Towards a sustainable transition

2024 Decarbonisation Progress Update

Rio Tinto

Acknowledgement of Country

Our operations are located on land and waters that have belonged to Indigenous Peoples for thousands of years. We respect their ongoing deep connection to, and their vast knowledge of, the land, water and environment. We pay respects to Elders, both past and present, and acknowledge the important role Indigenous Peoples play within our business and the communities where we live and work.

Contents

This document has been prepared to provide an overview of the projects underway to achieve our decarbonisation objectives.

It complements the climate change disclosures made in accordance with the Companies (Strategic Report) (Climate-related Financial Disclosure) Regulations 2022 (UK) and UK Listing Rules, as part of our 2023 corporate reporting published in February 2024.

Welcome

Jakob Stausholm
Chief Executive

From strategy to action

The materials we produce and the way we provide them to society matter. As a mining company and a processing company with a global footprint we have a key role to play in producing the materials the world needs to decarbonise, and in doing so, reducing our own emissions, and helping our customers reduce theirs.

In late 2021 we set ambitious emissions reduction targets. Decarbonisation is at the heart of our strategy and we firmly believe that a successful transition will make our business stronger and more competitive. We have now moved from strategy to action on decarbonisation and we are making clear progress against our short, medium and long-term targets. We are also focused on reducing emissions from our value chain, particularly those from steelmaking, and we are actively piloting potential solutions with our partners.

Decarbonising our business is deeply physical and complex. We are a very significant energy user and we are navigating rapidly evolving regulatory environments and other changes in the jurisdictions in which we operate. While we are making good progress, it is not a straightforward challenge and maintaining financial discipline is crucial.

As we seek to deepen our relationship with the communities where we operate, we also recognise that the transition to a low-carbon future will impact them. We are working with our partners to make sure communities experience the socio-economic benefits of an equitable energy transition.

While we still have a long way to go, we are building momentum on our decarbonisation pathway and I am proud of the progress our teams have made so far.

Our progress towards a decarbonised future

1998
Carbon pricing applied to investment decisions

2005
Published first climate change position statement

2007
Joined the U.S. Climate Action Partnership

2008
Published first climate change target based on emissions intensity reduction

2012
Became a founding member of the Aluminium Stewardship Initiative

2015
Signed the Paris Pledge for Action

2016
Produced first certified low-carbon aluminium

Mark Davies
Chief Technical Officer

Jonathon McCarthy
Chief Decarbonisation Officer

A clear path to net zero

In 2023, we redefined our approach to operational decarbonisation across Rio Tinto to deliver on the commitments we made in 2021 to halve emissions by 2030 and achieve net zero by 2050.

Over the past 18 months we have developed a clear path to pursue net zero Scope 1 and 2 emissions across our operations. We have a plan to address every tonne of carbon we currently produce and we are taking real action across our business, now. We are investing in initiatives that can reduce emissions today while developing the technology we need to achieve net zero in the future.

While we have a path to net zero, we don't yet have all the answers. We have adopted a flexible approach, readily adjusting our plans as new solutions emerge and technologies become available. This flexibility allows us to be responsive to our stakeholders and pursue decarbonisation plans that allow us to reduce emissions faster and more cost effectively in some cases, to benefit our regions and communities where we operate.

We are pleased to share this update with you.

2018

Stopped producing coal

Divested the last of our coal assets

2019

Reported voluntarily under the Task Force on Climate-related Financial Disclosures (TCFD)

Set first Scope 1 and 2 emissions abatement goals

2021

Put climate and the low-carbon transition at the centre of our strategy

Accelerated abatement targets for Scope 1 and 2 emissions, supported by capital expenditure

Made ICMM member commitment to reach net zero by 2050 or sooner

2022

Shareholders supported our climate action plan as a non-binding advisory vote

Launched nature-based solutions team to develop and invest in high-integrity projects

2023

Established Energy and Climate team

Introduced near-term Scope 3 commitments

2024

Introduced decarbonisation performance measures into Long Term Incentive Plan (LTIP)

Our strategy

We play a key role in supplying the materials needed for a low-carbon future

The energy transition will drive significant demand for copper, aluminum, lithium and other critical minerals. We aim to grow in these commodities as well as in the supply of high-grade, high-quality iron ore, essential for low-carbon steel production.

Transitioning our energy to clean sources not only reduces our environmental impact, but also shields us from the risks of fossil fuel market volatility and the increasing cost of carbon. Currently, 50% of our operational emissions are in scope for legislated carbon penalties, and that number is projected to rise. Decarbonising our operations not only ensures their long-term viability but also enhances future returns.

Solutions to fully decarbonise our operations are yet to be developed. We set both short and medium-term emissions reduction targets in 2021, to achieve a 15% reduction by 2025 and 50% reduction by 2030, with our ultimate goal of net zero emissions by 2050.

Over 94% of our Scope 3 emissions stem from the downstream processing of our products. We are investing in research and development projects to decarbonise our value chain, and working together with our customers and suppliers to accelerate their progress towards net zero.

Grow in the materials necessary to support a low-carbon transition

Reduce Scope 1 and 2 operational emissions

Work with our partners to reduce Scope 3 emissions

Targets and commitments

Net zero operational emissions by 2050

15% reduction by 2025
50% reduction by 2030
(against 2018 baseline)

Commit to partnering with customers and suppliers to help them achieve their targets a decade earlier.

Invest in breakthrough technologies to decarbonise our value chains.

Our operations stretch across 35 countries

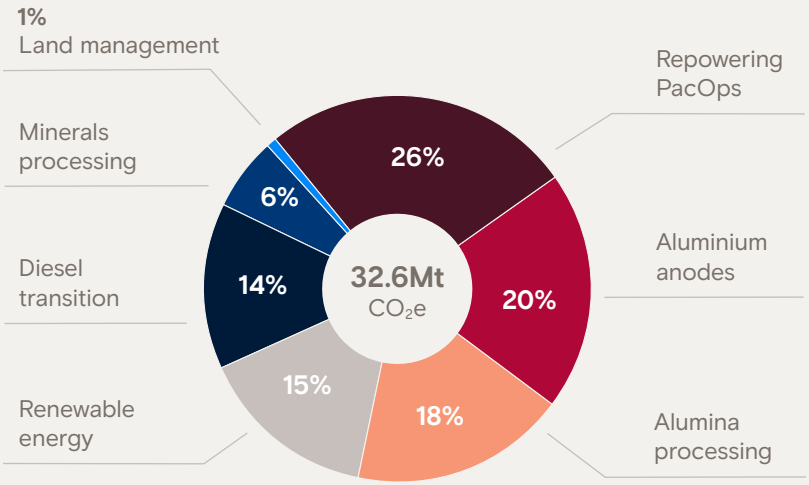
We have zero fossil fuel-producing assets in our portfolio and source 72% of our electricity from renewable sources. We have 8 hydropower plants in Canada, providing clean electricity to our operations in Kitimat, British Columbia, and Sept-Îles and the Saguenay–Lac-Saint-Jean region of Quebec. Our smelters in Iceland, New Zealand and Tasmania also benefit from the use of hydropower.

However, we still face a unique decarbonisation challenge. Approximately 80% of our Scope 1 and 2 emissions come from our processing operations which require high temperatures and or pressures traditionally met with fossil fuels.

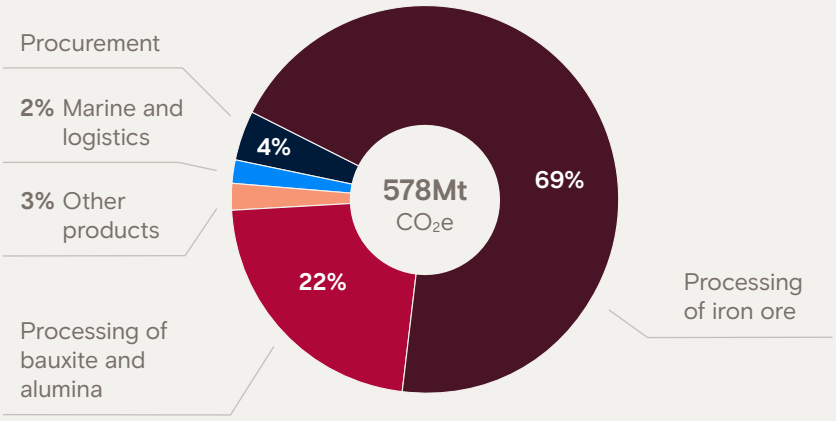
Two-thirds of our Scope 1 and 2 emissions come from our Aluminium business and two-thirds of our Scope 3 emissions are generated by our iron ore customers processing our ore into steel.

In 2023, our Scope 1 and 2 emissions totalled 32.6Mt CO_2e, while Scope 3 emissions reached 578Mt CO_2e.

Scope 1 and 2 emissions % (2023)



Scope 3 emissions % (2023)



Our approach

Our decarbonisation strategy addresses emissions reduction in the short, medium and long-term

We adapt our approach as technology evolves - from technologies we can deploy today, to the long-term industry breakthroughs that will revolutionise metals and minerals processing. Our primary focus is structural abatement – implementing the permanent solutions that minimise or eliminate emissions at the source. Where viable decarbonisation solutions may require more time, and to meet our compliance obligations, we use high-quality, high-integrity carbon credits.

Our 6 Global Decarbonisation Programs (GDPs) tackle all sources of carbon emissions in our business. These efforts are complemented by a team focused on offsets and nature-based solutions, to ensure we develop and secure high-integrity carbon credits.

Renewable energy

Diesel use

Minerals processing

Alumina refining

Aluminium anodes

Nature-based solutions

Steel

Alumina refining

Marine

Procurement

Deploying today	Developing next wave	Delivering industry breakthroughs
Value accretive and proven technology	**Grid scale renewables and unlocking electrification opportunities**	**Implement large-scale industry breakthroughs for "hard to abate" emissions**
Renewable energy (Build Own Operate, Power Purchase Agreements, Renewable Energy Certificates)	Underwriting large grid-level solutions	Global renewable energy penetration
Biofuels commercial deals Pongamia planting pilot	Preliminary mobile fleet electrification Biofuels feedstock production	Battery electric mobile fleet
Biocarbon to displace anthracite Electric calcination	Maximising the use of biogenic options BlueSmelting™ as pre-reduction process	BlueSmelting™ with green hydrogen
Biogenics trials	Double digestion to reduce energy demand	Green hydrogen calcination
ELYSIS™ commercial demonstration	ELYSIS™ for growth projects	ELYSIS™ for existing assets
Building pipeline of high-quality carbon credits for voluntary and compliance retirements	Partnering to develop high-integrity nature-based solutions projects	

We recognise the importance of helping our customers reduce their emissions (our Scope 3 emissions), and are working with them on projects to reduce their carbon footprint within our value chain.

BioIron pilot plant	High-grade Direct Reduced Iron (DRI)	Hydrogen DRI and electric melter
Optimised energy efficiency and use of our bauxite		
Improved energy efficiency Deploying transitional fuels (eg LNG, biofuels) where there is an opportunity	Partnering to support and develop end-state fuel solutions	Scaling of end-state fuels
Using decarbonisation as a key evaluation criterion	Collaborating with suppliers to realise abatement opportunities	

Our global decarbonisation programs

Renewable energy

We are replacing electricity generated from gas and coal with solutions like solar PV, wind, and other renewable technologies. Our approach varies, depending on factors including connectivity to an existing grid, land access requirements, opportunities to partner with First Nations people and Traditional Owners, and the availability of commercial solutions. We prioritise direct investments in renewable energy projects, while renewable energy certificates (RECs) provide a flexible mechanism to address emissions while we explore options.

Repowering Pacific Operations smelters

Two of our Australian aluminium smelters, Boyne and Tomago, source third party power from fossil fuel-based grids. The scale of the demand from these smelters means they are important anchors in their respective grids. We are working with a range of stakeholders to secure a repowering solution that includes access to competitive and renewable firmed electricity and supportive industry policy environments.

Diesel use

Electrification is the ultimate longer-term solution for repowering our mining fleet and we are working with partners to catalyse the development of this technology. Bridging the gap to electrification at scale, and for applications where electrification is not suitable, requires innovative complementary solutions. Renewable diesel is a drop-in replacement that can be used in existing equipment and offers significant emissions reduction over the lifecycle compared to traditional fossil diesel fuel.

Minerals processing

We are trialling technologies at IOC and RTIT Quebec Operations, including a pre-reduction process for ilmenite, biocarbon to replace anthracite in titanium smelting, and coke in iron ore pellet production.

Alumina refining

We are establishing a new benchmark for sustainable alumina refining by pioneering new technology that could reduce the amount of energy required to produce aluminium through process changes and improvements; improving energy efficiency and switching to lower carbon fuels, including hydrogen to generate heat.

Aluminium anodes

The consumption of carbon anodes in our aluminum smelters contributes about a fifth of our global emissions. Through our joint venture with Alcoa, we are developing and trialling carbon free aluminium smelting cells.

ELYSIS™ is a disruptive technology that eliminates all direct greenhouse gas emissions from the aluminium smelting process and generates oxygen as a by-product.

Offsets and nature-based solutions

Our nature-based solutions projects complement our work to reduce operational emissions and contribute to a nature positive future. They do not compete for capital with, or replace, our decarbonisation projects. We are investing in existing and new projects in Australia, Madagascar, Guinea and South Africa.

Project timeline

We are taking real action to decarbonise our operations and value chains

2015

Built 1.6MW Weipa solar facility

2018

Launched ELYSIS™ with Alcoa to develop and scale the world's first carbon-free aluminium smelting process

2019

Procured 1.5 TWh of clean power for Kennecott

Signed MOU with China Baowu Steel Group and Tsinghua University to develop new methods to reduce emissions and improve environmental performance across the steel value chain

2021

Launched START™ to improve transparency and traceability of aluminium production

Launched Charge On Innovation Challenge with BHP and Vale

Commenced construction of 8MW solar and BESS at QMM

Signed MOU with POSCO to explore decarbonisation technologies

Approved 4MW Weipa solar farm and BESS

Commenced construction of 34MW Gudai-Darri solar farm

Announced BioIron™ technology trials

2022

Signed one-year trial of marine biofuels with bp

Invested in aluminium recycling centre at Arvida

Partnered with Scania on agile autonomous haul trucks

Small-scale pilot of BioIron™ technology proves successful

Signed 130MW solar PV PPA for RBM

Completed Kemano hydropower project

2023

Approved Yarwun hydrogen calcination pilot plant

Transitioned our Boron operation in California to renewable diesel

Built 5MW solar plant at Kennecott

Partnered with H2 Green Steel to support the development of low-carbon iron and steelmaking

Expanded AP60 low-carbon aluminium smelter

Signed MOU with China Baowu to explore projects to decarbonise the steel value chain

Started BlueSmelting™ demonstration plant

Approved 12.4MW solar farm and BESS at Amrun

Formed JV with Matalco for recycled aluminium products

Signed MOU with Yindjibarndi Energy Corporation to explore renewable energy projects

2024

Announced PPAs for 2.2GW of wind and solar to power Gladstone operations

Signed long-term power deals for Tiwai Point aluminium smelter

Partnered with BlueScope and BHP on steel decarbonisation

Announced BioIron™ R&D facility in Western Australia

Signed 140MW wind PPA for RBM

Built 3.5MW solar facility at Diavik

Partnered with BHP on battery-electric haul truck pilots

Announced 2 new 5.25MW solar plants at Gove

Partnered with Ngarluma Aboriginal Corporation for development of an 80MW solar PV facility

Launched biofuels farming trial for renewable diesel production

Established Évolys JV to manufacture biocarbon

Executed 80MW wind VPPA for Kennecott

Added 9th and final LNG Newcastlemax dual-fuelled vessel to our fleet

Approved 25MW solar PV facility for Kennecott

Our progress

We are working on a range of projects which aim to achieve net zero operational emissions by 2050

BESS: Battery Energy Storage System; BOO: Build, Own, Operate; HBI: Hot Briquetted Iron; PPA: Power Purchase Agreement; PV: Photovoltaic; RECs: Renewable Energy Certificates; VPPA: Virtual Power Purchase Agreement.


GreenIron decarbonisation collaboration
Stegra (formerly H2 Green Steel) collaboration
Sweden
Nippon Steel climate change collaboration
Japan
POSCO climate change collaboration
South Korea
Baowu climate change collaboration
Shougang climate change collaboration
China
RECs and PPAs
Oyu Tolgoi
Solar PV PPA
Gove
Solar PV PPA & BESS
Amrun
Solar PV & BESS
Weipa
Reforestation, clean cooking and conservation
Madagascar
Wind & Solar PV PPAs
RBM
Wind & Solar PPA + BESS
QMM
Battery electric haul truck trials
Pilbara
Double digestion
QAL
Hydrogen calcination
Yarwun
BSL repowering
BioIron™ R&D facility
Baowu HBI study
Iron ore beneficiation pilot study
Western Australia
BlueScope-BHP decarbonisation collaboration
Location TBD, Australia
Tomago repowering
Sustainable grasslands and conservation
KwaZulu-Natal
Various renewable energy projects
Multiple locations, Pilbara
Savanna fire management, human-induced regeneration, environmental planting
Multiple locations, Australia
Renewable power
NZAS

Working together with Ngarluma Elders, Ngarluma Country

Deploying today

We are pursuing process efficiencies and innovative solutions to decarbonise our operations

Pilbara
Karratha Solar Farm

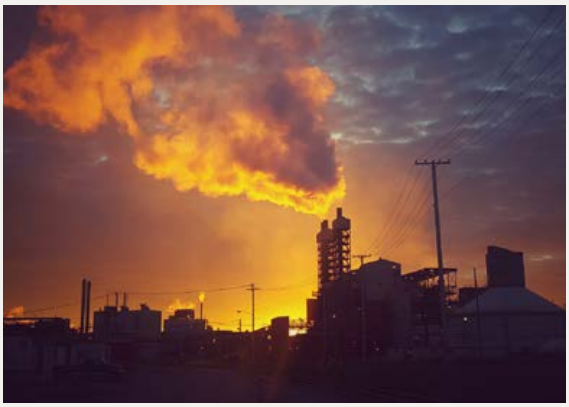
In 2024, we announced a partnership with the Ngarluma Aboriginal Corporation to jointly pursue development of an 80MW solar farm on Ngarluma Country, near Karratha. This would supply renewable energy to our operations in the Pilbara region.

This partnership approach reflects our focus on a just transition. The significant land requirements in the Pilbara for our solar projects, potential impacts to the local flora and fauna and associated heritage surveys are all being studied in consultation with Traditional Owners.

Thurso, Canada
Évolys

Rio Tinto and Aymium formed a new joint venture named Évolys Québec to manufacture a renewable metallurgical biocarbon product to reduce carbon emissions in large scale industrial processes. This biocarbon, sourced from biomass, offers a sustainable and local alternative for anthracite currently used in ilmenite smelting processes at the Critical Minerals and Metallurgical Complex in Sorel-Tracy.

The joint venture aims to be operational by the second quarter of 2025, with an initial capacity of 50,000 tonnes of biocarbon per year.



Vaudreuil
Electric calcination pilot

At Vaudreuil, we are piloting technology to partially electrify the calcining process to demonstrate the technical and commercial feasibility of using electric calciners powered by renewable energy to support decarbonisation of the alumina refining process.

The final stage in the alumina refining process, calcination currently uses fossil fuels to heat alumina hydrate up to 1100 degrees Celsius to remove chemically-bound water molecules.

Implementation following the pilot would mean that renewable energy would partially replace natural gas in the calciner, reducing emissions.

Yarwun
Biopellet trial

We are exploring biopellet co-firing technology at our Yarwun refinery in Queensland.

Biopellets are a promising renewable and near zero-emissions fuel source derived from treated organic materials like sustainably grown energy crops, forestry waste, agricultural residues, and industrial byproducts. They can be blended with coal, offering a sustainable alternative for powering our boilers.

We will trial biofuel blends from 5% to 50% coal substitution. We'll use biopellets with 83% less carbon than coal, and if a 15% biofuel blend proves successful, this could translate to a 120kt annual reduction in CO_2e emissions at Yarwun.

We're also supporting a local biopellet production trial to explore a domestic supply chain for this sustainable fuel source.

Gove

Pongamia planting pilot

Pongamia is a medium-sized, fast-growing tree, considered native in northern Australia. It produces seeds rich in oil and protein which can be used to produce renewable diesel.

Since late 2023, we have planted around 7,000 Pongamia saplings across 18 hectares of previously mined land near our Gove operations.

The primary purpose of the trial is to test Pongamia as a potential post-mining economic activity to support local communities. We are testing the ability for Pongamia to grow in low quality soil and Northern Territory climate conditions, and how the species responds to different water, fertiliser, topsoil, staking, and pruning regimes.

The trial has been supported by the region's Traditional Owners who have managed activities such as planting, pruning, staking and installation of irrigation. Traditional Owners will also be involved in monitoring and maintenance activities over the next 5 years.

US Operations

Renewable diesel

Our Boron operation in California has fully transitioned heavy machinery from fossil diesel to renewable diesel, with an anticipated CO_2e reduction of up to 45,000 tonnes per year, similar to eliminating the emissions of 9,600 cars.

In 2024, we replaced our entire fossil diesel consumption with renewable diesel at our Kennecott copper operation in Utah. This will reduce emissions by around 450,000 tonnes of CO_2e per year, similar to eliminating the emissions of more than 107,000 cars.

Sorel-Tracy and the Pilbara

Renewable diesel pilot projects

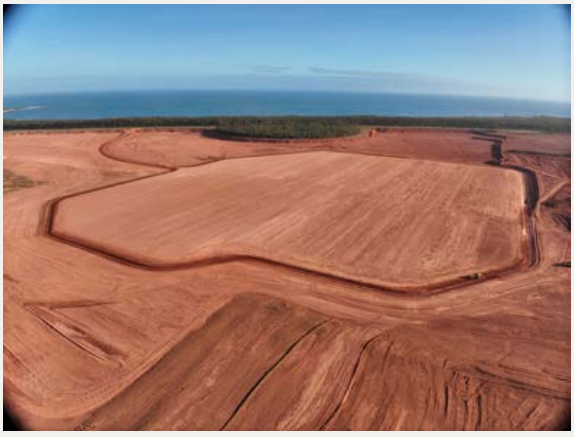
At RTIT Quebec Operations, renewable diesel is being trialled in mobile equipment at the Critical Minerals and Metallurgical Complex in Sorel-Tracy as part of a pilot project. Analysis of preliminary data will help us understand the potential for a complete conversion to renewable diesel in the future.

Pilbara

Yindjibarndi Energy Corporation

In 2023, we signed a Memorandum of Understanding with the Yindjibarndi Energy Corporation (YEC) to explore opportunities to collaborate on renewable energy projects on Yindjibarndi Country in the Pilbara, Western Australia.

The first project we're exploring with YEC is Project Jinbi: a 75MW solar power plant to be located west of the Millstream Chichester National Park, on Yindjibarndi Country.



Amrun

Solar and battery electric storage system (BESS)

Construction is underway on a 12.4MW solar farm and 8.8MVa/2.1MWh of battery storage for our Amrun bauxite operations near Weipa in Queensland. Aggreko will build, own and operate these assets.

Once complete, this project is expected to reduce Amrun's diesel electricity consumption by 37% and annual CO_2e emissions by 14,000 tonnes.

Gove

Solar PV and battery electric storage system (BESS)

Two new 5.25MW solar PV plants will be built on Gumatj and Rirratjingu Country on the Gove Peninsula, Northern Territory, as we move to secure a more sustainable power supply for the region beyond mining.

Aggreko will build, own and operate the solar plants, to be built on Rio Tinto leases following agreement with the Gumatj and Rirratjingu Traditional Owner Groups on the location of the facilities. This will help underpin a low-carbon future for the Gove community following the cessation of mining operations towards the end of the decade.

The solar farms are expected to reduce the region's annual diesel consumption by about 20% or 4.5 million litres a year, and lower annual carbon emissions by about 12,263 tonnes.

Richards Bay Minerals

Solar PV and wind power purchase agreements (PPA)

In June 2024, Richards Bay Minerals (RBM) signed a 20-year renewable PPA with Khangela Emoyeni Wind Farm, securing 140MW of wind energy from a new wind farm situated in the Western and Northern Cape Province in South Africa.

In 2022, RBM signed a similar agreement for the Bolobedu Solar PV plant in Limpopo with Voltalia. The Bolobedu 130MW solar PV project is anticipated to meet 17% of RBM's power consumption by generating up to 300GWh of renewable energy per annum.

Combined, the Khangela Emoyeni Wind and Bolobedu Solar projects will supply approximately 42% of RBM's existing energy needs, and present opportunities for job creation, skills development, and knowledge transfer within local communities during construction and operation.

QMM

Solar PV and wind PPAs

In 2021, QIT Madagascar Minerals (QMM) signed a partnership with CrossBoundary Energy to build and operate a 30MW solar PV and wind power plant. The first phase, now complete, comprises 14,640 solar panels generating 8MW, and an 8.25MW lithium-ion battery energy storage system.

Construction is underway on the second phase of the project, which will include expansion of the solar farm by 6MW and construction of a 19-turbine wind farm with a capacity of 16MW.

Diavik

Solar PV and wind

The 3.5MW solar PV power plant at our Diavik Diamond Mine represents the largest off-grid solar power plant across Canada's 3 northern territories.

With installation completed in 2024, the 6,620-panel facility is expected to generate 4.2 million kilowatt-hours of solar energy annually, reducing diesel consumption at Diavik by one million litres per year and cutting greenhouse gas (GHG) emissions by 2,900 tonnes of CO_2e. The facility is equipped with bi-facial panels which not only generate energy from direct sunlight, but also from the light that reflects off the snow that covers Diavik for most of the year.

The solar project complements a wind power plant at Diavik, which has been operating since 2012 and is the largest wind power installation in Canada's North, having generated approximately 200 million kilowatt-hours of electricity since activation.

Kennecott

25MW + 5MW solar PV

At our Kennecott copper operation in Utah, we completed construction on a 5MW solar PV power plant in 2023, with construction commencing on a second, 25MW solar PV plant in late 2024. Combined, the 2 solar PV plants will reduce Kennecott's Scope 2 emissions by 6%.

Shifting to sustainable energy solutions is a priority for Kennecott. The mine closed down its coal-fired power plant in 2019, moving to electricity paired with renewable energy certificates. Together with the installation of the 5MW solar farm, deployment of battery electric vehicles underground, and the operation's recent transition to renewable diesel, these measures have reduced Kennecott's overall carbon footprint by more than 80% from 2018 levels.

We produce tellurium as a byproduct of mining and refining copper at Kennecott, as one of only 2 U.S. producers of this critical mineral. Tellurium is a vital component of photovoltaic solar panels, including the solar panels used at Kennecott.

Pilbara

Gudai-Darri solar PV

At Gudai-Darri, we've installed a 34MW solar PV plant, which has completed its commissioning works and is progressing the testing and ramp up to full capacity. It is expected to supply all of Gudai-Darri's electricity demand during peak solar power generation times and approximately 65% of the mine's average electricity demand. Together with a lithium-ion battery energy storage system at Tom Price, and as part of an integrated system, the solar and battery can reduce our annual carbon dioxide emissions by about 90,000 tonnes compared to conventional gas powered generation.

Developing the next wave

Many of the initiatives we are pursuing now will enable emissions reduction later in the decade and after 2030

Gladstone
Repowering our assets

We've been working on a competitive repowering solution for our Gladstone assets for a number of years and in 2024 we achieved some key milestones.

We signed PPAs for a combined 2.2GW of renewable energy, catalysing the development of new large-scale renewable energy in Queensland.

The first, announced in January, was for 1.1GW of solar electricity from European Energy's Upper Calliope solar farm to be built near Gladstone. The second PPA was with Windlab for 1.1GW from the Bungaban wind project, representing 80% of capacity.

Once developed, these projects have the potential to lower carbon emissions by about 5 million tonnes per year and could generate the equivalent of 10% of Queensland's current power demand.

In August we reached an agreement with the Queensland Government on a support package to assist Boyne Smelters with the transition to a competitive and repowered future. This would come into effect in 2029 and is contingent on confirmation of a supportive industry policy environment at the federal level in Australia, our investment in further renewable energy and the approval of our joint venture partners.

Boyne Smelters, Gladstone, Queensland

New Zealand Aluminium Smelter (NZAS), Tiwai Point, New Zealand

Tomago

Seeking repowering opportunities

Tomago Aluminium smelter, in New South Wales, is Australia's largest. It uses around 10% of the New South Wales power supply to produce 590,000 tonnes of aluminium per year. Tomago Aluminium company is an independently managed joint venture and our joint venture partners are CSR and Hydro Aluminium.

Tomago relies on coal-fired electricity and its current electricity contract expires at the end of 2028. Tomago has embarked upon a process to repower the smelter with renewables and launched a Request for Proposal process in February 2024 seeking proposals from market participants for renewable energy and storage solutions. The Tomago team is working through submissions received via that process.

NZAS

Long-term agreement

In 2024, we signed long-term electricity contracts for our Tiwai Point aluminium smelter in New Zealand, securing the smelter's future while positioning it as a global leader in low-carbon aluminium.

By partnering with Meridian Energy, Contact Energy and Mercury NZ, we secured a stable supply of 572MW of renewable electricity which will power the smelter for the next 20 years.

Beyond the long-term power supply, the agreement supports grid stability when required, like during times of low rainfall. We have committed to demand response agreements of up to 185MW, transforming the smelter into a virtual power plant. This allows the smelter to adjust its electricity consumption in response to grid fluctuations, ensuring a reliable and efficient power supply for New Zealanders.

Our collaboration with energy partners, local Indigenous partners Ngāi Tahu, the Southland community, and the New Zealand government shows how this kind of partnership can drive positive change for both industry and society. We are exploring opportunities to replicate this successful model at other operations.

Queensland Alumina Limited (QAL)

Double digestion

Refining alumina from bauxite ore is an energy-intensive process, requiring extremely high temperatures and pressure. In the near term, our most significant opportunity lies in energy efficiency improvements. At QAL, we are working to develop double digestion technology. This involves process changes that remove the need for all bauxite to be processed at high temperature. It significantly reduces energy consumption compared to traditional methods, and could deliver up to a 30% reduction in emissions at QAL.

However, retrofitting a 60-year-old refinery with this complex and expensive technology requires careful planning and execution. We are actively collaborating with the Australian Government, who have pledged to match our financial investment in both the feasibility studies and the capital works required for this groundbreaking project.

Australia

Pongamia biofuel trial

In September 2024 we announced we were acquiring approximately 3,000ha of cleared land near Townsville in Queensland to test the viability of Pongamia seed as a renewable diesel feedstock.

Our farm managers Midway will plant approximately 750,000 Pongamia saplings. The pilot will study growth conditions, measure seed oil yields, and assess the viability of Pongamia seed oil as a renewable diesel feedstock.

We expect our pilot could generate approximately 11 million litres of renewable diesel annually.

Importantly, the pilot could also catalyse a biofuel feedstock industry sufficient to meet domestic demand, enhance the region's fuel security, create local economic opportunities, and contribute to emissions reductions targets.

Mongolia

Battery swap electric truck trial

We are partnering with China's State Power Investment Corporation (SPIC) to trial battery swap electric truck technology at Oyu Tolgoi copper mine in Mongolia.

This 2 year trial of 8 mining trucks, 13 batteries, a battery swap and charging station, will test a full electrification ecosystem for the first time at a Rio Tinto operation.

Each battery is anticipated to last up to 8 hours, depending on the work performed, and the battery swap process takes around 7 minutes, enabling increased use of the equipment through minimal charging downtime.

The trucks, operated by Oyu Tolgoi drivers, will perform tailings dam rehabilitation work and topsoil movement, and the system will be maintained by Oyu Tolgoi personnel while we learn about how the full electrification ecosystem operates and potential applications across the business.

While this system is already in operation across China, technical experts from Rio Tinto and Oyu Tolgoi worked closely with SPIC and truck manufacturer Tonly to adjust equipment design to align with Rio Tinto electrical and truck safety requirements.

The first of the eight trucks will arrive at Oyu Tolgoi in December 2024. The remaining 7 trucks and battery swap and charging infrastructure will be in operation on site by mid 2025.

Technician at the BlueSmelting™ demonstration plant in Sorel-Tracy, Canada

Delivering industry breakthroughs

Many of the solutions we need to achieve net zero by 2050 do not yet exist, but we're determined to be a catalyst for their development

Quebec
BlueSmelting™

Rio Tinto scientists have been researching a way to reduce carbon emissions while producing titanium dioxide – a sought-after material for the energy transition.

In 2023, they transformed their big idea into a full-scale, operational demonstration plant – the largest of its kind in the world. It can produce up to 40,000 tonnes of ilmenite ore a year with dramatically fewer emissions.

This new pre-reduction technology, known as BlueSmelting™, could reduce carbon emissions from ilmenite processing at Rio Tinto Iron and Titanium's (RTIT) Quebec Operations by up to 95% – the equivalent of removing 145,000 cars from the road.

When fully implemented, the BlueSmelting™ project has the potential to reduce up to 70% of RTIT Quebec Operations' global greenhouse gas emissions.

Yarwun

Hydrogen calcination pilot

We are partnering to build a hydrogen plant at our Yarwun refinery in Australia in a world-first, proof-of-concept project to reduce carbon emissions from the alumina refining process.

The pilot will demonstrate the viability of using hydrogen in the calcination process, where hydrated alumina is heated to temperatures of up to 1,000°C.

It's a A$111 million partnership with Sumitomo Corporation, the federal government's Australian Renewable Energy Agency (ARENA) and Central Queensland Hydrogen Hub (CQHH). Sumitomo will build and operate a 2.5MW electrolyser on-site to supply more than 250 tonnes of hydrogen per year to the refinery once operational in the second half of 2025. If successful, the program could pave the way for global adoption of this technology.

Pilbara

Battery electric haul trucks

Diesel-fuelled mining equipment and locomotives accounted for 14% of our Scope 1 and 2 emissions in 2023. Haul trucks are the largest users of diesel and present a significant challenge for us to solve. In an industry first, we're joining forces with BHP to test battery-electric haul trucks in Western Australia's Pilbara region. Together with two leading haul truck manufacturers, Komatsu and Caterpillar, we're aiming to accelerate the development and deployment of this technology.

We'll run trials with Caterpillar and Komatsu from late 2024 to collect data on battery performance, charging systems, and overall productivity in Pilbara conditions, and we'll share the information so we learn faster.

Quebec

ELYSIS

We are installing carbon-free aluminium smelting cells at our Arvida smelter in Quebec, Canada, using the first technology licence issued by the ELYSIS™ joint venture.

This groundbreaking project represents a US$285 million investment, and marks a major step towards commercialising this innovative technology. The plant will have the capacity to produce up to 2,500 tonnes of commercial quality aluminium per year without direct greenhouse gas emissions, with first production targeted by 2027.

This demonstration plant is crucial for scaling up the ELYSIS™ technology in preparation for its wider adoption across the industry.

A Komatsu 930 battery electric haul truck

Tsitongambarika Forest, Fort Dauphin, Madagascar

Nature-based solutions

While our priority is decarbonising our business, we are developing and investing in high-integrity nature-based solutions because we believe they are a win-win-win for people, nature and climate

Our nature-based solutions projects complement the work we are doing to reduce our emissions and reduce the social and environmental risks and impacts of our operations. They do not compete for capital with, or replace, our decarbonisation projects. Instead, we treat them as standalone carbon and nature investments that can bring positive outcomes in the regions where we operate.

We are investing in existing and new projects in Australia, Madagascar, Guinea and South Africa.

Our goal is to work with communities to enable at least 500,000 hectares of high-integrity nature-based solutions projects globally by 2025.

Madagascar
Tsitongambarika forest

The Tsitongambarika forest is a 45,000-hectare protected area, with a varied and unique wildlife. Also known as TGK, Tsitongambarika is the only remaining forest of its kind in Madagascar, and one of the world's most irreplaceable sites for threatened biodiversity. With an estimated 8,000-plus households in the protected forest and the surrounding buffer zone, most of these families rely on TGK for their livelihoods, including food, water, fuelwood or charcoal and building materials like timber. Despite the difficult terrain in places, the forest is extremely threatened.

In partnership with the Government of Madagascar, BirdLife International, Asity Madagascar and other partners, we are supporting the development of the TGK REDD+ project.

The project relies on a variety of integrated activities that provide sources of direct income, and address the root causes of forest loss and degradation by helping communities find alternatives to address livelihoods challenges.

For example, together with SaniTap, we are working to provide alternative cooking fuel and equipment to reduce the local communities' reliance on firewood and charcoal from the TGK and its surrounding areas. The project aims to support the transition to cleaner, more efficient cookstoves, and from charcoal use to renewable biomass pellets for more than 20,000 households in the Anosy region.

As part of our landscape-based approach, we are also looking to create an aggregated 35,000-hectare afforestation and reforestation project across the south and northeast of Madagascar. This project will include planting of indigenous tree species, fruit species and large scale pongamia for biofuels.

'REDD' stands for 'Reducing emissions from deforestation and forest degradation in developing countries. The '+' stands for additional forest-related activities that protect the climate, namely sustainable management of forests and the conservation and enhancement of forest carbon stocks.

South Africa

In South Africa, we partnered with Sayari Earth, Peace Parks Foundation and WILDTRUST to complete a feasibility study for a large-scale, landscape level nature-based solutions project in KwaZulu-Natal Province.

The Province is home to the Maputaland-Pondoland biodiversity hotspot which faces significant threats, including under-resourced protected areas, and unplanned/unsustainable land use including overgrazing, forestry and commercial agriculture.

The feasibility study is expected to conclude in mid-2025 and will identify opportunities to develop high-integrity projects in collaboration with local communities.

Guinea

The forests of the Guinée Forestière region, close to the Simandou project, have been reduced to a small proportion of their original extent. The remaining forests, which contain an enormous diversity of species, are highly threatened and fragmented from centuries of farming, logging and settlement.

We completed feasibility work for a clean cooking, fuel-switching program, now moving into a pilot phase. We also identified a high-quality reforestation project, and we are working with local conservation organisations to investigate REDD+ and mangrove restoration projects.

Rangers at Arnhem Land
Image credit: David Hancock

Australia

Savanna fire management

We are investing in savanna fire management carbon credits from Indigenous-owned projects near our operations.

Near our Gove operations in the Northern Territory we are working with Arnhem Land Fire Abatement, an Aboriginal-created, owned and operated not-for-profit carbon business. Similarly, close to our Weipa operations in Far North Queensland, we are supporting several projects including the Aurukun Savanna Burning project and the Oriners and Sefton Savanna Burning project.

These projects bring multiple benefits in addition to fire management and nature repair, as carbon finance is reinvested into the communities to support training, employment though ranger programs, and enhanced connection to Country.

Human-induced regeneration

We have identified and invested in natural regeneration projects where pastoral land is reforested by reducing over-grazing, preventing clearing and managing feral and invasive species. We have established a detailed process for reviewing projects prior to investment that includes assessment of project design, evidence of regeneration and project resilience.

For example, we acquired a 14.15% interest in Australian Integrated Carbon (Ai Carbon), a leading developer of high-quality carbon credits. Ai Carbon has an existing portfolio of more than 40 carbon farming projects across 8 million hectares in Australia. Our investment supports Ai Carbon's growth strategy which includes the implementation of projects in future methodologies such as integrated farm and land management.

Environmental planting

We invested in the first close of the Silva Carbon Origination Fund to provide us with access to large-scale, high-integrity carbon credits from land reforestation projects integrated with sustainable agriculture.

Reducing value chain emissions

Scope 3

37%

reduction in shipping emissions in 2023 (relative to 2008 baseline)

In 2023, our Scope 3 emissions were 578Mt CO_2e (equity basis), approximately 18 times higher than our Scope 1 and 2 emissions.

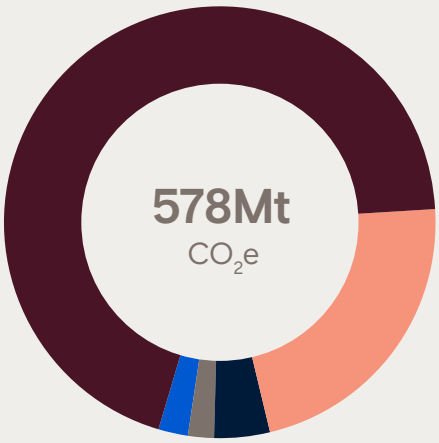
We have limited control over these emissions, as they come primarily from our customers in Asia while processing our iron ore into steel, and our bauxite into alumina and then aluminium. We are committed to working with customers and suppliers to address these emissions, and to helping them achieve their targets a decade earlier and reach net zero by 2050.

Together, we're investing in research and development to create new low-carbon products and processes, and taking part in industry initiatives to accelerate solutions and advocate for supportive policies.

Our strategy addresses our 4 most significant categories of customer emissions:

- Steel decarbonisation
- Aluminium value chain
- Shipping
- Procurement

Our Scope 3 emissions



69% Iron ore

22% Aluminium and bauxite

4% Procurement

2% Other customers

2% Marine and logistics

Reducing our customers' emissions

Scope 3

Steel

Iron and steelmaking processes account for 8% of the world's carbon emissions and accounted for 69% of Rio Tinto's Scope 3 emissions in 2023.

As one of the world's largest iron ore producers, we are committed to driving decarbonisation across the steel value chain. We are working with numerous strategic partners across the world, across ecosystems and value chains, to unlock the most sustainable and economic pathways for our iron ores.

Our strategy has a 3-pronged approach

Optimising existing pathways

We are collaborating with steelmakers to enhance the efficiency of traditional blast furnace operations by optimising the blast furnace burden, reducing emissions from sintering, improving energy efficiency and recycling slag. We're also exploring opportunities to increase the use of iron ore lump, as using lump avoids the emissions associated with pre-processing such as sintering and pelletising.

Accelerating emerging pathways

We are supporting the transition to lower-carbon steelmaking technologies, such as shaft furnaces to produce Direct Reduced Iron (DRI) for our high-grade iron ores from the Iron Ore Company of Canada and eventually Simandou, by building a portfolio of options in energy-advantaged regions.

Pioneering future pathways

We are investing in research and development to create innovative decarbonisation pathways for Pilbara ores. Our BioIron™ technology, which uses sustainable biomass and microwave energy instead of coal, has demonstrated significant emissions reductions in pilot testing. We are also exploring electric smelting furnace technology and impurity-removal techniques to unlock the potential of lower-grade iron ores.

BioIron™
Pioneering breakthrough technologies

Our BioIron™ process has the potential to reduce CO_2 emissions by up to 95%* in the steelmaking process.

BioIron™ is a world-first technology that has the potential to play a significant role in a low-carbon steel future. BioIron™ uses raw biomass produced from agricultural by-products (instead of metallurgical coal) and microwave energy, to convert Pilbara Iron ore to metallic iron during steelmaking. It also uses approximately 65% less electricity during steelmaking when compared to other green hydrogen technologies.

We have proved BioIron™ works on a small scale through a successful collaboration with the University of Nottingham and Metso Corporation.

In June 2024, we announced we are investing US$143 million to develop a research and development facility in Western Australia to further assess the effectiveness of BioIron™, to support decarbonising the global steel value chain.

**When using renewable energy and fast-growing biomass.*

Electric smelting furnace technology
Collaborating with industry

To accelerate the decarbonisation of steelmaking, we are collaborating with China's largest steelmaker, Baowu, on electric smelting furnace (ESF) technology along with the pelletisation of Pilbara ores, with the target to construct a small-scale Electric Smelting Furnace (ESF) at one of Baowu's steel mills in China by 2026.

We also joined forces with Australia's other major iron ore producer, BHP, and the country's largest steelmaker, BlueScope, to jointly investigate the development of Australia's first ESF pilot plant.

This collaboration provides a platform to develop and potentially invest in a pilot facility and aims to demonstrate that production of molten iron from Pilbara ores is feasible using renewable power when combined with Direct Reduced Iron (DRI) process technology. If successful, it could help open a potential pathway to near-zero greenhouse gas emission-intensity operations for steelmakers that rely on Australian iron ore to meet global steel demand.

We are assessing several locations in Australia for the proposed pilot facility and the pre-feasibility study work program is ongoing.

Aluminium

Our short to medium-term focus is on collaborating with customers to find practical solutions that improve the energy efficiency of alumina refining and optimise the use of our bauxite.

We are collaborating with 3 major customers, representing 47% of our bauxite sales. By sharing expertise and developing joint projects, we are aiming to reduce emissions from the digestion of bauxite and through organics management. We are also exploring ways to optimise the moisture content of bauxite and improve energy efficiency.

Over 85% of our Scope 3 emissions from the aluminium value chain come from the aluminium smelting process. Our ELYSIS™ technology, a carbon-free smelting process, positions us as a leader in low-carbon aluminium production. Lessons learned from this technology will be invaluable in supporting industry-wide decarbonisation.

Procurement

We are engaging with our top 50 suppliers, who represent 40% of our procurement-related Scope 3 emissions. Our focus is on driving supplier accountability for setting and achieving decarbonisation targets, while also collaborating on emissions measurement and reduction strategies. We have now also incorporated decarbonisation criteria into our procurement processes, with a particular emphasis on high-emission categories such as raw materials, explosives, and mining equipment.

Shipping

As we work towards reducing our carbon intensity and achieving net-zero emissions from the shipping of our products by 2050, we aim for 10% of our time-chartered fleet to use net-zero emissions fuel by 2030*, progressing to 100% by 2040, in line with our First Movers Coalition pledge. To achieve our ambitions, we are focused on:

- Improving vessel efficiencies through modification of our owned and chartered fleet
- Using transitional fuels to deliver tangible short- to medium-term emission reductions
- Partnering to support and develop end-state fuel solutions, including advocacy and addressing regulatory challenges, which will help advance the industry's transition to net-zero shipping.

Crowdsourcing solutions to reduce shipping emissions

As a leading charterer and significant stakeholder in international shipping, we are taking steps to reduce the carbon footprint of our maritime fleet.

In 2023, we achieved a 37% reduction in carbon intensity (against the International Maritime Organisation's 2008 intensity target baseline year) across our global fleet by applying fuel efficiency measures such as using more efficient and larger vessels; making design improvements and technical modifications; and digitally optimising speed and route selection.

To explore opportunities for further improvement, we launched a marine challenge portal to crowdsource ideas for accelerating fuel efficiency. It attracted 72 potential solutions, including automated propulsion optimisation tools for navigational use, real-time onboard metocean data capture, and hull lubrication systems.

Selected technologies have been installed onboard 4 of our vessels, and we expect these measures to save up to 25% in fuel consumption per vessel.

**Subject to the availability of technology, supply, safety standards, and the establishment of reasonable thresholds for price premiums*

Innovation

Innovating for the transition

We don't yet have all the answers to achieve net zero, but we have an industry-leading technology and research and development organisation. We're partnering with universities, governments, other companies and start-ups to test, develop and accelerate technologies we need for decarbonisation.

We believe that investing in these technologies could not only reduce our emissions, but also unlock new opportunities for growth and value creation. We allocate around US$200 million a year to decarbonisation research and development.

Investing in technology and start-ups

To help solve critical business challenges, through our dedicated venture capital fund we invest in technology and start-ups including:

- Aymium
- ClearFlame
- Electric Hydrogen
- ElectraLith
- Evok Innovations
- Rondo Energy
- Terra CO2
- Highview Power

Progressing the portfolio

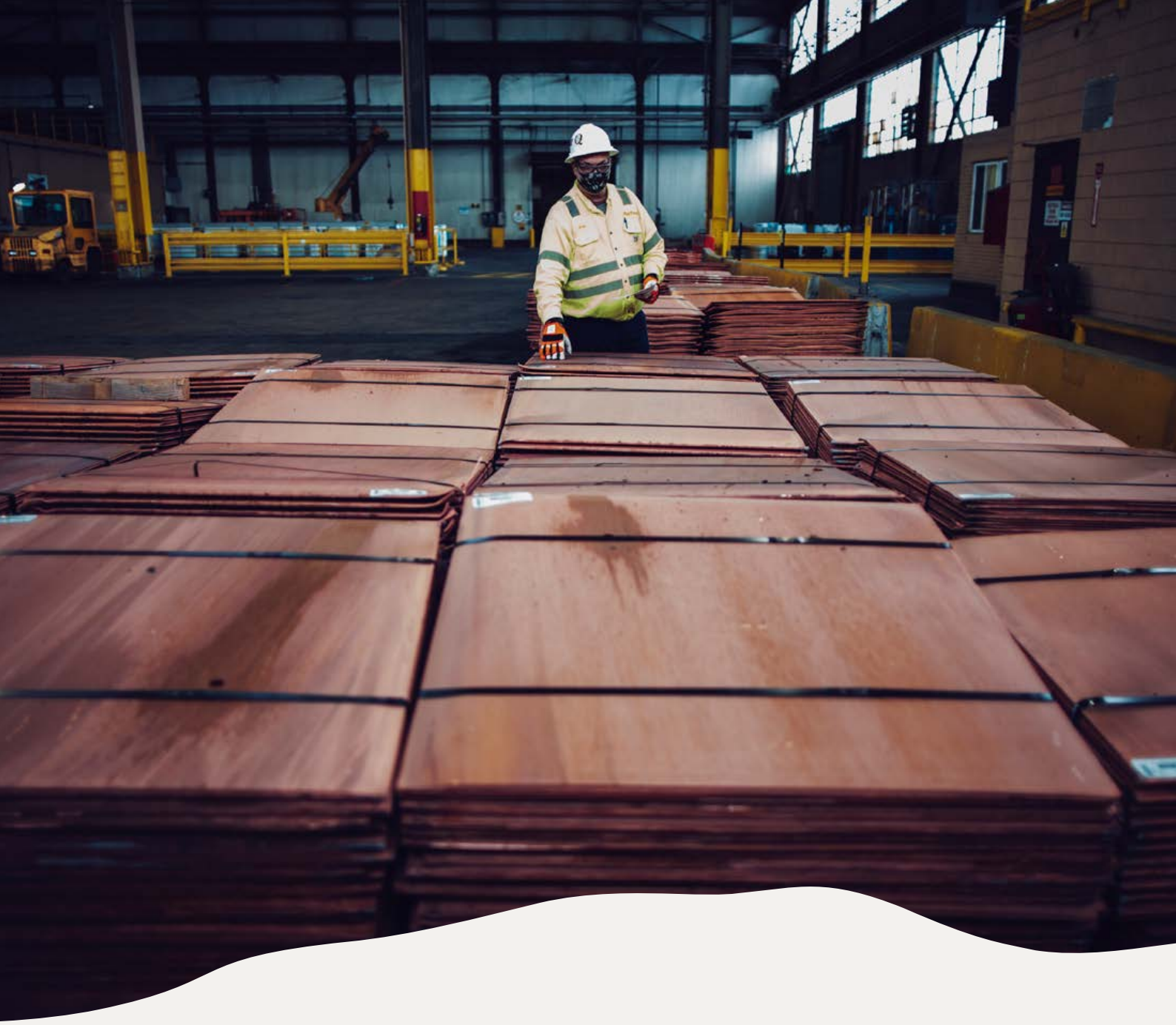
In collaboration with our partners, we are progressing key projects, including:

- ELYSIS™
- Nuton™
- BlueSmelting™
- Hydrogen calcination
- Steel decarbonisation and BioIron™
- Évolys

Bringing the outside world in

Our Innovation Advisory Committee brings together experts in innovation and research and development. The Committee is helping us accelerate our innovation portfolio and offers guidance on emerging technologies in health and safety, environmental, social and governance, growth, carbon abatement, productivity, automation, machine learning and AI.

To help us find innovative ways to provide the materials the world needs for the energy transition, we have also committed US$150 million over ten years to create a Centre for Future Materials led by Imperial College London.



Nuton™

A lower impact way to produce copper

Nuton™, a Rio Tinto venture, is a bio-heap leaching technology. Developed over 3 decades of research and development, it has the potential to produce copper from resources that were previously too technically challenging or expensive to process in any other way.

This technology achieves recovery rates of up to 85% from primary sulphide ore, the most abundant type of copper ore in the world – substantially higher than recoveries achieved by alternative leaching technologies.

With Nuton™, we aspire to provide the copper the world needs, while meeting society's higher expectations about the way it's produced. We aim to produce the lowest footprint primary copper, while working with our partners to create a positive impact on water, energy, land, materials and society.

Grow in materials

The global shift to a low-carbon economy is driving unprecedented demand for our core commodities, and we are well-positioned to capitalise on this growth

Copper, lithium, and aluminum are essential for renewable energy infrastructure and electric vehicles, while high-quality iron ore remains crucial for low-carbon steel production.

We are making strategic investments to strengthen our position in this evolving landscape. Our Rincon lithium project in Argentina has significant potential to supply the burgeoning electric vehicle market.

In copper, our Oyu Tolgoi mine is a world-class asset that will continue to be a cornerstone of our business as copper demand grows. And our high-quality iron ore is essential for the steel in our buildings, cars and infrastructure. Recognising the growing importance of recycling in a circular economy, we have formed a joint venture with Giampaolo Group to purchase a 50% stake in Matalco, the leading secondary aluminium producer in North America.

To meet the growing demand for critical minerals, we are strategically investing in high-quality iron ore, copper, aluminium, lithium and scandium.

Iron Ore

With a planned investment of US$6.2 billion, we are developing the infrastructure to unlock the potential of our Simandou iron ore project. Once operational, Simandou will deliver 60 million dry tonnes of high-grade iron ore annually, significantly enhancing our iron ore product portfolio.

Additionally, the Rhodes Ridge project in Western Australia represents a promising opportunity to expand our iron ore production. We have approved a US$77 million pre-feasibility study to assess its development potential.

Aluminium

Our acquisition of a 50% stake in Matalco has strengthened our position as a leading aluminum producer. This partnership combines the strengths of North America's largest primary and secondary aluminum producers, enabling us to meet the growing demand for low-carbon products.

Our US$1.1 billion investment in expanding the AP60 smelter in Quebec demonstrates our commitment to producing low-carbon aluminum. This project, supported by the Quebec government, will use advanced technology to reduce carbon emissions.

We aim to increase disciplined capital growth to up to **US$3 billion** per year in 2024 and 2025 to fund strategic initiatives. This investment will not only drive shareholder value but also position us as a leading supplier of the critical minerals necessary for a sustainable future.

Copper

The Oyu Tolgoi underground mine in Mongolia is a cornerstone of our copper strategy. With the start of production, we have significantly enhanced our copper output. We are also expanding underground mining at Kennecott, targeting an additional 250,000 tonnes of copper production over the next decade. Additionally, our joint venture with First Quantum Minerals on the La Granja project in Peru will potentially unlock access to one of the world's largest undeveloped copper deposits.

Minerals

Our Rincon lithium project in Argentina is progressing towards production. A 3,000 tonnes per annum starter lithium carbonate plant is on its way while studies are underway for a full-scale operation. We also look forward to closing our acquisition of Arcadium, a world-class lithium business that will strengthen our position as a global leader in energy transition commodities.

Our acquisition of the Burra Scandium Project in Australia highlights our focus on emerging minerals. Scandium is a critical component in various advanced technologies, and this project aligns with our strategy of diversifying our portfolio and capturing growth opportunities.

“As a mining and processing company with a global footprint we have a key role to play in producing the materials the world needs to decarbonise.”

Jakob Stausholm
Rio Tinto Chief Executive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