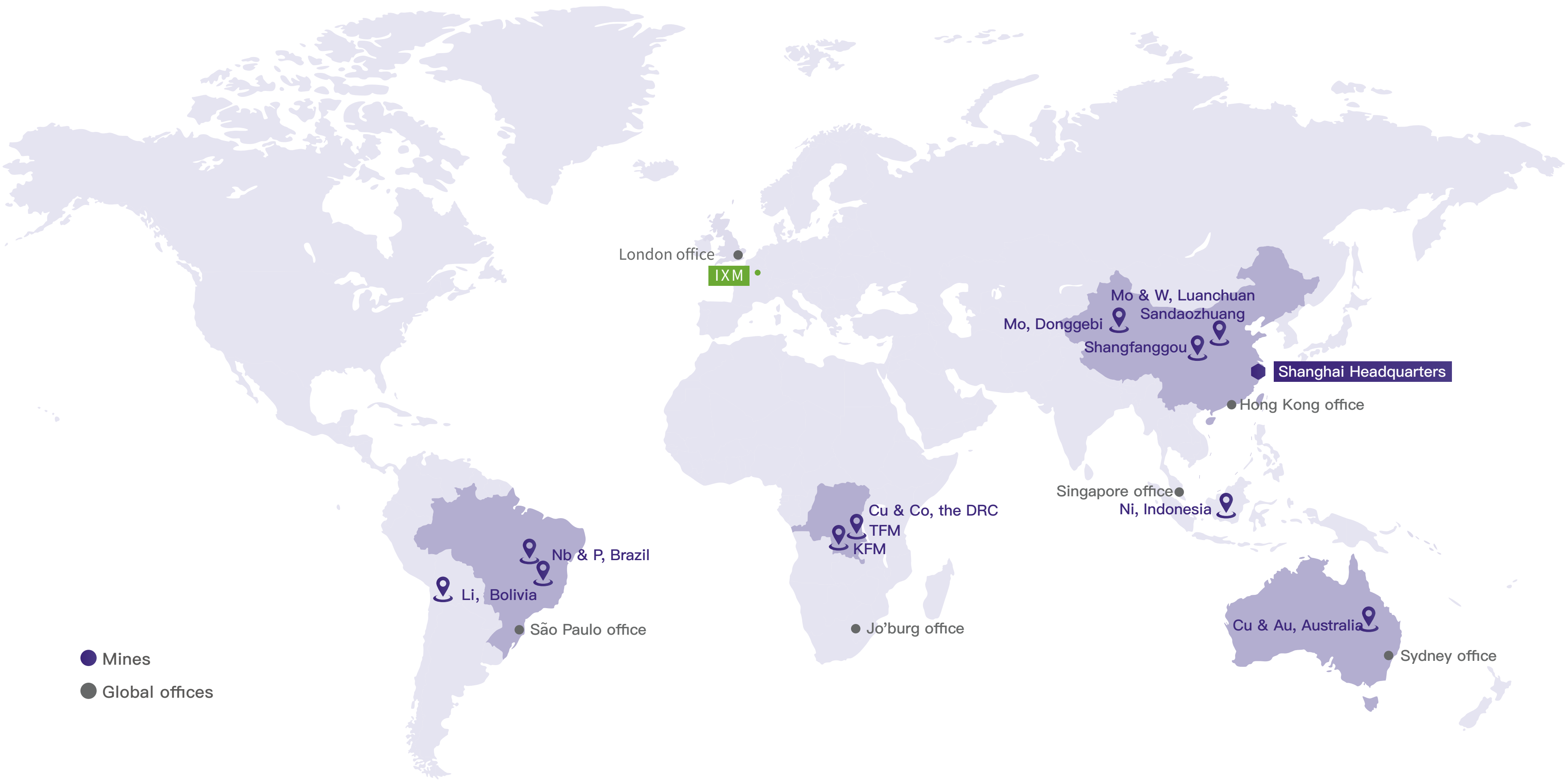
01

About CMOC

Headquartered in the People's Republic of China, CMOC Group Limited (hereinafter "CMOC", "we", or "the company") is a public holding company engaged in the mining, processing, and trading of base and rare metals. The company's main mining assets are currently located in the Democratic Republic of the Congo (DRC), China, Brazil, and Australia, while its metal trading business spans more than 80 countries. The company is one of the world's largest producers of tungsten, cobalt, niobium, and molybdenum, as well as a leading copper producer. It is also a major producer of phosphatic fertilizers in Brazil, and ranks among the world's top three base metals merchants through its wholly-owned subsidiary IXM. The company is listed on the Shanghai Stock Exchange (SHA: 603993) and the Hong Kong Stock Exchange (HKEX: 03993).

- **Cu** — Globally important copper producer
- **Co** — The world's 2nd largest cobalt producer
- **Mo** — The world's leading molybdenum producer
- **W** — The world's leading producer of tungsten smelt
- **Nb** — The world's 2nd largest niobium producer
- **P** — Brazil's 2nd largest phosphate fertiliser producer
- **Ni** — 30% equity participation in the Huayue HPAL project
- **Li** — Partnering with CATL developing lithium mines in Bolivia
- 3rd largest base metals trader in the world

Our vision is to become a highly esteemed, cutting-edge, and world-leading resources company. In recent years, we have strived to capture the historic opportunities presented by the global energy transition and the trend towards a carbon neutral future, establishing ourselves as a leading supplier of copper, cobalt, nickel, lithium, and other metals for the sustainable energy sector. We are also committed to implementing stringent environmental, social, and governance (ESG) criteria, safeguarding our planet's precious resources, and delivering sustainable development in order to create maximum value for our stakeholders.



Overview of CMOC's global operations

ESG governance

CMOC has incorporated climate change into its ESG governance framework, under which responsibilities are divided among the Board of Directors, senior executives, and individual operating sites. As the company's highest governing body, the Board of Directors is responsible for risk oversight, and also convenes the Strategic and Sustainability Committee, which is led by the Chairman of the Board and is responsible for formulating the company's sustainability strategy.

At the executive level, the company has appointed a Vice President for Sustainable Development, who is also responsible for the Group ESG department. As a senior executive, the Vice President reports to the Group CEO and the Strategic and Sustainability Committee of the Board, and is responsible for driving Board decision-making on sustainability matters, overseeing the implementation of the company's sustainable development strategy, and monitoring and assessing sustainability-related risks at each of our operating sites. In addition, in 2019 the company established a Sustainability Executive Committee, which is responsible for promoting cooperation and collaboration between functional departments on key ESG topics and seeking interdepartmental solutions to ESG challenges.

At the operational level, all of our subsidiaries employ a dedicated team of staff with extensive expertise in environmental management, occupational health and safety, human resources, community engagement, and other ESG-related topics. These teams are responsible for implementing the Group's ESG strategy and policies and managing sustainability risks in line with local needs and circumstances.

Energy management and carbon emissions

Large-scale mining and metallurgy require significant amounts of energy. CMOC has a long-standing commitment to lowering emissions, and has adopted a range of measures to increase the use of renewable energy and reduce greenhouse gas emissions. To this end, we have formulated a number of specific goals, including reducing energy intensity per unit of processed ore by using energy-efficient production methods, and ensuring that at least 40% of our energy is sourced from renewables by 2025 by promoting the use of clean energy sources such as solar and hydropower, and by retrofitting our mining machinery.

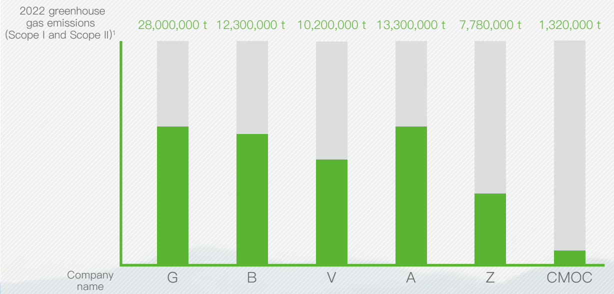
Due to the company's ongoing expansion, total energy consumption increased from 2,874,000 MWh in 2017 to 4,230,000 MWh in 2022, an increase of 47%. In 2022, 13.4% of direct energy consumption was sourced from renewables such as biomass and residual heat, while 63.2% of indirect energy consumption was sourced from renewables such as hydropower and solar power. Overall, renewable sources accounted for 38.8% of total energy consumption.

In 2022, our total greenhouse gas emissions ("carbon emissions" or "greenhouse gas emissions") measured on a CO_2-equivalent basis were approximately 1,320,000 tonnes, or 0.028 tonnes per tonne of processed ore (emissions intensity) — lower than the global industry average.

Proportion of renewable energy

At least 40%

By 2025



Greenhouse gas emissions of global mining companies

Note[1]: At the time of writing, company V had not yet disclosed their greenhouse gas emissions for the year 2022. For comparison, the corresponding figure for 2021 is presented in the table.

Climate change vision

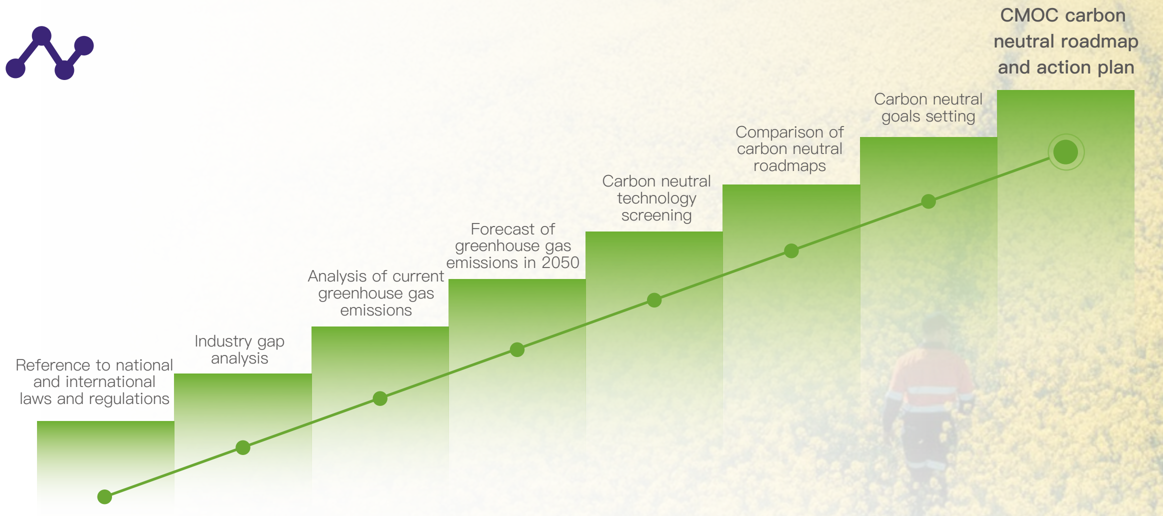
As a world–leading, multinational mining company with a diverse range of business activities, CMOC has a long–standing commitment to implementing internationally recognized ESG principles and standards. We are acutely aware of the potential for climate change to cause food, economic, and humanitarian crises, as well as produce far–reaching impacts on our global operations.

In recent years, the impacts of climate change on our operations have become increasingly apparent: China and Europe experienced historic heat waves, our NPM mine in Australia saw historically high rainfall, and a forest fire broke out at a community near our Brazilian site during a prolonged drought. These extreme weather events only serve to highlight the urgent need for concerted global climate action. As a mining company, we have an important role to play in delivering on the commitments of the Paris Agreement to limit global warming to 1.5 ˚C above pre–industrial levels.

In January 2022, the Board of Directors reviewed and approved CMOC's Climate Vision, which specifies the following aims: "We will incorporate climate change into the company's ESG governance framework. The Strategic and Sustainability Committee of the Board will be responsible for monitoring implementation and establishing a top–down framework for managing the company's response to climate change. We will work together with international and domestic stakeholders and make our due contribution to achieving a carbon neutral world."

Carbon neutral roadmap

In 2022, guided by our Climate Change Vision and our desire to pursue more ambitious climate goals, we commissioned a leading sustainability consultancy firm to formulate a carbon neutral roadmap and action plan with reference to national and international laws and regulations, gap analysis, forecasts of greenhouse gas emissions up to the year 2050, carbon neutral technologies, and the commitments defined in our carbon neutral strategy.



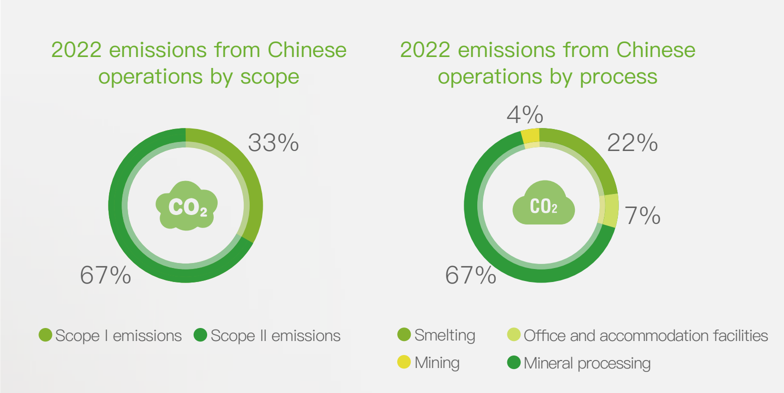
Emissions Forecasts

02

Analysis of 2022 emissions

We analyzed greenhouse gas emissions from different processes in each of the countries where our mining assets are located, namely China, the DRC, Australia, and Brazil. In 2022, total carbon emissions from all of the Group's operations amounted to 1.32 million tCO_2e. Emissions from our DRC operations were highest, followed by our operations in China, Australia, and Brazil.

Emissions from our Chinese operations

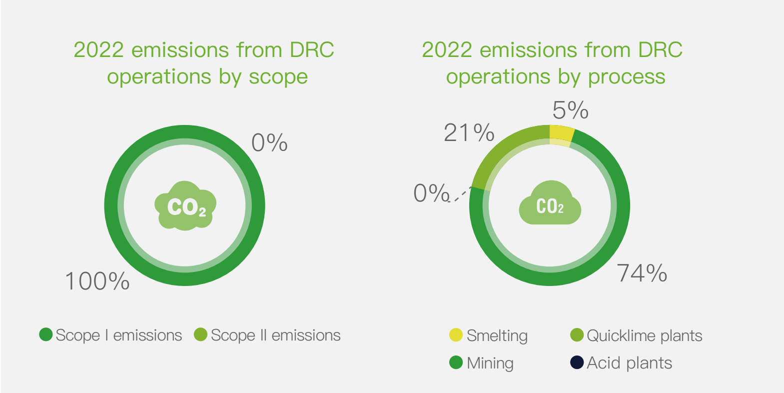


The 2022 emissions data for our Chinese operations is shown in figs. *2022 emissions from Chinese operations by scope* (breakdown of emissions by scope) and *2022 emissions from Chinese operations by process* (breakdown of emissions by process):

Scope: Scope II emissions accounted for 67% of total emissions, all of which were attributable to purchased electricity. Scope I emissions accounted for 33% of the total, and primarily originated from the use of fossil fuels by fixed and mobile sources.

Processes: 4% of emissions were attributable to mining, 67% to mineral processing, 22% to smelting, and 7% to office and accommodation facilities.

Emissions from our DRC operations



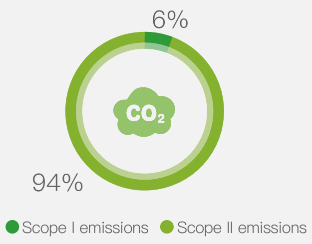
The 2022 emissions data for our DRC operations is shown in figs.*2022 emissions from DRC operations by scope* (breakdown of emissions by scope) and *2022 emissions from DRC operations by process* (breakdown of emissions by process):

Scope: At our DRC operations, all purchased electricity was sourced from hydropower, and therefore there were no Scope II emissions.

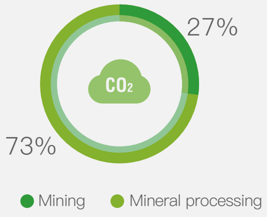
Processes: Emissions from mining account for the greatest proportion of total emissions (74%), followed by quicklime plants (21%) and smelting plants (5%). The processes used in acid plants generate minimal emissions, and also release large amounts of residual heat that can be recovered for cogeneration.

Emissions from our NPM operations

2022 emissions from NPM operations by scope



2022 emissions from NPM operations by process



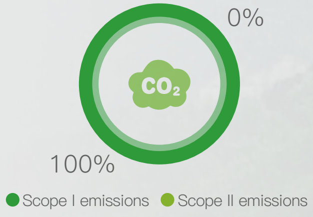
The 2022 emissions data for our NPM operations in Australia is shown in figs.*2022 emissions from NPM operations by scope* (breakdown of emissions by scope) and *2022 emissions from NPM operations by process* (breakdown of emissions by process):

Scope: NPM has replaced a large proportion of its mining and production equipment with electric equipment. As a result, Scope II emissions accounted for 94% of total emissions, with Scope I accounting for just 6% of the total.

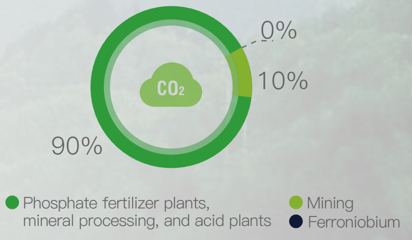
Processes: Only two processes are used at our NPM operations: mining, which accounted for 27% of total emissions, and mineral processing, which accounted for 73% of the total.

Emissions from our Brazilian operations

2022 emissions from Brazilian operations by scope



2022 emissions from Brazilian operations by process



The 2022 emissions data for our Brazilian operations is shown in figs.*2022 emissions from Brazilian operations by scope* (breakdown of emissions by scope) and *2022 emissions from Brazilian operations by process* (breakdown of emissions by process):

Scope: All purchased electricity for both our mining sites was sourced from hydropower, and therefore there were no Scope II emissions.

Processes: Mining accounted for 10% of total emissions, while other processes (phosphate fertilizer plants, mineral processing, and acid plants) accounted for 90% of the total.

Emissions forecasts through 2050

The following forecasts are a projection of CMOC's emissions through 2050, and were made with reference to the IEA's Net Zero Emissions by 2050 Scenario (NZE), as well as the company's future expansion plan.

IEA's Net Zero Emissions by 2050 Scenario (NZE)

The Net Zero Emissions by 2050 Scenario (NZE) lays out an ambitious pathway for the global energy sector to achieve net zero emissions, and includes the following key aims:

- Achieve net zero CO_2 emissions in the global energy sector by 2050.
- Deliver a phased transition away from fossil fuels to renewable energy, including solar power, wind power, hydropower, and bioenergy.
- Leverage new technologies, processes, and systems to maintain global economic growth and deliver a continuous increase in living standards.
- Encourage international cooperation to combat climate change and achieve net-zero emissions on a global scale.

The purpose of the NZE Scenario is to provide a feasible pathway for limiting the rise in global temperatures to 1.5 °C, as envisaged in the Paris Agreement. In addition to reducing CO_2 emissions, phasing out fossil fuels, and encouraging the use of renewable energy, the NEZ Scenario also highlights the need for technological innovation and international cooperation.

The NZE Scenario provides a pathway for the global energy sector to achieve net-zero CO_2 emissions by 2050, and is consistent with limiting the global temperature rise to 1.5 °C with no or limited temperature overshoot (with a 50% probability), in line with reductions assessed in the IPCC in its *Special Report on Global Warming of 1.5 °C*.

The NZE Scenario is expected to have numerous positive impacts on demand for CMOC's products:

01
Increased electrification will lead to a significant increase in demand for copper, cobalt, and tungsten.

Cu Co W

02
The rollout of renewable energy infrastructure — in particular wind energy — will boost demand for steel, which will in turn stimulate demand for molybdenum and niobium.

Mo Ni

03
The market for phosphate fertilizer will also benefit to a certain extent, as its growth prospects are closely associated with growth in demand for biofuels.

P

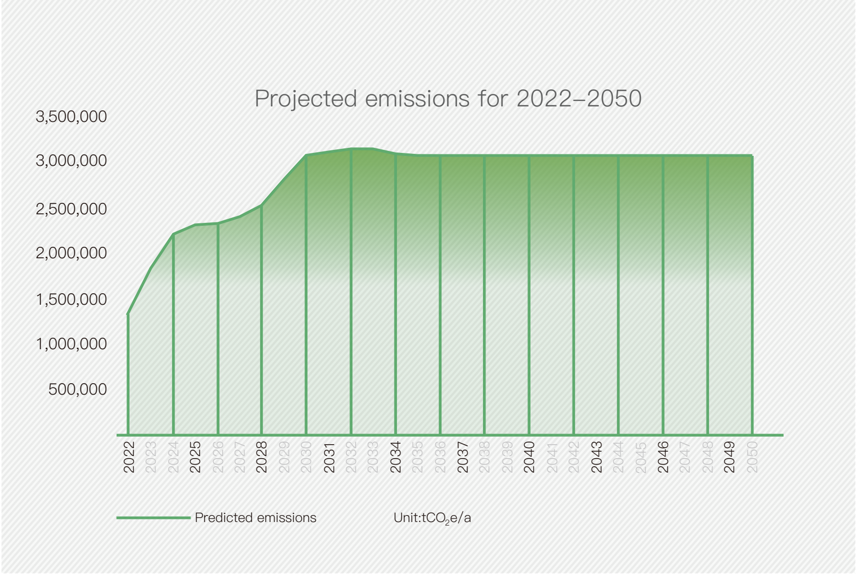
Based on the predicted impact of the NZE Scenario on the mining sector, we issued production forecasts for the years 2022 through 2050. According to these forecasts, cobalt production is expected to peak in 2029, followed by molybdenum, tungsten, and phosphate fertilizer in 2030, niobium in 2031, and copper in 2032[2].

Note[2]:The calculations for peak production are theoretical forecasts based on the NZE Scenario. Future production or growth trajectories may vary significantly from these forecasts, which do not constitute a substantive commitment by the company to investors.

Emissions forecasts for 2022 through 2050

Based on the projected impact of the IEA's NZE Scenario on the mining sector and demand for CMOC's key metal products, and with due consideration to our operational circumstances, we produced a forecast of our future emissions trajectory for the years 2022 through 2050.

Without considering external factors (e.g. country-specific carbon neutral policies or the development of low carbon technologies) or internal emissions reduction polices, our emissions are expected to peak in 2032 at approximately 3.14 million tCO_2e. Our DRC operations will continue to account for the greatest proportion of emissions for the foreseeable future, and therefore offer the most potential in terms of reducing our overall carbon footprint.



Carbon Neutral Strategy and Commitments

03

Based on our emissions forecasts for the years 2022 through 2050, and with reference to the IPCC's very low emissions scenario SSP1–1.9, government policies in the countries where we operate, and the commitments of the International Council on Mining and Metals (ICMM), we formulated our own carbon neutral strategy with a series of specific commitments.

Global carbon neutral requirements

IPCC very low emissions scenario (SSP 1–1.9)

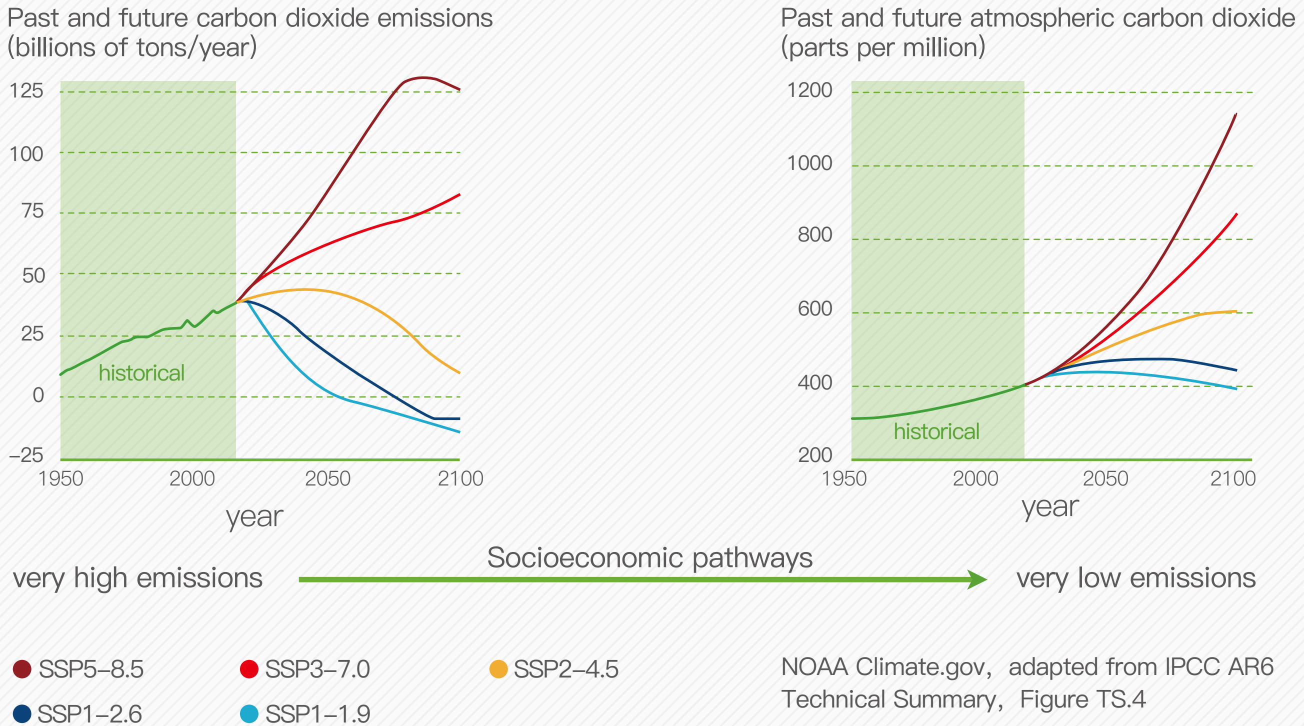
The SSP 1–1.9 very low emissions scenario is the most ambitious scenario envisaged by the IPCC in its Sixth Assessment Report, and lays out a sustain–ability–focused, low–emissions pathway with the following specific targets:

01 Ensure a rapid decline in global emissions to net zero by about 2050, followed by a period of net–negative emis–sions.

02 Ensure that atmospheric concentrations of CO_2 stabilize at less than 400 ppm by 2100 (consistent with limiting the increase in average global temperatures to 1.5 °C).

03 Reduce demand for fossil fuels and deliver a rapid transition to clean energy.

The SSP1–1.9 scenario aims to explore solutions for delivering a transition to a low–carbon economy, and provides a feasible pathway for meeting the goals of *the Paris Agreement*. Compared with other scenarios, the SSP1–1.9 scenario offers the best possible chance of limiting the increase in average global temperatures to within 1.5 °C by the end of this century, and outlines the policies and technologies that will be required in order to meet this goal.



Forecasts of future emissions and atmospheric CO_2 under the various IPCC emissions scenarios

Global carbon neutrality policy requirements

Local laws and regulations

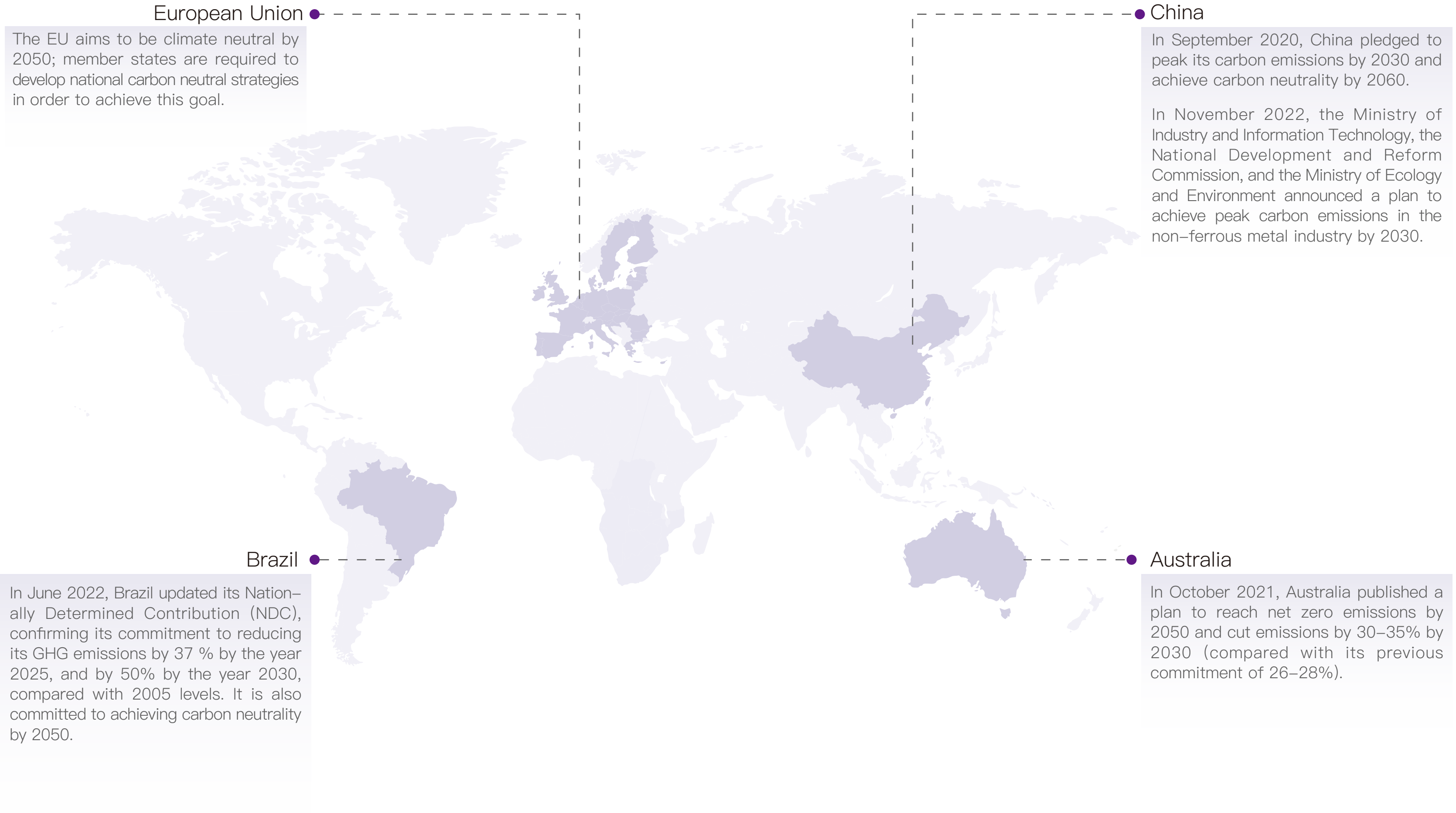
The countries in which CMOC operates have introduced a series of climate-related policies and regulations in response to the commitments outlined in *the Paris Agreement* (see picture on the right).These policies have played an important role in shaping the company's operational and carbon neutral strategies.

International Council on Mining and Metals (ICMM)

Although CMOC is not an ICMM member, we pay close attention to the commitments made by ICMM members in relation to greenhouse gas emissions, including the following:

- A commitment to reach net zero Scope I and Scope II greenhouse gas emissions by 2050, and to set meaningful short and medium-term targets for building clear pathways to achieving this goal.
- Accelerate action to address Scope III emissions.
- A commitment to ensuring that targets cover all material sources of emissions, aligning to the GHG Protocol definition of organizational boundaries and materiality.

An overview of the key carbon neutral policies in each jurisdiction is provided below:



Carbon neutral strategy

Based on the aforementioned emissions forecasts and with reference to the ambitious carbon neutral policies and targets outlined above, we formulated a carbon neutral strategy with the following key commitments:

Support the goals of *the Paris Agreement*, namely to limit global warning to 1.5°C above pre-industrial levels.

Achieve peak Scope I and Scope II emissions by 2030.

Achieve net-zero Scope I and Scope II emissions by 2050.

Reduce our Scope III emissions.

Carbon Neutral Roadmap

04

Analysis of low–carbon technologies

Preliminary analysis

Before deciding on specific technological measures to lower our emissions, we conducted research to investigate the impact of three key factors on our future emissions: government policies, improvements in energy efficiency, and the development of carbon capture and storage technologies.

Government policies:

Australia has pledged to achieve carbon neutrality by 2050, while China has committed to reaching the same goal by 2060. This will require increasing the share of renewable energy in order to build a net–zero power grid. Currently, electricity from thermal power stations is used at both our Chinese and Australian operations, and therefore the climate policies of these countries will play a fundamental role in informing our carbon neutral strategy in these locations.

Improvements in energy efficiency:

In light of increasingly stringent energy efficiency requirements and ongoing improvements in energy efficiency, significant emissions savings can be achieved through the routine replacement of machinery and vehicles. Savings can also be made by conducting energy efficiency inspections and optimizing equipment and processes, without the need for large–scale replacement of machinery.

Carbon capture and storage:

Concerted climate action and the emergence of carbon trading markets have accelerated the development of carbon capture and storage solutions such as reforestation and revegetation. Reforestation has been the subject of extensive research, and has the potential to capture large amounts of carbon in the context of our annual closure and reclamation projects.

Carbon offset schemes

A carbon offset is a reduction or removal of emissions of carbon dioxide or other greenhouse gases made in order to compensate for emissions made elsewhere. Carbon offsets are measured in tonnes of carbon dioxide–equivalent, and provide an alternative method for reducing greenhouse gas emissions as part of emissions control strategies and emissions trading systems. For example, companies can invest in carbon offset schemes developed in accordance with internationally recognized rules in order to mitigate the impact of their emissions. Carbon offset schemes have both social and economic value, as they place a cost on emitters and provide a financial incentive for companies to reduce emissions.

Analysis of potential low–carbon solutions

Solution	China	DRC	Australia	Brazil
Upgrading of machinery (Scope I emissions)				
Electrification	● Policy support ● Advanced EV and battery industry	● Policy support, widespread use of hydropower	● Policy support ● Advanced EV and battery industry	● Policy support
Hydrogen fuel	● Policy support ● Mature supply chain	● (disadvantage) Hydrogen fuel industry is still in its infancy	● Policy support ● Abundant resources and advanced clean energy industry ● Mature supply chain	● Policy support ● Abundant resources and advanced clean energy industry ● Mature supply chain
Natural gas	● Policy support ● (disadvantage) Limited supply	● Abundant supply	● Abundant supply ● Mature market	● Policy support
Biodiesel	● Policy support ● (disadvantage) Limited supply	● (disadvantage) Limited supply	/	● Policy support ● Abundant resources and agricultural land, favorable climate
Increasing share of clean energy (Scope II emissions)				
Solar power	● Policy support ● Abundant land resources and sunny climate ● Mature industry	● Policy support ● Sunny climate	● Policy support ● Abundant land resources and sunny climate (New South Wales) ● Mature industry	● Policy support ● Sunny climate (State of Goiás) ● Mature industry
Wind power	● Policy support ● Abundant wind resources ● Mature industry	/	● Policy support ● Abundant wind resources (New South Wales) ● Mature industry	● Policy support ● Abundant wind resources (State of Goiás)
Hydropower	● (disadvantage) Lack of hydropower resources	● Policy support ● Abundant hydropower resources	● Policy support ● (disadvantage) No large rivers suitable for hydropower in the vicinity of the NPM site.	● Policy support ● Abundant hydropower resources (State of Goiás)

注：● indicates a significant disadvantage; ● indicates a significant advantage;
"/" indicates that there are no significant advantages or disadvantages.

Suitability of low–carbon solutions

In order to deliver a Group–wide reduction in Scope I and Scope II emissions, we conducted research into the suitability of various low–carbon solutions, focusing on the upgrading of machinery and increasing the share of clean energy in our energy mix. In this context, we identi–fied seven potential solutions: electrification, hydrogen fuel, natural gas, biodiesel, solar power, wind power, and hydropower. We then analyzed the advantages and disadvantages of these solutions in the countries where our mining assets are located, considering factors such as the supply of local resources, policy support, and the socioeconomic environment. The results of this analysis are presented in figure *Analysis of potential low-carbon solutions*.

Comparison of emissions reduction strategies

Based on the aforementioned suitability analysis as well as the emissions data from our individual operations, we selected three different strategies for reducing emissions:

(1)Carbon offset schemes

As a 'passive' strategy, carbon offset schemes do not require fixed investment and rely instead on the purchase of carbon credits in order to offset the emissions from our operations.

(2)Electrification + renewable energy

As an 'active' strategy, this requires replacing existing machinery and changing how we source our energy in order to reduce our reliance on fossil fuels. Electrification offers significant potential in terms of emissions savings and is less dependent on local socioeconomic conditions, while renewable energy sources such as solar power harness natural resources and are compatible with government policies.

(3)Clean energy alternatives + carbon offset schemes

This strategy features elements from both of the aforementioned strategies: in less developed countries, a combination of clean energy alternatives and carbon offset schemes, and in more developed countries, a combination of alternative energy sources and advanced machinery.

The recommended strategies for each of the countries in which CMOC operates are listed in figure *Recommended emissions reductions strategies*.

We analyzed the potential of each of the aforementioned three strategies in terms of compliance, technology, cost, and reputation in order to identify the best strategy and inform the decision–making process during the formulation of our carbon neutral roadmap.

The results of the analysis are shown in figure *Comparative analysis of emissions reduction strategies*.

Based on the results presented in fig. *Comparative analysis of emissions reduction strategies*, strategy 2 (electrification + renewable energy) offers the best potential in terms of compliance, technology, cost, and reputation, and enables emissions to be eliminated at source.

Recommended emissions reductions strategies

Strategy \ Country	China	DRC	Australia	Brazil
Strategy 1	• Carbon offset schemes	• Carbon offset schemes	• Carbon offset schemes	• Carbon offset schemes
Strategy 2	• Electrification • Solar power, hydropower, wind power	• Electrification • Solar power, hydropower	• Electrification • Solar power, wind power	• Electrification • Solar power, hydropower, wind power
Strategy 3	• Electrification • Wind power	• Natural gas • Carbon offset schemes	• Hydrogen fuel • Wind power	• Biodiesel • Carbon offset schemes

Comparative analysis of emissions reduction strategies

	Strategy 1 (carbon offset schemes)	Strategy 2 (electrification + renewable energy)	Strategy 3 (clean energy alternatives + carbon offset schemes)
Compliance	The use of carbon offset schemes to achieve carbon neutrality is only partially recognized by legislation, stock exchanges, and carbon neutral guidelines/initiatives	Subject to compliance with specific sustainability requirements, emissions reduction measures are generally recognized by legislation, stock exchanges, and carbon neutral guidelines/initiatives.	
Technology	Carbon offset infrastructure is steadily improving, while costs are steadily falling; offset schemes are similar in nature to financial products, as there are no technological barriers to investment.	Measures such as electrification, solar power, and wind power have a proven track record.	Natural gas, hydrogen fuel and other clean energy alternatives have good long–term prospects.
Cost	Costs can be reduced by delaying implementation.	Requires large initial investment, but generates significant cost savings over the long term; both strategies involve similar operational and maintenance costs.	
Reputation	Carbon offsets schemes do not constitute real emissions reductions and are the subject of frequent criticism.	Electrification measures facilitate the transition away from fossil fuels and make a substantial contribution to lowering emissions.	Retains fossil fuels in the energy mix, and therefore only makes a limited contribution to reducing emissions.

● Good
● Average
● Poor

Comparison of carbon neutral roadmaps

Implementation timeframe

Year of implementation

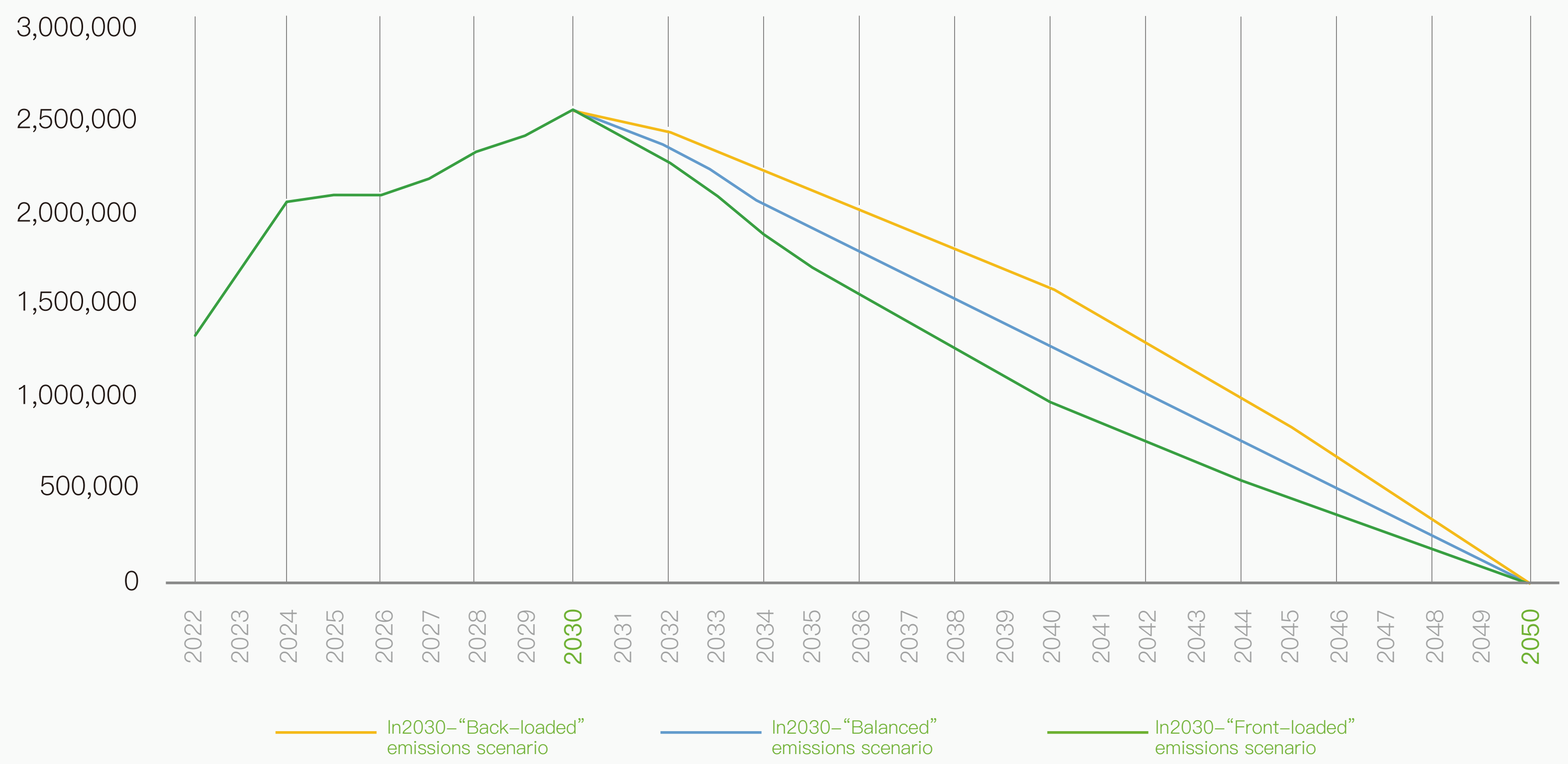
In order to compare the impact of different implementation timeframes, we modelled five different scenarios depending on the year in which our carbon neutral roadmap is implemented (2025, 2030, 2035, 2040, and 2045).

Speed of implementation

We also modelled a further three scenarios to compare how the speed of imple–mentation would affect our emissions trajectory and expenditure:

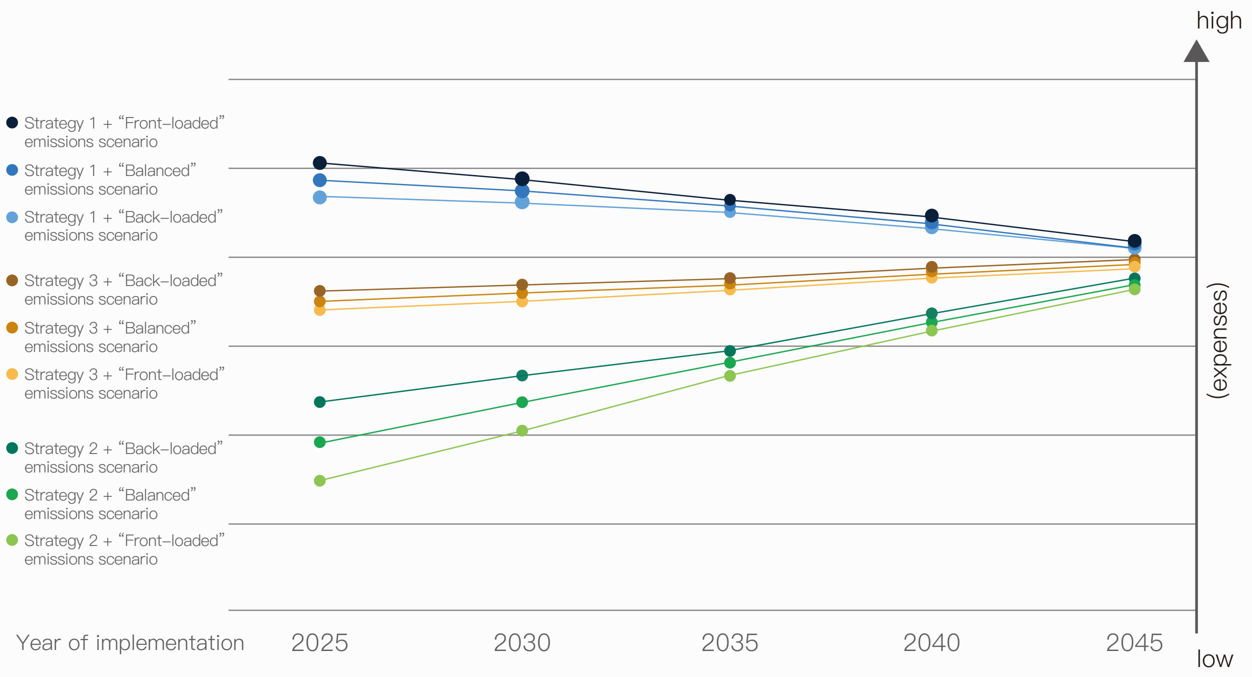
- A "balanced" scenario in which emissions are cut by a fixed amount each year.
- A "back–loaded" scenario in which annual emission cuts progressively increase (i.e. the deepest cuts are made during the later phase).
- A "front–loaded" scenario in which annual emission cuts progressively decrease (i.e. the deepest cuts are made during the earlier phase).

The impact of these three scenarios on our emissions trajectory is shown in fig. *Emissions trajectory under three different implementation scenarios (assuming implementation commences in 2030).*



Emissions trajectory under three different implementation scenarios (assuming implementation commences in 2030) (tCO_2e)

Comparative analysis



Total cost of 45 roadmap configurations

Based on the aforementioned emissions reduction strategies and implementation scenarios (3 emissions reduction strategies, 5 scenarios for the year of implementation, and 3 scenarios for the speed of implementation), we identified 45 potential configurations for our carbon neutral roadmap. We then proceeded to perform comparative analysis of each roadmap by considering a range of factors including cost, our commitment to peaking emissions by 2030, investment risks, and technological progress.

Comparative cost analysis

After determining our strategic carbon neutral goals, we calculated the economic cost of each of the 45 aforementioned configurations. The total cost of each configuration is shown in fig. *Total cost of 45 roadmap configurations*. Based on figure, the following conclusions can be drawn:

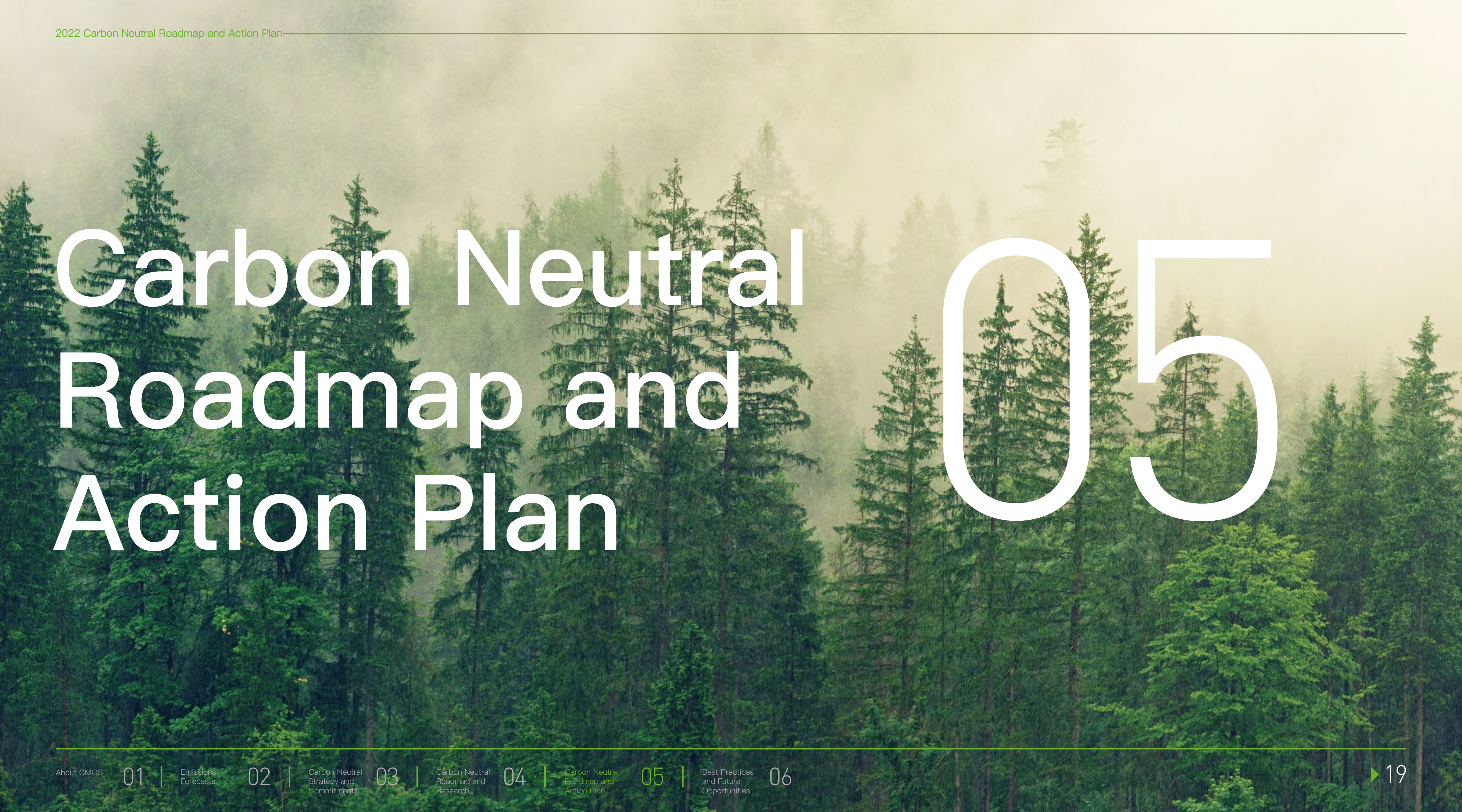
- In the case of strategy 1, the year of implementation is inversely correlated to the total cost (later implementation = lower total cost).
- In the case of strategies 2 and 3, the year of implementation is directly correlated to the total cost (earlier implementation = lower total cost).
- Strategy 1 has the highest cost, followed by strategy 3 and strategy 2.

Investment risks

Large–scale investments in new low–carbon technologies present a significant financial burden and risk for the company. A more desirable strategy would be to scale up investments over the long term in order to allow the company to analyze the benefits of different low–carbon technologies and direct its investments toward those technologies which offer the greatest potential.

Technological progress

Over the coming decades, CMOC is well positioned to reap the benefits of technological progress. These include lower operational and maintenance costs, as well as access to emerging technologies such as artificial intelligence, cloud computing, big data, and IoT, which will enable the company to drive its digital transformation, introduce smart manufacturing processes, and lay the foundations for an innovative growth model. However, large–scale investments in emerging low–carbon technologies whose effectiveness may not yet be proven constitute a significant risk for the company. A more prudent strategy would be to phase in investments over the long term in order to ensure that low–carbon solutions are tailored to the needs of each operating site.

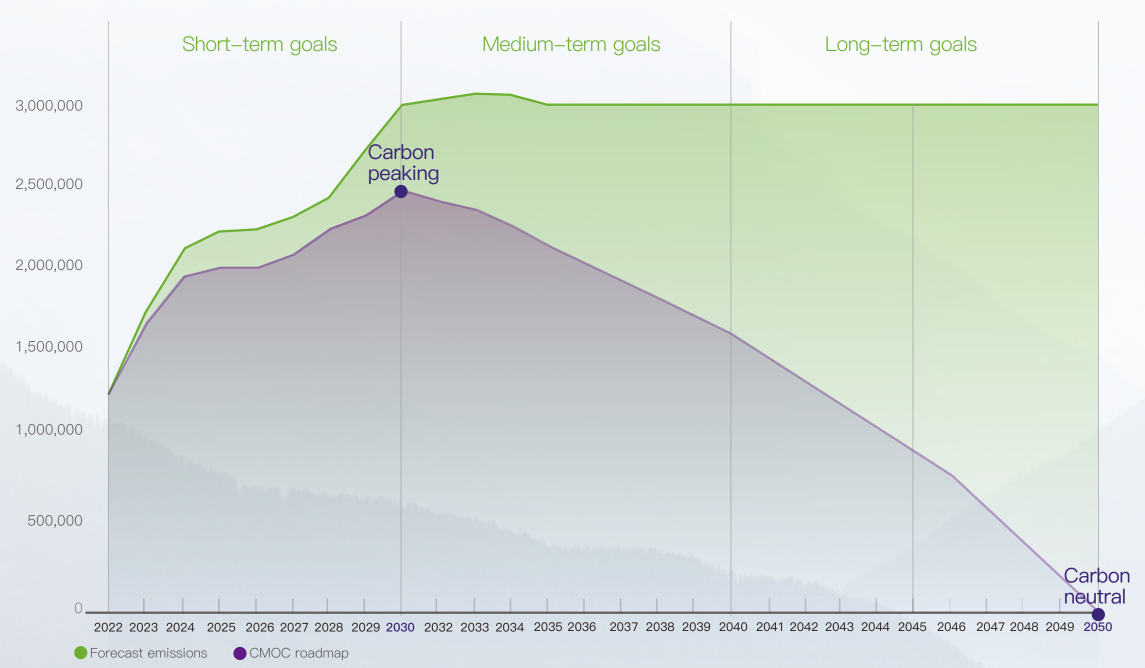


Carbon Neutral Roadmap and Action Plan

05

Carbon Neutral Roadmap and Action Plan

After giving due consideration to all of the aforementioned factors, we developed a carbon neutral action plan that envisages a comprehensive range of measures across four key areas: energy efficiency, electrification, renewable energy, and carbon capture and storage. Implementation is scheduled for 2030, after which we will follow a "back-loaded" emissions trajectory in order to reach net-zero emissions by 2050 (see fig. 4.3). In addition, we plan to invest at least US$ 1.5 billion up to the year 2050 in order to deliver on our carbon neutral action plan.



Short-term goals and action plan (before 2030)

Short-term goals:

- Reduce our emissions intensity (per unit of processed ore) by 15% compared with 2022.
- Reach peak emissions by the year 2030.

Action plan:

- Instruct each operating site to formulate an implementation plan and raise awareness of CMOC's carbon neutral roadmap.
- Progressively implement energy efficiency measures in routine operations.
- Launch pilot electrification and renewable energy projects.
- Assess effectiveness of carbon neutral strategies at each operating site and optimize management strategies.

Medium-term goals and action plan (2030-2040)

Medium-term goals:

- Deliver a 38% reduction in emissions by 2040 compared with the 2030 peak.
- Deliver a 60% reduction in emissions intensity (per unit of processed ore).

Action plan:

- Continue to implement energy efficiency measures in routine operations.
- Require contractors to use zero-carbon and low-carbon technologies.
- Continue to assess the effectiveness of carbon neutral strategies at each operating site and optimize management strategies.
- Launch large-scale electrification and renewable energy projects (e.g. solar, wind, and hydropower).
- Increase investment in renewable energy infrastructure and support the transition to a green economy.
- Monitor developments in low-carbon technologies and update our technology strategy.

Long-term goals and action plan (2040-2050)

Long-term goals:

- Deliver a 67% reduction in emissions by 2045 compared with the 2030 peak.
- Achieve carbon neutrality by 2050.

Action plan:

- Continue to implement energy efficiency measures in routine operations.
- Introduce stringent criteria to require contractors to use zero-carbon and low-carbon technologies.
- Continue to assess the effectiveness of carbon neutral strategies at each operating site and optimize management strategies.
- Continue to implement electrification measures and renewable energy projects (e.g. solar, wind, and hydropower).
- Continue to increase investment in renewable energy infrastructure and support the transition to a green economy.
- Monitor developments in low-carbon technologies and update our technology strategy.

Best Practices and Future Opportunities

06

Our carbon action roadmap envisages a comprehensive range of measures across four key areas: energy efficiency, electrification, renewable energy, and carbon capture and storage. The following section provides an overview of best practices and future opportunities in each of these fields.

Energy efficiency

Future opportunities

- **Optimization of mining processes:** Prioritize efficient mining technologies such as combined open-pit and underground mining, block cave mining, and smart GPS/BeiDou fleet management; optimize mining parameters such as stripping ratios, transportation routes, and operational coordination to continuously reduce carbon emissions per tonne of ore mined.
- **Optimization of beneficiation processes:** Use a variety of efficient beneficiation technologies, such as crushing ore more finely to reduce milling, phased milling and dressing, SABC milling circuits, and the earlier separation of tailings to continuously reduce carbon emissions per tonne of ore processed.
- **Optimization of smelting processes:** Adopt efficient smelting technologies such as bioleaching, hydrometallurgy, autogenous smelting, and short-process methods to continuously reduce carbon emissions.
- **Efficient use of equipment and machinery:** Prioritize more efficient, energy-saving technologies when selecting and upgrading equipment and machinery for various processes, and ensure high levels of operational efficiency through regular monitoring and servicing.
- **Monitoring of energy efficiency:** Improve the management of energy resources to increase energy efficiency levels; monitor energy consumption to promptly identify wasted energy; introduce energy-efficiency labelling, KPIs, scorecards, and other clear metrics to raise awareness of energy efficiency; and implement real-time monitoring, predictive analytics, and other automated technologies to optimize the monitoring of energy consumption in our mining operations.

Best practices

Our NPM mine in Australia uses a block cave mining method to extract deposits from underground, enabling a production volume of approximately 20,000 tonnes/day. In addition to its high productivity, block cave mining is highly-automated, uses electric machinery, and is less energy-intensive than other mining methods. Compared with manual mining techniques, block cave mining has enabled our NPM mine to increase daily production by 23% and lower material and labor costs by 62% and 80% respectively, as well as significantly reduce carbon emissions.

At our Chinese operations, we have developed our own technology to recover residual heat from rotary kilns used for smelting, delivering a notable reduction in our consumption of natural gas and electricity. Significant emissions reductions have been achieved through our proprietary self-heating technique for smelting ferromolybdenum, which relies entirely on self-heating processes and does not require additional energy input. We have also implemented a number of other measures to reduce emissions, such as upgrading permanent magnet motors, fitting autoclave motors with variable-frequency drives, and installing energy-saving drying technology for tungsten concentrate.

Utilization of residual heat from rotary kilns

NPM unmanned underground mining

Electrification

Future opportunities

- Electric equipment and machinery can be used throughout our mining and processing operations. This includes electrified excavators, haul trucks, and drilling rigs. When powered by electricity from green sources, electric equipment generates zero emissions and can therefore make an important contribution to achieving our strategic goal of carbon neutrality.
- In addition to electrification, unmanned machinery and smart mining technologies can help to further reduce energy consumption and carbon emissions at our mining sites.

Best practices

At a time of growing focus on smart technology and green energy within the mining industry, we have continued to develop smart and low-carbon technologies for use in our mining processes. In 2018, our Chinese mining operations joined forces with a third-party company to develop a fully electric haul truck that can recover between 25% and 30% of the energy used. Energy consumption and maintenance costs are at least 50% lower than an equivalent diesel truck, and a 1-hour charge is sufficient to power the vehicle for at least 8 hours. In 2019, the vehicle received a Gold Innovation Award from the China Industry-University-Research Institute Collaboration Association (CIUR); as of December 31st, 2022, there were 92 electric vehicles in operation at our Chinese mining sites (85% of the total fleet). In addition to delivering over RMB 100 million in cost savings, these vehicles have also made a significant contribution to reducing our emissions.

In 2019, we teamed up with Huawei to introduce unmanned electric mining machinery powered by 5G technology. This machinery is equipped with devices such as cameras and millimetre-wave radar to enable safe, 24-hour unmanned operation.

In July 2022, our Chinese operations opened a battery swap station for our electric vehicle fleet. Capable of serving up to 40 vehicles, the new facility can swap out batteries in just 3.5 minutes (compared with 1.5 hours to recharge the battery at a charging station), increasing vehicle transportation efficiency by 40%.

Unmanned electric trucks

Charging station for electric haul trucks

Renewable energy

Future opportunities

- Solar power is an ideal source of alternative energy that offers considerable potential for the mining sector: it produces little to no pollution, provides an unlimited supply of energy, and can be generated on land used for agriculture and animal husbandry.
- Wind power is ideally suited to mountainous and hilly terrain, and offers numerous benefits including short construction times, flexible capacity, and low operational and maintenance costs. This form of energy is also well suited to the topography of our mining sites.
- Hydropower offers enormous potential in terms of installed capacity, reliability, energy storage, and flexibility. The natural water cycles of rivers can be harnessed to build cascading systems of hydropower plants, which can be deployed on a large scale in the DRC and Brazil.
- Bioenergy is energy made from renewable biofuels such as biodiesel, bioethanol, and biomass. Biofuels have a promising future, and are already used extensively at our Brazilian operations.

Best practices

CMOC has launched pilot projects for a range of renewable energy sources, with a particular focus on solar and hydropower.

At our Chinese operations, we deployed distributed photovoltaic systems during the reclamation of three decommissioned tailings storage facilities. These systems have an installed capacity of 42 megawatts and are expected to generate a total of 47 million kWh of electricity per year.

At our DRC and Brazilian operations, we source 100% of electricity from hydropower, enabling us to achieve zero Scope II emissions. We also play an active role in local hydropower projects: in the DRC, our TFM operation has invested US$256 million since 2007 toward the repair of four turbines at the Nseke Hydroelectric Power Station, which have an installed capacity of 260 megawatts and are expected to re-enter operation in 2023.

The Nseke Hydroelectric Power Station

The turbines currently under repair

Photovoltaic systems at our decommissioned tailings storage facilities in China

Carbon capture and storage

Future opportunities

- Carbon capture and storage involves collecting carbon dioxide at source from lime plants, coal-fired boilers, and other emission sources, and then storing it using various methods to prevent its release into the atmosphere. At our mining sites, carbon dioxide can be sequestered beneath mining shafts or pits.
- We will implement reclamation projects at our tailings storage facilities, waste rock piles, and other areas of our mining sites in order to create carbon sinks that absorb carbon dioxide from the atmosphere.

Best practices

At the Sandaozhuang mine in China, we have adopted a phased approach to reclamation and formulated plans tailored to local conditions. We revegetated the permanent slope to reduce the exposed post-mined area and planted protective forest belts around slag piles to control wind erosion. Beneath this tree cover, we planted easy-rooting, fast-spreading shrubs and grasses to improve soil quality. In addition, we planted kudzu vines on the upper part of the slope and Japanese ivy on the lower part to achieve vertical greening and create a stable, layered, and mixed population of plants. Both the Sandaozhuang and Shangfanggou molybdenum mine have been certified as "National Green Mines". In 2022, we restored 226,000 square meters of vegetation at the Sandaozhuang molybdenum mine and 61,500 square meters of vegetation at the Shangfanggou molybdenum mine.

In Brazil, our operations are located in the Cerrado savannah biome and the Atlantic Forest biome, areas which are particularly rich in biodiversity. In accordance with legal requirements, we have introduced biodiversity conservation measures embedded within an active reforestation program linked to the use of biomass at the Catalão site in the state of Goiás. CMOC has reforested 1,448 hectares of land, and between 2019 and 2022 planted over 89,000 saplings. These reclamation and restoration projects have helped to create natural carbon sinks.

Ecological reclamation

To become a highly respected, modern and
world-class resource company.

CMOC洛阳钼业

CMOC Group Limited

WWW.CMOC.COM

Global Management Headquarters

Building 2, No. 18 Gonggong Road, Hongkou District, Shanghai, China
EMAIL: 603993@CMOC.COM

Place of incorporation

North of the Yi River in Chengdong New District, Luanchuan County, Luoyang City, Henan Province, China
TEL : +86 0379-68603993 FAX : +86 0379-68658017