



CLIMATE ACTION PLAN

PROGRESS
REPORT
2023

INSIDE

- A message from the CEO
- Emissions performance analysis
- Third-year report on climate actions
- Climate action on the ground

CLIMATE ACTION PLAN

PROGRESS REPORT 2023

CLIMATE ACTION PLAN OBJECTIVES



TECHNOLOGY PATHWAYS to reduce carbon emissions



TRANSPARENT REPORTING and informed advocacy



KNOWLEDGE SHARING and enhanced partnerships

EMISSIONS REDUCTIONS



SCOPE 1 EMISSIONS

Reduction in safeguard mechanism scope 1 emissions in FY22



SCOPE 1 & 2 EMISSIONS

Average reduction in NGERs scope 1 and 2 emissions in FY22



MCA MEMBERS

Full members reporting to National Greenhouse and Energy Reporting Scheme



1. NET ZERO BY 2050

MCA members announced ambition to achieve net zero emissions by 2050

MEMBER COMMITMENTS (% OF SURVEYED FY2020 EMISSIONS)



NET ZERO BY 2040

Emissions target of MCA's NGERs reporting members



NET ZERO BY 2050

Emissions target of MCA's NGERs reporting members



NET ZERO EMISSIONS

All MCA members support the Paris Agreement



2. TOWARDS SUSTAINABLE MINING (TSM)

MCA members adopted the TSM Climate Change Protocol

CLIMATE ACTION PLAN PROGRESS



CLIMATE SUBMISSIONS

Climate-related submissions to government in FY23



MEMBER ACTIONS

Showcased in this year three progress report



CAPITAL INVESTMENT

Announced climate capital spend 2020-2030



3. COST CONTAINMENT

Secured cost containment measure in new safeguard mechanism policy



IDENTIFIED RISKS

1. Impact of government policy changes
2. Changing stakeholder expectations
3. Market demands and fluctuations



IDENTIFIED OPPORTUNITIES

1. New energy technologies
2. Greater operational resilience and performance
3. Increased resource efficiencies

Resourcing tomorrow
Australian Mining



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Committed to change

Australian mining has made substantial progress in the three years since the MCA launched the Climate Action Plan.

In June 2020, the Australian minerals sector strengthened its commitment to climate action with the launch of the Climate Action Plan to highlight the sector's efforts to decarbonise and address climate change.

The 2020-2023 plan outlined a series of actions focused on three key themes:

- Support developing technology pathways to achieve significant reductions in Australia's greenhouse emissions
- Increased transparency on climate change related reporting and informed advocacy
- Knowledge sharing of the sector's responses to addressing climate change.

This progress report marks the completion of the initial three-year work program identifying new prospects, accelerating existing action and creating lasting pathways towards the industry ambition of net zero emissions by 2050.

The shadow cast by the COVID-19 pandemic did not deter the sector from progressing the implementation of this plan.

In this report, the MCA is pleased to show that the industry emissions trend line has continued downward – reflecting the ongoing focus to reduce emissions across the sector.

The sector continues to keep emissions down while supporting Australian jobs, and royalties and taxes, to state and federal governments.

In FY22, MCA member facilities' scope 1 emissions reported to the safeguard mechanism were more than 9 per cent lower than in FY18, while total safeguard mechanism emissions have remained basically flat.

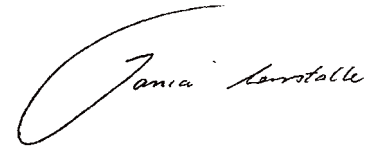
In the National Greenhouse and Energy Reporting scheme (NGERs), MCA member's scope 1 and 2 emissions fell by over 7 per cent in FY22 while total NGERs reporting entities emissions fell by 2.1 per cent.

On 1 July 2023, the federal government's new safeguard mechanism came into effect. This is particularly relevant for Australia's resources sector which represents around 40 per cent of safeguard mechanism emissions and over two-thirds of Australia's total exports.

In this report, the MCA again showcases member announcements and activities – from deploying renewable energy, to working with customers in the development of technologies to reduce emissions along the supply chain, to progressing vital technologies such as carbon capture usage and storage (CCUS).

Having established a strong base, Australia's mining industry will continue to progress climate action initiatives and report regularly on progress.

I commend our member companies for their support in implementing the Climate Action Plan.



Tania Constable
Chief Executive Officer
Minerals Council of Australia



Emissions performance analysis

To June 2022 (FY22)

Between July 2020 – June 2021 (FY21) and July 2021 – June 2022 (FY22) MCA member companies continued to adopt and invest in low emissions technologies. These efforts have helped keep FY22 scope 1 emissions down and below FY18 emissions levels.

This emissions analysis uses mining-related emissions associated with MCA full members' facilities under the safeguard mechanism and reported corporate level emissions under the National Greenhouse and Energy Reporting scheme (NGERs).

The result for MCA member companies is partly explained by continuing COVID-19 and weather-related impacts on production. The emissions analysis was rebased in FY22 due to changes in MCA membership. These changes were backdated to prior reporting years to ensure consistency between reporting periods and transparent accounting for MCA membership changes.

The safeguard mechanism applies to facilities with scope 1 covered emissions of more than 100,000 tonnes of carbon dioxide equivalent (CO₂-e) per year.

The National Greenhouse and Energy Reporting scheme is a single national framework for reporting and disseminating company information about greenhouse gas emissions, energy production, energy consumption and other information. NGERs uses a facility threshold of 25,000 tonnes of CO₂-e (scope 1 and 2) and a corporate group

threshold of 50,000 tonnes CO₂-e (scope 1 and 2). Additionally, there are energy production and consumption thresholds that trigger reporting.

Safeguard mechanism

Across all facilities in the safeguard mechanism, emissions were 137.5 MtCO₂-e in FY22, which is an increase of 0.8 MtCO₂-e on the 136.9 MtCO₂-e reported in FY21 and below the Government's anticipated safeguard mechanism reform starting volume (1 July 2023) of 143 MtCO₂-e.

Over the period between FY21 and FY22, MCA member companies continued to adopt and invest in new low emissions technologies and these efforts have helped to keep emissions down with FY22 emissions 9.3 per cent below FY21 emissions compared to an increase of 0.6 per cent for all facilities in the safeguard mechanism.

National Greenhouse and Energy Reporting scheme (NGERs)

During FY22, total emissions reported under NGERs fell by 2.1 per cent. This includes both scope 1 and 2 from all NGERs reporting entities, including MCA members. For MCA members, mining activity's total emissions (scope 1 and 2) fell by 7.8 per cent.

Figure 2 shows the year-on-year changes in emissions for MCA members reporting under NGERs split by emissions scope. In FY22, member emissions fell while exports, state royalties and corporate taxes all continued to rise significantly.

In FY22, MCA member scope 1 emissions fell by 9.3 per cent while mining royalties and company taxes more than trebled.



9.3%▼

SCOPE 1 EMISSIONS

Reduction in safeguard mechanism scope 1 emissions in FY22



7.8%▼

SCOPE 1 & 2 EMISSIONS

Average reduction in NGERs scope 1 and 2 emissions in FY22

Figure 1

MCA MEMBER SAFEGUARD MECHANISM TRENDS

All facilities, FY18 base year = 100

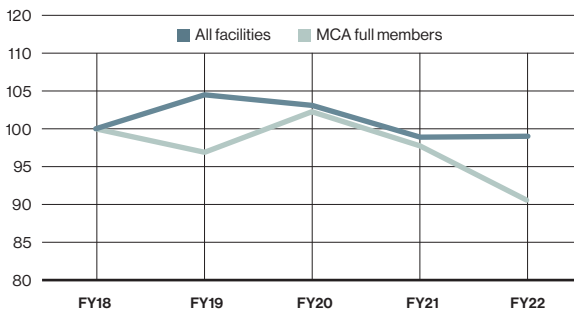


Figure 2

MCA MEMBER NGERS GHG EMISSIONS

Annual % change

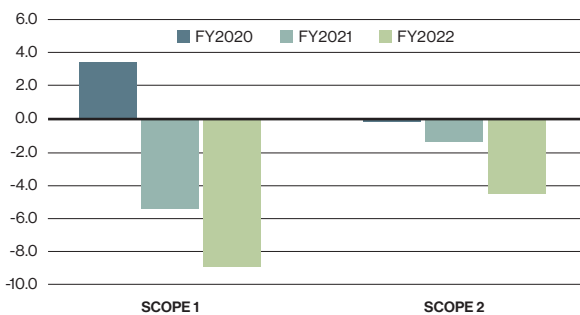
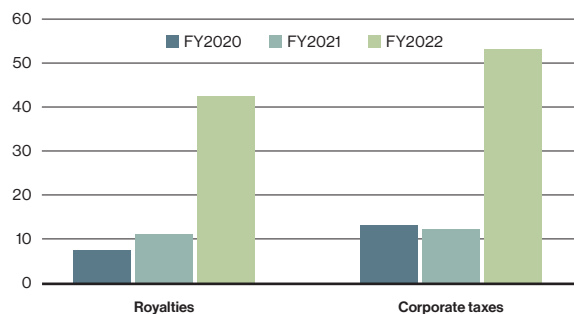


Figure 3

MINING SECTOR ROYALTIES & COMPANY TAXES

YoY% change



New safeguard mechanism policy
Effective 1 July 2023

Changes to the safeguard mechanism came into effect from 1 July 2023. The new policy aims to reduce facility baselines 'predictably and gradually over time' to provide a supportive policy framework for industry's own commitment to net zero by 2050.

Previously, facilities needed to operate within emissions baselines in accordance with established methodologies. Baselines were focused on minimising increases in emissions intensity and not on forcing aggregate reductions. Although rare, where facilities exceeded their baselines, they had to procure Australian Carbon Credit Units (ACCUs) as offsets for compliance.

The amended safeguard mechanism is a substantial change. Facilities will need to develop technologies and processes to reduce their emissions or face rising carbon offset costs. The changes also enable the Clean Energy Regulator to issue safeguard mechanism credits (SMCs) to facilities operating below their baselines to use for future compliance or to trade to facilities.

During the consultation phase, the MCA successfully advocated for the inclusion of a price management mechanism to ensure facilities were not exposed to unlimited upside price risk. This aligns the SGM with best practice in comparable international schemes. Analysis of the ACCUs market suggested potentially significant supply shortfalls could cause speculative demand, higher prices and a higher risk of carbon leakage. Aligning the SGM with other international schemes limits this risk.

Throughout the consultation, the MCA emphasised the industry's ambition to work towards net zero by 2050, and to engage constructively in implementing sustainable changes to the safeguard mechanism. The MCA focused on ensuring that costs were managed, that the scheme maintained the government's commitment to keeping Australian industry competitive, and that facilities were not forced to close and see emissions 'leak' overseas.

Third-year report

Themes and actions

1 Developing technology pathways to achieve significant reductions in Australia's greenhouse gas emissions

Encouraging substantial investment across a broad range of low-emissions technologies.



The action

Enhance national and global discussions on low emissions technologies and report on the potential of innovative mitigation and adaptation technologies.

Status report

- External consultants were commissioned to survey key technologies needed to reduce emissions in mining and inform member planning.
- The work undertaken led to an increased understanding of likely timelines for the development and availability of emissions reducing technologies.
- Discussions with investor groups and the finance community occurred to better understand challenges and opportunities in the transition.
- Advocacy for clean energy technologies such as nuclear energy and carbon capture use and storage has been critical to support and encourage all low emissions technologies.



The action

Define a greater role for the minerals sector in the global and national transformation to lower emissions.

Status report

- Continued member support for renewable energy development through Purchasing Power Agreements (PPAs) and partnering has flourished through the plan period.
- Member engagement and agreement making with battery and EV producers is well underway for supply of minerals and metals.
- Strong industry advocacy for critical minerals exploration and development in Australia and the need for enabling policy development has ramped up.
- Made a submission to the government's Critical Minerals Strategy Discussion Paper calling for clear policy settings that improve investment conditions for mining in general - and critical minerals in particular.



The action

Support the development of policies and technologies to achieve least-cost abatement in order to help meet the net zero emissions goal of the Paris Agreement and maintain the competitiveness of energy-intensive and trade exposed sectors.

Status report

- Constructive engagement with Commonwealth government departments and agencies on the development of the National Reconstruction Fund and Powering the Regions Fund.
- Engagement included submissions to inquiries and appearances before Parliamentary committees.
- Supported wide remit for ARENA, access to international abatement and mapped the major innovation and research initiatives.
- Commissioned work for members on timelines for key mining emissions technology availability such as electric trucks and methane abatement.

2 Increased transparency on climate change reporting and informed advocacy

Providing timely, accurate and reliable information to enhance members' capacity to act.



ACTION 4

The action

Understand the opportunities and risks of net zero emissions for the Australian minerals sector having regard to the Australian Government's commitments under the Paris Agreement and the aspirations set by the states and territories.

Status report

- Engagement with media on the critical minerals opportunity for Australia and the necessary reforms for Australia to develop its resources and enable the global transition.
- Extensive modelling to understand the economics of the transition, including modelling of the NEM to understand the potential for electrification and reducing scope 1 emissions.



ACTION 5

The action

Build the capacity of Australia's minerals sector relating to climate-related financial disclosures (including from the Taskforce on Climate-related Financial Disclosure).

Status report

- Held multiple climate-related financial disclosure webinars for members which included presentations by experts.
- Provided submission to Treasury Department's consultation on Climate-Related Financial Disclosure supporting alignment with TCFD, mitigating regulatory burden and seeking efficiencies and minimal duplication.



ACTION 6

The action

Share member company approaches to scenario analysis and how it is strategically used within the sector to address climate related opportunities and risks.

Status report

- Development of the Towards Sustainable Mining climate change protocol establishes a transparent reporting template.
- Regular quarterly meetings of the MCA Energy and Climate Change Committee to share company learnings, the results of studies on the evolving electricity system and other policy developments.



ACTION 7

The action

Engage in ongoing development of current policies including the safeguard mechanism.

Status report

- Constructive engagement with Department of Climate Change, Energy, the Environment and Water on changes to the safeguard mechanism.
- Extensive modelling including understanding comparable international schemes and how projections for the Australian offsets market needed to be addressed in the scheme changes.

3 Knowledge sharing of the sector's responses to addressing climate changes

Improving members' understanding of global climate change initiatives and partnerships.



The action

Showcase commitments and practices in mining operations.

Final report

- MCA website now features member actions and activities focused on emissions reduction, technology development, partnerships and renewable energy support.
- Climate Action Plan annual reporting has showcased member actions on the ground reflecting the diversity of activity underway
- Submission to the government's National Climate Resilience and Adaptation Strategy.

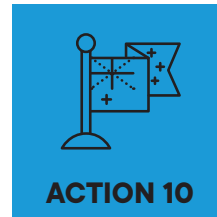


The action

Lead discussions on the opportunities of commodity stewardship.

Final report

- A report was commissioned and supplied to members as a primer on blockchain opportunities in mining.
- A workshop on circular economy was held with members and a report is under development.
- Supported consultation on the design of the \$1 billion Value-adding in Resources Fund in the National Reconstruction Fund in a submission to the government's critical minerals discussion paper.



The action

Positively engage in relevant climate agendas and public consultation processes including UNFCCC, Sustainable Development Goals (SDGs) and Intergovernmental Panel on Climate Change (IPCC), as well as collaboration with relevant organisations.

Final report

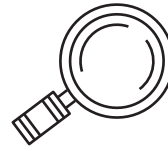
- Obtained observer status to the Intergovernmental Panel on Climate Change.
- Engagement with the federal government on potential participation at COP28 in the United Arab Emirates to showcase Australia's critical minerals opportunity.
- Ongoing collaborations with Australian Industry Greenhouse Network (AIGN) and other organisations involved in climate policy, carbon trading market development, and low emissions technology development.

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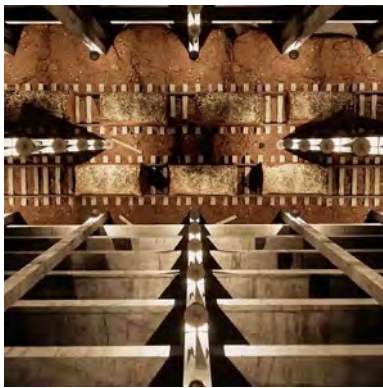
PROGRESS REPORT 2023

...on the ground

Case studies



- Gravitational energy
- Mine electrification
- Climate planning
- Renewable energy
- Fuel swapping
- Carbon capture
- Autonomous haulage
- Pumped hydro

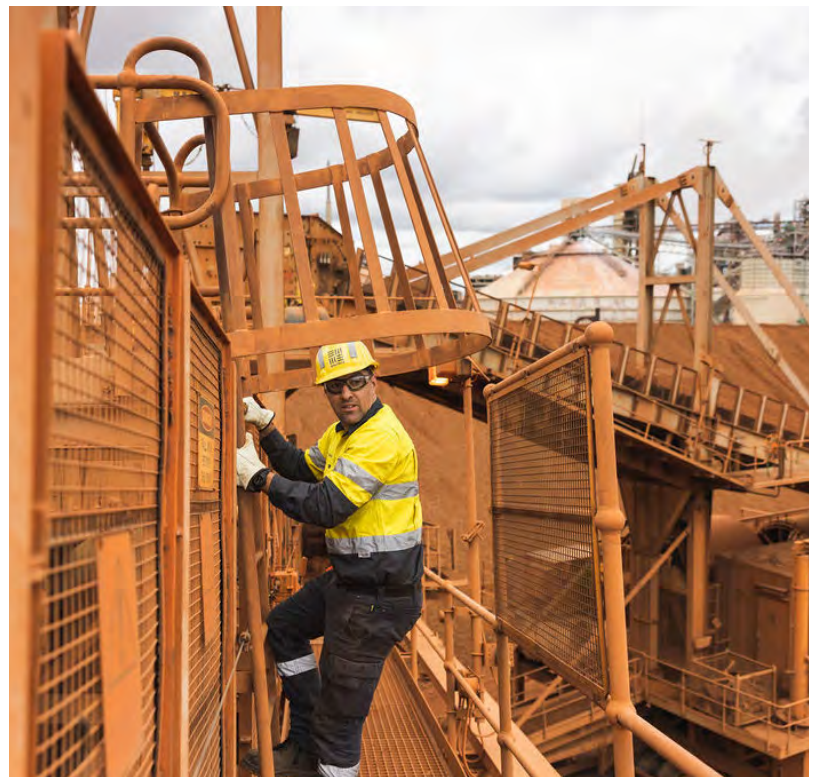


Gravitational energy

Disused shafts a possible energy storage solution

Yancoal has partnered with Green Gravity to study the application of its innovative energy storage technology at the former Astar coal mine in NSW. A pre-feasibility study will investigate the use of decommissioned ventilation shafts for renewable energy storage.

In preparing the study, the team will assess the potential for Green Gravity's gravitational energy storage technology to provide long-duration energy storage to the NSW electricity grid. The study will also assess how gravitational energy storage can assist in delivering beneficial post-mining land use.



Industrial heat

Operational efficiencies support decarbonisation plans

South32's Worsley Alumina is pursuing initiatives to reduce operational demand for steam and improve efficiencies through more effective use of industrial heat. As well as reducing water consumption, these initiatives could reduce the operation's CO₂ emissions by between 10 and 20 per cent.

A dilution reduction project which began last year reduces energy

demand through evaporation in the Bayer process at the refinery. Once fully commissioned, this project has the potential to abate more than 80,000 tonnes of CO₂-e per year.

Further energy efficiency and energy conversion projects are being studied as Worsley Alumina pursues longer-term energy transition solutions focused on electrification and renewable energy.

Reducing diesel use in mining

Electric mining

Collaboration with third parties is one way the mining industry is developing the innovative technologies needed to shape the processes, technology and infrastructure to support the mine sites of the future.

Miners and original equipment manufacturers (OEMs) have collaborated over decades to develop high-tech equipment of a scale that could only be dreamt about a few short years ago.

The diesel engine and diesel fuel have been fundamental to much of that innovation and have enabled the scaling up of equipment and operations to meet the demand for minerals and metals needed to build modern industrial societies.

In Australia, CO₂ emissions in mining operations from diesel equate to around 8 million tonnes per annum and mining companies and OEMs are collaborating on solutions to reduce these emissions as fast as possible.

Electrification is considered to be a game changer for the mining industry as it drastically reduces emissions and exposure to diesel particulates underground, as well as being a key technical foundation for the automation of mining equipment.

The challenge

In an electrified mining operation, everything is more interdependent. Today, machines are refuelled every 12 to 24 hours. In the future, energy management will be monitored to the minute in a highly integrated and well-orchestrated system.

Fuel stations will be replaced with battery chargers, and dynamic energy transfer solutions will be capable of delivering energy to equipment without interrupting production.

The smart electrified mine will see energy used to get a truck to its assigned load zone, navigating the mine site, and perhaps even charging the machine as it travels uphill with trolley assist technologies.

Remote operators and sensor technologies will manage the battery in real time as the truck dumps its load before making a stop at a stationary charger for a quick charge rather than waiting in the queue at the shovel.

Key developments

MCA associate member Komatsu is developing a truck where the power source can be upgraded over the life of the chassis.

Komatsu's existing ↗
diesel-electric dump truck.





➤ Komatsu's MC51 all electric hard rock continuous miner designed and built in Australia.



➤ Komatsu's autonomous haul truck concept (above), and hybrid drive excavator (below).

Komatsu has worked to reduce greenhouse gas emissions in mining for decades. Products such as electric drive haul trucks, electric power shovels and technologies such as regenerative storage capabilities and fuel saver programs have led to reductions in emissions intensity to-date.

And while diesel engines are getting cleaner and more efficient, Komatsu is also developing more sustainable alternatives.

Komatsu has a long history in electrification with diesel-electric drive dump trucks, electric mining excavators, electric rope shovels, electric drag lines, diesel-electric wheel loaders, electric underground mining machines and diesel-electric load haul dumps (LHDs).

The addition of a pantograph at the front of a truck can allow it to run on electricity on portions of its route. This is particularly helpful on inclines where more power is needed.

Further, battery power in haulage is also developing rapidly.

Truck designs in development are equipped with battery power instead of a diesel engine. In the future, power can come from diesel engines, electricity from a pantograph, a battery power with a pantograph, or hydrogen fuel cells.

Propulsion technology is developing rapidly, but with the truck being so well built that it can last over 20 years, there is understandable operator concern regarding obsolescence. For this reason, the truck is designed as a development platform for power agnostic haulage allowing for changes in the power source going forward. Komatsu envisages upgrading the power source over time with the truck adapting as power technology evolves.

Komatsu trucks have been designed around electric drives since the 1960s allowing the chassis and the electric drive train to remain in place

as the power source is changed out. It has nearly 1500 Electric Drive trucks operating in Australia.

The engine module is designed such that it can be disconnected and slid out of the front of the machine for easier and faster repair, overhaul and replacement. This modularity concept approach is driving the innovation to upgrade the power source.

Komatsu is working with major customers to develop its power agnostic truck concept. MCA members BHP, Rio Tinto and Anglo American have joined other international companies in Komatsu's Greenhouse Gas (GHG) Alliance. Companies will provide site data, analysis and feedback as the truck evolves. Komatsu's power agnostic truck, which until now has been undergoing testing at the company's proving grounds in Arizona, will have its first global customer trials take place in Australia within the next two-three years, with a goal of commercial offering towards the end of the decade.



CASE STUDIES

Electric drilling

Olympic Dam trials its first fully electric underground 'Jumbo'

BHP is trialling its first fully electric 'Jumbo' at Olympic Dam to support its emissions reduction targets and minimise reliance on diesel.

The 28.7 tonne, 14.5 metre long Epiroc Boomer M2 is powered by a 150 kW traction motor and 150 kW battery system and is being tested for efficiency, productivity and comfort over a 12-month period.

Jumbos are used in underground mining to drill holes which are then loaded with explosives to open up new areas for mining. Post-blasting Jumbos are used to install large bolts

to stabilise mine walls. BHP currently operates 16 Epiroc Jumbos at Olympic Dam in South Australia.

The Jumbo is also breaking new ground in its user experience by reducing noise and vibration, and eliminating heat and the emissions of diesel particulate matter.

BHP has a medium-term target to reduce operational CO₂ emissions by at least 30 per cent by FY2030, from an FY20 baseline. Around 40 per cent of BHP's operational emissions in its FY20 baseline year came from diesel-powered vehicles.



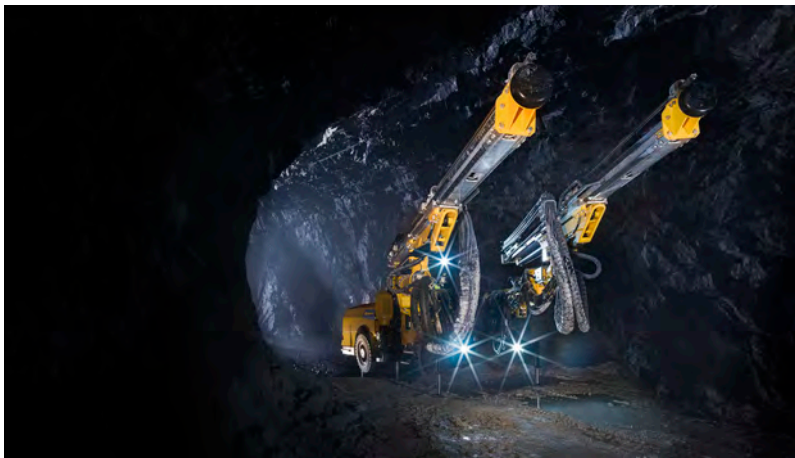
Climate adaptation planning

Risk mitigation through climate planning

One pillar of Newmont's Energy and Climate Strategy is to adapt its mining operations and support host communities prepare for and mitigate physical impacts related to climate change.

Newmont began climate adaption planning in 2022, partnering with ENGIE Impact consultants to formulate site-specific plans.

Newmont has completed three of four steps in its Climate Change Adaptation Planning Guideline – screening, climate impact analysis, and risk and opportunity assessments. Adaption planning is the fourth, which will address high priority risks and opportunities.



Mine electrification

Perenti collaboration on mine electrification solutions

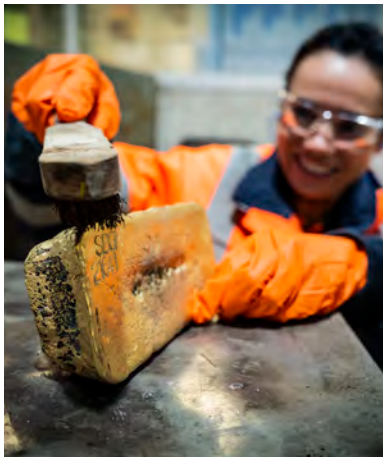


Perenti signed an agreement in November 2022 with global technology company ABB to explore approaches to support net zero emissions targets for underground and open-pit mines. Working together, experts from both companies will address electrification in hauling operations, power distribution, energy efficiency and power management.

The collaboration will explore business models and solutions to provide wider services for pilot, brownfield and greenfield mining

projects to support electrification, and was recently awarded its inaugural contract to undertake a study for the full underground electrification of a nickel project.

All aspects of electrification will be considered including mine design optimisation, production and operating philosophy, fleet selection, power distribution and electrical infrastructure design, electrification system and battery management, ESG and safety impact analysis, as well as cost modelling.



Emissions reduction

Gold producer targets 30% CO₂ reduction by 2030

AngloGold Ashanti announced a carbon emissions reduction target that aims to achieve a 30 per cent absolute reduction in its Scope 1 and 2 Greenhouse Gas (GHG) emissions by 2030 through a combination of renewable energy projects, fleet electrification and lower-emission power sources.

Approximately 60 per cent of the planned emissions reductions will come from large renewable energy projects, including wind and solar projects at the company's Australian operations and solar power plants in both Guinea and Ghana.



Renewable energy

Rio Tinto invests in renewable assets for the Pilbara

Rio Tinto is investing in renewable energy assets to decarbonise its Western Australian iron ore operations.

Rio Tinto is working to develop 1 GW of renewable energy assets, a mix of solar, wind and storage, in the Pilbara by 2030.

These efforts are part of a global commitment to invest approximately \$7.5 billion to halve scope 1 and 2 emissions by 2030.

Initial funding has been approved for a 100 MW solar photovoltaic system, and associated transmission infrastructure, on the Pilbara coast.

Catalyst abatement

Technology first to reduce manufacturing emissions



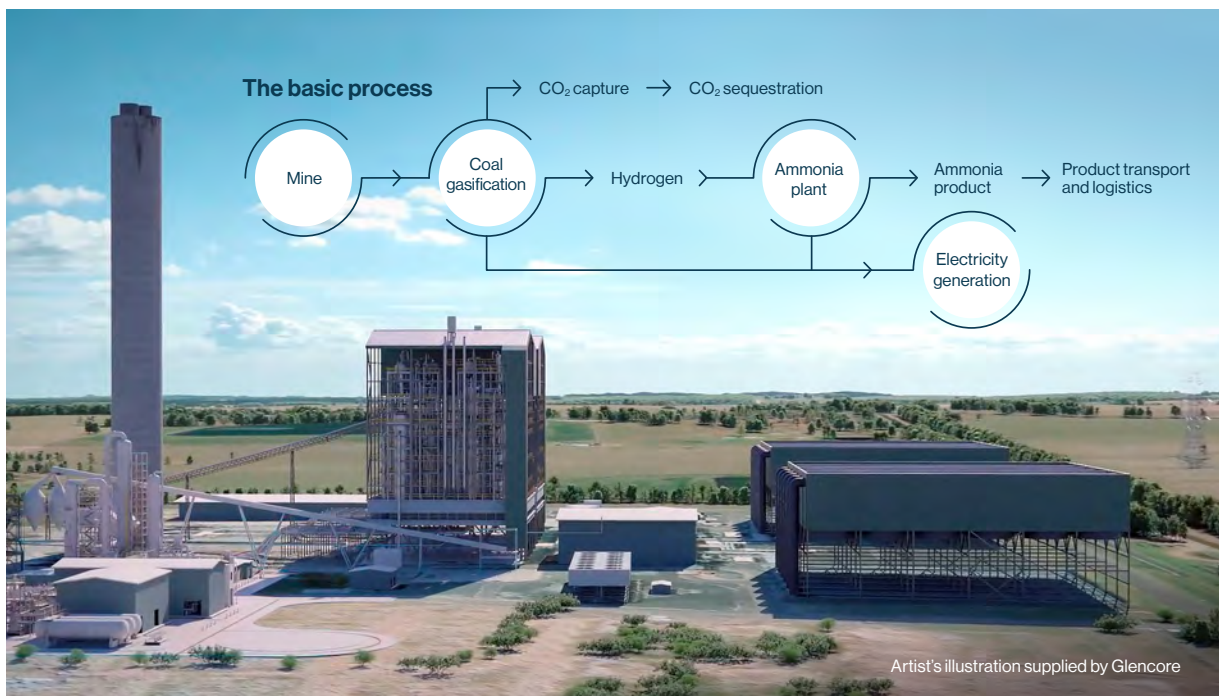
Orica is rolling out an Australian first emissions reduction technology across its manufacturing sites at Newcastle and Gladstone.

Kooragang Island Decarbonisation Project in NSW aims to eliminate at least 567,000 tCO₂-e per year from the site's operations and 11 per cent of Australia's total chemical industry process emissions.

The tertiary catalyst abatement technology has been installed at Newcastle and is expected to reduce the site's total emissions by 48 per cent.

The same technology will be deployed at Yarwun manufacturing facility in Gladstone, Queensland. This project is estimated to reduce scope 1 emissions from the site by 200,000 tCO₂-e per year.

➤ Minister for Climate Change and Energy Chris Bowen (centre) with Orica CEO Sanjeev Gandhi and NSW Minister Jennifer Aitchison.



Artist's illustration supplied by Glencore

Carbon capture and storage

Glencore investigates clean hydrogen project using coal and CCS in Queensland

Glencore is investigating a clean hydrogen and ammonia project using coal as a feedstock, and carbon capture and storage (CCS), to permanently sequester emissions from the process in a repository in Queensland. The project is currently at an early, pre-feasibility stage.

To produce hydrogen from coal it needs to be gasified above ground to create syngas which is then processed to make hydrogen (H₂) and then ammonia (NH₃). Ammonia, which is a hydrogen carrier, can then be economically and safely stored and transported to domestic and international customers.

The project is to be located near the Wandoan coal resource about 400 km north-west of Brisbane, with captured CO₂ emissions transported via pipeline to the permanent storage site.

Glencore is investigating the potential use of a relatively small portion of the Wandoan coal resource (up to 4 Mt per annum) to produce clean

hydrogen and ammonia, with the intention to capture approximately 90 per cent of CO₂-e emissions from this process.

Glencore does not plan to develop the Wandoan coal resource as a traditional coal mine, but the resource is ideal for hydrogen production. It has a low strip ratio and coal properties suited to above-ground gasification.

The development timeline envisages pre-feasibility studies being completed in 2023 with front-end engineering and design 2024-2027; detailed design 2027-2029. Subject to positive approval decisions at each stage, construction would commence in 2029 with commissioning in 2032.

Both the hydrogen and carbon storage projects will require state and commonwealth government approvals, including a detailed Environmental Impact Statement.

Glencore's initial investment of A\$40 million will fund pre-feasibility

studies. The project could be an important bridge enabling broader uptake of clean hydrogen technology in Australia and globally, while at the same time providing a range of socio-economic opportunities for the surrounding region.

Recent estimates from the International Energy Agency and the US Department of Energy suggest that currently, hydrogen produced from natural gas, without CCS, costs around US\$0.80-\$1.70 per kg, (depending heavily on gas prices) or around \$15 per GJ. CCS is estimated to add around \$0.50 per kg. Coal based production with CCS is estimated at \$2-3 per kg.

Meanwhile, producing hydrogen from electrolysis using low-carbon power is currently around US\$3 - \$8 per kg, based on around 60 kWh of power demand per kg H₂. There are projections of cost reductions as electrolyzers are deployed more widely and the potential for renewable power costs to reduce further.



Electric vehicles

EV studies drive electrification at Newcrest

Newcrest Mining has completed electric vehicle trade-off studies for its Cadia and Haverton mining operations, and begun a hybrid haul dump loader trial as a potential transition technology.

Newcrest will also implement an electric road train trial at Telfer and has begun planning for a second electric light vehicle trial at Cadia. The company is also progressing wind resource monitoring for inclusion in the Telfer/Haverton renewables concept study.

Newcrest continues to work on Scope 3 emissions, developing approaches to mitigate and adapt as the industry transitions to a lower-carbon future.

Fuel swapping

Renewable fuel trials underway at Yandi iron ore



BHP's Yandi iron ore mine is trialling the use of hydrotreated vegetable oil (HVO) to help power mining equipment in Western Australia.

Supplied through a collaboration with BP, the renewable diesel made from HVO will be used in haul trucks and other mining equipment over an initial three-month trial period. About 40 per cent of BHP's operational

greenhouse gas emissions come from using diesel fuel, and this is a core focus of the company's decarbonisation strategy.

Ultimately, the aim is to have fully electric trucking fleets at sites, but alternative fuels like HVO may help reduce emissions in the meantime while the electrification transition takes place.



100% renewable

Green energy puts Anglo American on path to carbon neutrality by 2040

Anglo American has sourced the supply of 100 per cent renewable electricity for its Australian operations from 2025, agreeing terms for a 10-year partnership with Stanwell Corporation, the Queensland Government-owned provider of electricity and energy solutions.

The deal effectively removes all scope 2 emissions from Anglo American's steelmaking coal business in Australia from 2025. The partnership with Stanwell

Corporation, linked to two major wind and solar projects in Queensland, is a big step towards Anglo American's target of carbon neutral operations in Australia – and globally – by 2040.

Anglo American will support Stanwell Corporation in its investment in 650MW of renewables capacity for Queensland. The partnership underwrites two major investments – Clarke Creek Wind Farm in Central Queensland, and Blue Grass Solar Farm near Chinchilla.

CASE STUDIES



Autonomous haulage

Autonomous trucks reduce mining footprint

Rio Tinto and Scania have established a long-term research and development collaboration agreement to develop more agile autonomous haul trucks to pursue potential environmental and productivity benefits.

Under the agreement, Rio Tinto's Channar mine has become the first active partner site for Scania's autonomous mining solution. The partnership also includes options for the future transition to electric-powered vehicles.

As well as potential decarbonisation benefits, this partnership provides a path to potential productivity improvements, and creates optionality across Rio's diverse portfolio.

Pumped hydro

Post-mining energy hub being explored

Yancoal has identified Stratford Mining Complex (SMC) as an ideal location to establish a renewable energy hub post-mining. The proposed post-mining land use has the potential to provide continued investment in the Gloucester Valley.

SMC is an existing open cut coal mining complex located



Emissions reduction

Energy consumption the focus of emissions reduction at Mt Weld

Lynas Rare Earths is working to reduce energy consumption and emissions and improve operational efficiency throughout its operations.

Lynas completed an assessment of renewable energy options to support its approximately \$500 million project to expand capacity at the Mt Weld mine and concentration plant to meet the accelerating demand for rare earth materials and reduce reliance on diesel power generation.

Under the proposed plan, the thermal baseload will be supplied by a gas then hybrid renewable power station with renewable penetration capability

from a mixture of solar, wind and battery energy storage systems to enable a total installed power of over 60 megawatts.

At Mt Weld, diesel is consumed in mining machines and other vehicles, processes and used to generate electricity. During FY22, the processing flowsheet significantly reduced the heating requirements of the flotation circuit through the utilisation of diesel as a reagent (not combusted).

This new Mt Weld processing flowsheet reduced energy demand by the equivalent of taking 515 cars off the road per year.





Solar energy

First large-scale solar battery project to power Port Hedland port facilities

Emissions are expected to halve at BHP's iron ore port facilities in Port Hedland by the end of 2024, with a large-scale renewable Power Purchase Agreement (PPA) with Alinta Energy enabling the construction and connection of a 45MW solar farm and 35MW battery energy storage system into Alinta Energy's existing Port Hedland power station.

Once completed, it is expected that 100 per cent of average day time energy requirements for BHP's

port facilities will be powered by solar, with the remaining power requirements met through the integrated battery energy storage system and access to Alinta Energy's existing gas fuelled power station facilities.

BHP is the foundation customer of Alinta's solar battery hybrid project, which is expected to be the first large scale renewable facility at Port Hedland and will support the expansion of the renewable energy industry in Western Australia.

New technology

Whitehaven explores microbial algae to turn CO₂ into usable products

Whitehaven is investing in emerging emissions reduction technologies for Scope 1 emissions. One such technology is a process owned by Hydrobe Pty Limited (Hydrobe) in which Whitehaven is a significant investor.

Hydrobe has a world-patented process to run industrial emissions through chambers of specially selected microbial algae and bacteria that turn CO₂ into saleable products

including fertiliser, green hydrogen and syngas.

Whitehaven is considering the application of this technology to mine sites and to end users of its products.

The difference in the Hydrobe approach to decarbonisation is that the company's patented biological process converts CO₂ without generating new CO₂. That is, Hydrobe's energy requirements are generated from biological reactions.

Green steel

New study to pilot an electric smelting plant

BHP has initiated a study to design an electric smelting furnace (ESF) pilot plant. The ESF would aim to demonstrate a pathway to lower CO₂ intensity in steel production and would support a decision to construct a facility in Australia.

A small-scale demonstration plant would be able to enable steel producers and technology providers to generate and share learnings with the aim of accelerating a scaling up of ESF plant designs.



Carbon capture

Pilot CCUS trial set for leading steel maker

BHP will pilot carbon capture and utilisation technology (CCUS) with one of the world's largest steelmakers, and its own major iron ore customer, HBIS Group in China.

The pilot CCUS project will develop and test technologies that can be integrated into steel production processes to reduce CO₂ emissions. Technologies will include vacuum pressure swing adsorption, an alternative technology to capture CO₂, and two utilisation technologies (slag mineralisation and biological conversion to protein) to sequester associated CO₂.

Renewable energy

Orica on track to be powered by 100% renewable electricity

Orica has taken another step towards achieving its net zero ambition by 2050, by announcing it will source 100 per cent renewable electricity by 2040, with an interim step of 60 per cent by 2030.

Orica has entered into a Power Purchase Agreement (PPA) with Lightsource bp for renewable electricity generated by its Wellington North solar farm.

The Wellington North solar farm will supply around 50 per cent of Orica's Australian electricity needs, reducing Orica's global Scope 2 emissions by

over 60,000 metric tonnes of carbon emissions annually.

Globally, Orica's proportion of electricity sourced from renewables will be around 30 per cent once Wellington North is fully operational.

This latest commitment builds on Orica's target to reduce scope 1 and 2 GHG emissions by at least 40 per cent compared with 2019 levels, by 2030 and further signals Orica's intent to further decarbonise its operations and enhance its competitiveness in a lower carbon economy.



Hybrid energy

Major new wind and solar plant to power Tropicana

AngloGold Ashanti Australia has announced plans to build one of the largest renewable energy projects in Australia's natural resource sector. Construction of the plant is expected to start later this year, with the project due for completion in early 2025.

The 62 MW hybrid wind and solar plant will be built and operated by Pacific Energy. Pacific Energy owns and operates the existing gas-fired power station at the mine.

As well as improving energy security at Tropicana, located 330 kms east-northeast of Kalgoorlie, the hybrid energy project will also significantly reduce natural gas consumption at the gold mine.



Rail fleet

Aurizon fleet decarbonisation actions underway



Aurizon is deploying current and near-term solutions to reduce the carbon footprint of its rail fleet while advancing research to deliver on the company's 2050 net zero emissions target.

Aurizon will invest \$50 million and is working with partners to develop and trial battery and hydrogen technology projects aimed at reducing emissions from rail transport supply chains.

In 2023, Aurizon commenced a project

with Progress Rail, a Caterpillar company, to develop a battery electric locomotive by retrofitting and replacing the diesel engine of an existing locomotive.

This will be the first freight locomotive assembled in Australia powered by batteries, allowing the potential future use of totally renewable energy sources for freight hauls. It will also capture regenerative energy that is created when trains brake or travel downhill.

CLIMATE ACTION PLAN PROGRESS REPORT 2023

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September 2023

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