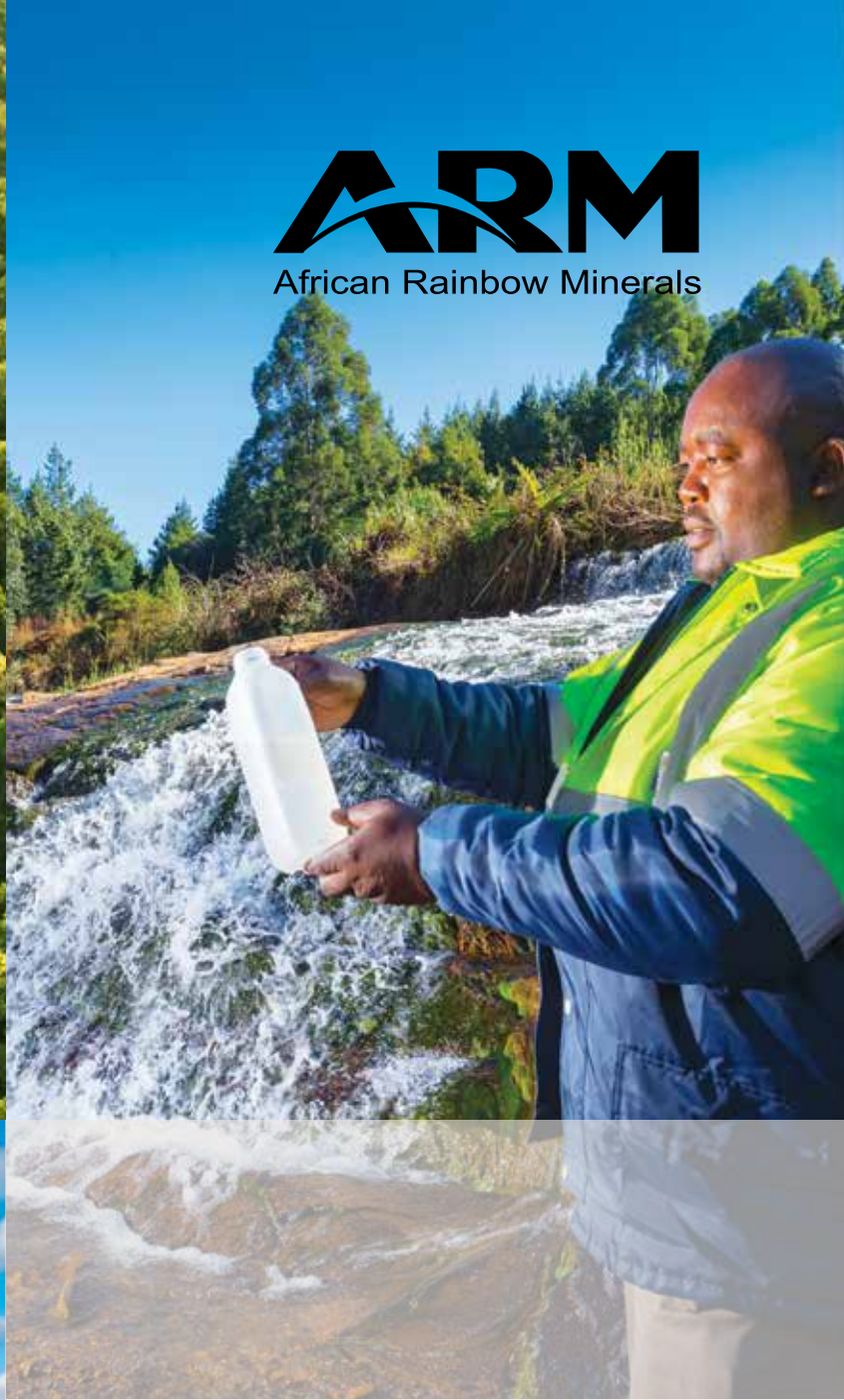




ARM
African Rainbow Minerals



**Report on
climate change
and water**

2021

African Rainbow Minerals (ARM) is a **leading South African diversified mining and minerals company** with operations in South Africa and Malaysia. ARM mines and beneficiates iron ore, manganese ore, chrome ore, platinum group metals (PGMs), nickel and coal and also has a strategic investment in gold through Harmony Gold Mining Company.



Information available on our website



Information available elsewhere in this report

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All monetary values in this report are in South African rand unless otherwise stated. Rounding may result in computational discrepancies on management and operational review tabulations.

All photographs were taken prior to the onset of Covid-19 and thus may include people without masks.

Our 2021 suite of reports

IAR

2021 integrated annual report

A holistic assessment of ARM's ability to create sustainable value, with relevant extracts from the annual financial statements, the environmental, social and governance (ESG) report and Mineral Resources and Mineral Reserves report.

AFS

2021 annual financial statements

The audited annual financial statements have been prepared according to International Financial Reporting Standards (IFRS).

ESG

2021 ESG report

A detailed performance on our key environmental, social and governance matters. The ESG report includes the full remuneration report and should be read in conjunction with the GRI Index.

CCW

2021 report on climate change and water

A detailed performance on our key climate change and water matters, in line with the TCFD and TPI frameworks.

KING

2021 King IV™ application register

A summary of how ARM implements the principles and practices in King IV to achieve the governance outcomes envisaged.

MRMR

2021 Mineral Resources and Mineral Reserves report

In line with JSE Listings Requirements, ARM prepares Mineral Resources and Mineral Reserves statements for all its mining operations as per SAMREC guidelines and definitions (2016).

AGM

2021 notice to shareholders

- Notice of annual general meeting
- Form of proxy
- Commitment to good governance
- Board of directors
- Report of the audit and risk committee
- Report of the social and ethics committee chairman
- Summarised remuneration report
- Summarised directors' report
- Summarised consolidated financial statements

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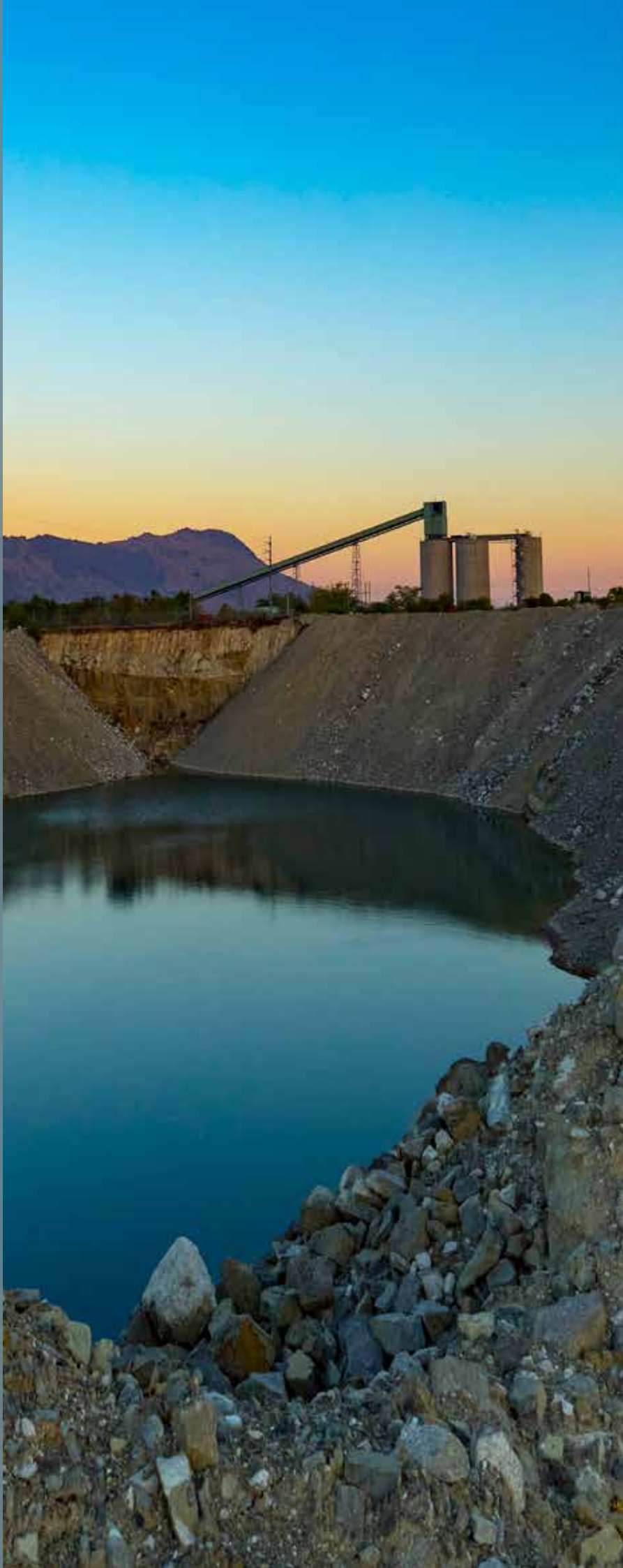
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About this report

ARM's 2021 report on climate change and water offers detailed insight into our initiatives to improve our performance and reporting on climate change and water management.



About this report

ARM's 2021 report on climate change and water offers detailed insight into our initiatives to improve our performance and reporting on climate change and water management. It should be read with our 2021 integrated annual report and our 2021 environmental, social and governance (ESG) report, which are available on our website at www.arm.co.za.

In this report, we only deal with operations that we either directly control or jointly manage, including those that form part of our ARM Ferrous and ARM Platinum divisions. Like our ESG report, this report does not address the operations, joint ventures or investments that we do not manage directly – such as ARM Coal, the Sakura Ferroalloys smelter and Harmony Gold – or projects that are in exploration, development or feasibility phases.

In our climate-change and water-management strategies and reporting, we draw on various frameworks, guidelines, good-practice measures and regulatory compliance requirements. We also seek to continually meet the reporting expectations of our varied and evolving stakeholder base.

This report uses the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) and the position statements of the International Council on Mining and Metals (ICMM) on water stewardship and climate change as its core framework. We have also considered:

- ICMM membership requirements and performance expectations
- Transition Pathways Initiative (TPI)
- CDP (formerly the Carbon Disclosure Project)
- JSE, including the FTSE-Russell ESG Index
- Global Reporting Initiative (GRI) mining and metals sector disclosures
- World Economic Forum's stakeholder capitalism metrics
- Engagements with NGOs, NPOs and other stakeholders
- Regulatory reporting requirements
- Other evolving reporting expectations.

Carbon emissions have been calculated and reported based on ARM's equity share (attributable emissions) in the operations where we have joint operational control and in accordance with the Greenhouse Gas (GHG) reporting protocol. This does not apply to reporting of GHG emission reductions and performance relative to our GHG reduction target, which we disclose on a 100% basis.

In F2019, our stakeholders asked us to disclose GHG emissions from our direct investment in coal and our investment in ARM Coal, which has a 20% share in the Participative Coal Business (PCB) and a 51% share in Goedgedvonden Mine. Glencore Operations South Africa owns the remaining stakes and has management control of ARM Coal's operations. In F2020, we were also requested to disclose emissions associated with our interest in Harmony Gold.

In terms of the former, Glencore reports on these emissions to the Department of Forestry, Fisheries and the Environment (DFFE), as it does for all its South African operations. In F2020, we received GHG emissions-related data for the operations relevant to us from Glencore, and reported our attributable emissions under scope 3 in the F2020 supplementary report. This data has again been supplied and reported on this year.

Following engagement with Harmony Gold, we also report on GHG emissions attributable to our 12.12% investment in Harmony Gold under scope 3 for the first time in F2021.

As in prior years, this report replaces our CDP disclosures, which were affected by the CDP's reporting timeframes. Previously, our data collection, verification and external data assurance processes were still under way when the CDP report was due, which caused a 12-month delay in our submission. This issue has been overcome through this supplementary report.

The information in this report covers our activities for the year to 30 June 2021 on a 100% basis and is consistent throughout, with the exception of GHG emissions, which are disclosed on an attributable basis in proportion to our operational shareholding, excluding Sakura.

Statement from the chairman of the ARM social and ethics committee

Dr Rejoice Simelane

Chairman of the social and ethics committee



*Responsible environmental, social and governance practices are integral to ARM's strategic priorities to operate safely, responsibly and efficiently, and to partner with communities and other stakeholders. Our commitment to ethical and responsible practices is embedded in the company values and governance structures and embodied by our leadership. Demonstrating this commitment allows ARM to deliver competitive outcomes and live up to our motto of **We do it better.***

The board delegates responsibility for monitoring the effective management of sustainable development to the social and ethics committee while retaining ultimate responsibility for this area. The committee operates according to its terms of reference, which are regularly updated, and is supported by executive management, relevant executive committees as well as governance structures. It oversees the management of environmental, social and governance (ESG) risks, which are identified by internal and external stakeholders and governance processes, including the enterprise risk management programme.

We recognise that we do not operate in isolation from the world around us and we endeavour to build on our good relationships with our stakeholders and engage them in open dialogue. We recognise our responsibility to manage and mitigate the potential negative impacts of our business activities, which unlock the value in mineral reserves to catalyse growth and development in the societies in which we operate.

ARM welcomes the maturing of the sustainability discourse evident in the increasing focus on environmental and social responsibility by investors, funders, customers and civil society, among others. We are extremely pleased that ARM's ESG practices are recognised by our continued inclusion in the FTSE/JSE Responsible Investment Top 30 Index.

Since F2019, ARM's commitment to responsible ESG practices has been embedded in awards made in terms of the 2018 conditional share plan and 2018 cash-settled conditional share plan through a 25% weighting of the performance conditions governing the vesting of these awards. These include safety, transformation and climate change performance conditions (see page 159 of the ESG report). Cash bonuses for senior executives also include a safety modifier, with a further downward adjustment in the case of fatalities.



We collaborate across operations and in industry associations to share learnings and implement industry good practice. ARM is a member of the International Council on Mining and Metals (ICMM), shares its commitment to mining with principles and has implemented its sustainability framework. Over the past three years, ARM operations and the corporate office have completed self-assessments against the ICMM's 38 performance expectations (PEs). Validation of these self-assessments was included in the scope of the external assurance over ESG data, performed by IBIS ESG Consulting Africa (Pty) Ltd. Gaps identified are being addressed as part of our preparation to report on the PEs in more detail by September 2022.

ARM recognises the critical global challenges that climate change presents and the effects these may have on our business, our stakeholders and the world. We are committed to participating in the global response to reduce carbon emissions and to mitigating the physical impacts caused by climate change. Our CEO led a qualitative climate-scenario analysis during the year through a series of workshops to assess the resilience of our business to climate transition and physical risks, in line with TCFD recommendations. This informed our long-term greenhouse gas (GHG) emission reduction target, which was approved by the board after year end and announced by the chairman at the presentation of our F2021 results. We aim to achieve net zero GHG emissions (scope 1 and 2) from mining by 2050 and have set goals and commitments to achieve this target. We have committed to develop a short, medium and long-term decarbonisation pathway to marry our short-term target with our long-term goal.

To take meaningful steps towards our GHG reduction ambition, we are continually exploring options to invest in renewable energy-generation technologies or to buy electricity from renewable sources. We have also taken initial steps to establish an internal carbon price for evaluating new projects and acquisitions. A range of carbon prices has been applied to our prefeasibility studies on solar power and battery-storage systems at our Black Rock and Khumani mines in the Northern Cape.

In F2021, we implemented our new energy and carbon-management system which helps operations report on energy consumption, carbon-emissions performance relative to interim targets, and agreed measures to reduce energy consumption and GHG emissions. This information is shared with the executives of each division quarterly.

ARM's F2021 estimated carbon footprint (scope 1 and 2 attributable emissions) decreased by 2% to 1.0 million tonnes of carbon dioxide equivalent (tCO₂e) and electricity consumption decreased 1.3% to 1 543GWh. Our current target is a 4% absolute reduction of scope 1 and 2 emissions by F2023 against the F2018 baseline through emission-reduction initiatives (excluding divestments and Nkomati Mine).

One of the areas we are focusing on as we work to mitigate climate change is improving our accounting and reporting processes. ARM has made significant strides in improving the completeness and accuracy of our scope 3 inventory. We have focused on our most material scope three categories: emissions associated with the use and processing of products (notably iron ore, manganese ore and ferromanganese) and emissions associated with our investments (notably thermal coal with Glencore and gold with Harmony Gold). We will continue to improve our scope 3 inventory in F2022 while working closely with our joint-venture partners to ensure risks are mitigated.

This year, we improved emissions accounting at Cato Ridge Works and, in F2022, we will interrogate our GHG accounting organisational boundary. For the first time this year, we have included emissions savings associated with reduction initiatives in the scope of our third-party assurance.

As a member of ICMM, we commit to publicly disclosing where our position differs to that of the ICMM on climate change. We continue to engage as an active member through the climate-change working group. We have provided feedback and comments on proposed additions to the climate change position statement as part of the ICMM's enhanced collective leadership. Our policy and commitments are aligned with the ICMM and we will update our long-term target in line with pending updates to the ICMM climate change position statement. In F2022, we will review our industry associations' positions on climate change to ensure alignment of our direct and indirect climate-related lobbying with our new long-term ambition.



Statement from the chairman of the ARM social and ethics committee *continued*

Water quality and availability are recognised in the group's top ten risks. Our water reporting aligns with the ICMM's position statement, which is based on the water accounting framework for the minerals industry of the Minerals Council of Australia. Since implementing the framework three years ago, our measurement of water impacts and water reporting have significantly improved. Our understanding of water reuse efficiency, a key indicator in monitoring and managing consumption and losses, continues to develop. Water reuse efficiency increased to 78%.

Total water withdrawal decreased 1% to 20.0 million cubic metres in F2021. While we finalise context-based water targets, we have extended our previous target to reduce withdrawals of potable water by 15% in F2021 relative to F2011. I am pleased to report that we achieved a 17% reduction in F2021 and have set a goal for F2022 to maintain this reduction.

In F2021, we completed an initial assessment of the physical climate-change impact on our supply chains as part of our climate-scenario analysis. We will expand this

assessment and investigate opportunities to enhance community resilience to water-related impacts through our socio-economic development and corporate social investment programmes.

I thank my colleagues on the social and ethics committee and board for their support and input during the year. We are grateful to our stakeholders for their support and positive engagements, and remain mindful that ARM's ability to create value depends on the value we create for others.

On behalf of the board, I thank management and employees for their dedication. Through your actions, we are demonstrating our shared commitment to act with integrity, respect the environment and make a positive contribution to society as we work towards achieving our strategic goals.

Dr RV Simelane

Chairman of the social and ethics committee



Climate change

There is perhaps no global crisis that is likely to affect more people, in more regions around the world, in as many ways over the short, medium and long term, as climate change. It is the crisis of our time and, without meaningful measures to address it, probably the crisis of future generations too.



Climate change

Our position on climate change

There is perhaps no global crisis that is likely to affect more people, in more regions around the world, in as many ways over the short, medium and long term, as climate change. It is the crisis of our time and, without meaningful measures to address it, probably the crisis of future generations too.

At ARM, we are aware of the critical global challenges that climate change presents and the effects these challenges may have on our business, our stakeholders and the world. As a result, we are committed to participating in the global response to reduce carbon emissions and to mitigating the physical impacts caused by climate change.

We have implemented robust processes to measure and report on carbon emissions at our operations, and identify opportunities to reduce these emissions. We are actively developing technology and processes to enhance energy efficiency at our operations, for example, while improving fuel efficiency and reducing our carbon footprint through other targeted initiatives.

Together with other groups in the mining industry, we also continue to produce the metals that are critical to a low-carbon future.

Our climate-change policy recognises:

- The need for an urgent global response to the threat of climate change across all areas of society and the economy. We are committed to being part of the solution
- The need for an effective binding global agreement on climate change that we support, and related initiatives under the Paris Agreement, to hold the increase in the global average temperature to well below 2°C and to pursue ways to limit that increase to 1.5°C
- The need to reduce emissions from the use of fossil fuels and support collaborative approaches to accelerate the use of low-emission technologies as part of the transition to a lower-emissions economy
- The practical challenges that South Africa, as a developing country with domestic supplies of fossil fuels, will face in making that transition to a low-carbon economy
- The vital role in reducing GHG emissions that broad-based, effective carbon pricing can play, alongside other market mechanisms that drive the reduction of GHG emissions and incentivise innovation
- The importance of providing climate-related disclosure to measure and respond to climate-change risks and opportunities. We welcome the transparency around

climate-related risks brought by the TCFD and see value in its recommendations.

We commit to:

- Engaging with our peers, governments and others to develop effective climate-change policies. We support the movement towards a low-carbon economy and are committed to constructive engagement with government on measures aimed at achieving this. Important issues still under consideration and discussions with government include using carbon tax to support targeted mitigation actions, alignment with other mechanisms such as carbon budgets, and clarity on carbon tax allowances and offsets (see page 59)
- Implementing governance, engagement and disclosure processes to ensure climate-change risks and opportunities are considered in business decision-making (see page 58)
- Supporting carbon pricing and other market mechanisms that drive the reduction of GHG emissions and incentivise innovation. We support global efforts to address systemic challenges that inhibit this transition, such as a lack of willingness to pay for lower-carbon products; limited alternatives and options to reduce emissions, especially in hard-to-abate industrial sectors; and a lack of incentives and support to facilitate expensive, long-term investments in new technologies and processes. These will require collective efforts and we will collaborate, to the extent appropriate, to drive the changes necessary to achieve a net-zero carbon industry (see pages 22 and 36)
- Demonstrating leadership by advancing operational-level adaptation and mitigation solutions through, for example, researching, developing and piloting new technologies (see page 23)
- Engaging with host communities on our shared climate-change risks and opportunities and helping host communities to adapt to the physical impacts of climate change (see pages 50, 55 and 58)
- Supporting initiatives to mitigate GHG emissions, both in collaboration with our peers and individually, by promoting innovation, developing and deploying low-emissions technology, and implementing projects that improve energy efficiency and incorporate renewable energy supply in our energy mix (see pages 34 and 37)
- Disclosing scope 1 and 2 emissions annually and setting emission reduction targets informed by the scientific requirements to achieve the 1.5°C global temperature goal, and associated efforts towards a net zero carbon industry, by 2050 (see pages 25 and 35). In F2021, we set a long-term target in line with the scientific requirements and included commitments to various actions needed to achieve this target

Climate change continued

- Engaging with stakeholders to determine a preferred approach to reporting scope 3 emissions and exploring our role in reducing those emissions (see page 27). In F2021, we significantly improved our scope 3 emissions accounting, and our first scenario analysis process informed a range of commitments towards addressing our role in reducing GHG emissions across our value chain
- Supporting the global transition to a low-carbon economy by contributing to the sustainable production of commodities essential to the energy and mobility transition, and by working with the partners and key suppliers along our value chains (see page 12).



ARM is a formal supporter of the TCFD
(<https://www.fsb-tcfd.org/supporters/>)



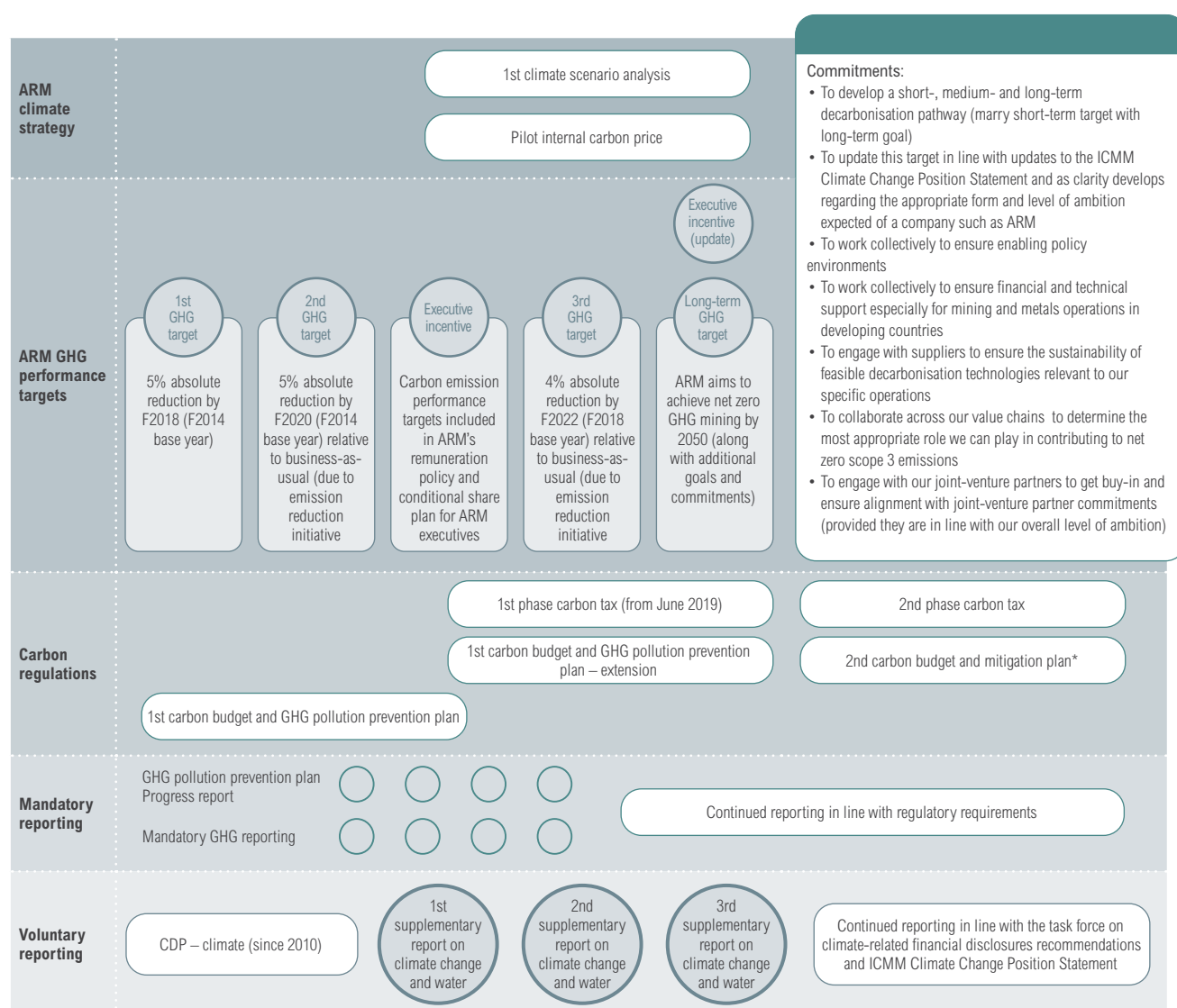
TPI: Questions 1, 2, 3, 10 and 19



Our journey to date

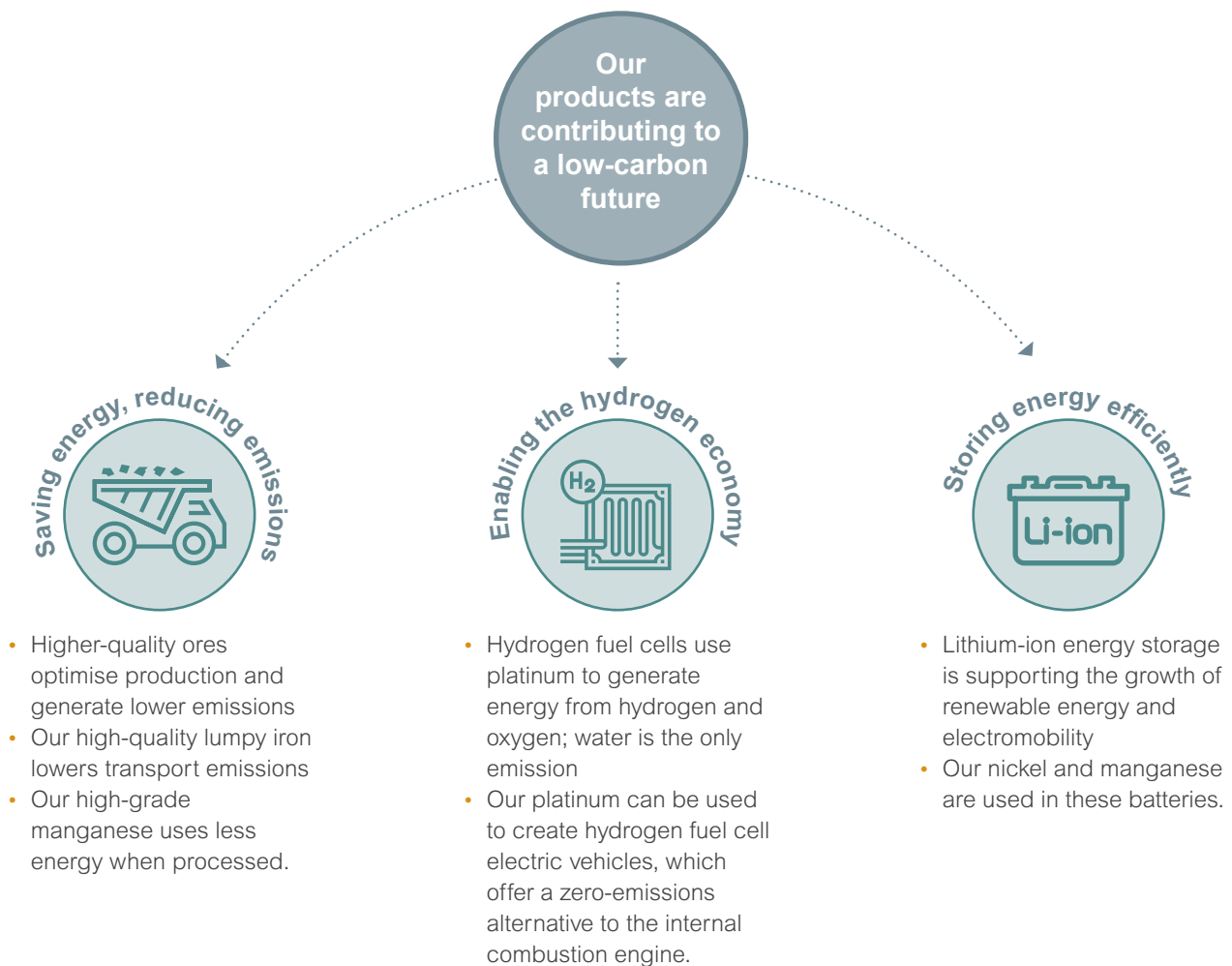
Our focused programme to comply with new climate-change regulations, as well as non-negotiable but voluntary requirements and reporting expectations for climate change and water, originated in 2017 and has continuously been reviewed and updated. Given that the regulatory and voluntary requirements are related, we have aimed to embed a methodical process for developing systems, reporting and building capacity to meet current and evolving requirements.

We continue to disclose our performance according to the TCFD framework, have completed an initial climate-scenario analysis process and have set a long-term GHG reduction target in line with the goals of the Paris Agreement. We plan to fully implement TCFD recommendations by F2024, subject to clarity on how the mining industry should integrate climate risks and opportunities into mainstream filings.



Calendar year	Pre 2017	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	To 2030
Financial year	F2017	F2018	F2019	F2020	F2021	F2022	F2023	F2024	F2025	F2026	F2027	Beyond F2027	

Climate change continued



Governance

Oversight and management responsibility

The ARM board, through the social and ethics committee chaired by Dr Rejoice Simelane, has ultimate responsibility for climate-change management. The responsibility for implementing this work rests with the chief executive officer (CEO), who delegates to the chief executives of each division and the executive: sustainable development. This executive is responsible for reviewing ARM's sustainable development policies, strategies and targets, including our revised GHG reduction target, and ensuring these are aligned with the board's commitment to zero tolerance for harm to employees, host communities and the environment. The ARM social and ethics committee provides oversight by monitoring and reporting on the manner and extent to which we protect, enhance and invest in the wellbeing of the economic, social and natural environments in which we operate.

Climate-related issues, through the reporting of the social and ethics committee, remuneration committee and our divisions' operational reviews, form part of the agenda of quarterly board meetings. Recent meetings have tabled:

- ARM's long-term GHG reduction ambition, which is aligned to achieving net zero carbon mining by 2050 and the 1.5°C global climate goal
- Amendments to the remuneration policy, including updates to climate-change incentives linked to ARM's GHG reduction target
- Approving the annual supplementary report on climate change and water
- Receiving/monitoring quarterly reports on water licences
- Monitoring water use and climate-change compliance.

The growth and strategic development committee evaluates growth opportunities and plans the content for a two-day strategy session with the board. ARM's climate scenario analysis, which was conducted in F2021, explored climate-related impacts on demand for commodities, and its results will feed into this committee's strategic sessions in F2022. Chaired by the CEO, the committee meets regularly and provides feedback to the executive chairman.

Our governance and reporting structure is illustrated on page 13.

Assmang, a joint venture between ARM and Assore Ltd, has established a social and ethics committee that monitors environmental performance in the ARM Ferrous division. It is chaired by the ARM executive director: new business development and investor relations and reports to the ARM social and ethics committee. In the ARM Platinum division, every operation has a sustainable development committee, which is chaired by the ARM executive: sustainable development and reports to the executive committee or board of the respective joint ventures, as appropriate, as well as to the ARM social and ethics committee.

The executive: sustainable development also reports to the management risk and compliance committee, a subcommittee of the audit and risk committee of the board, on matters and activities related to climate change and carbon emissions as a standard agenda item. This includes an update on carbon tax and the global industry standard on tailings management.

TPI: Question 6



Incentives

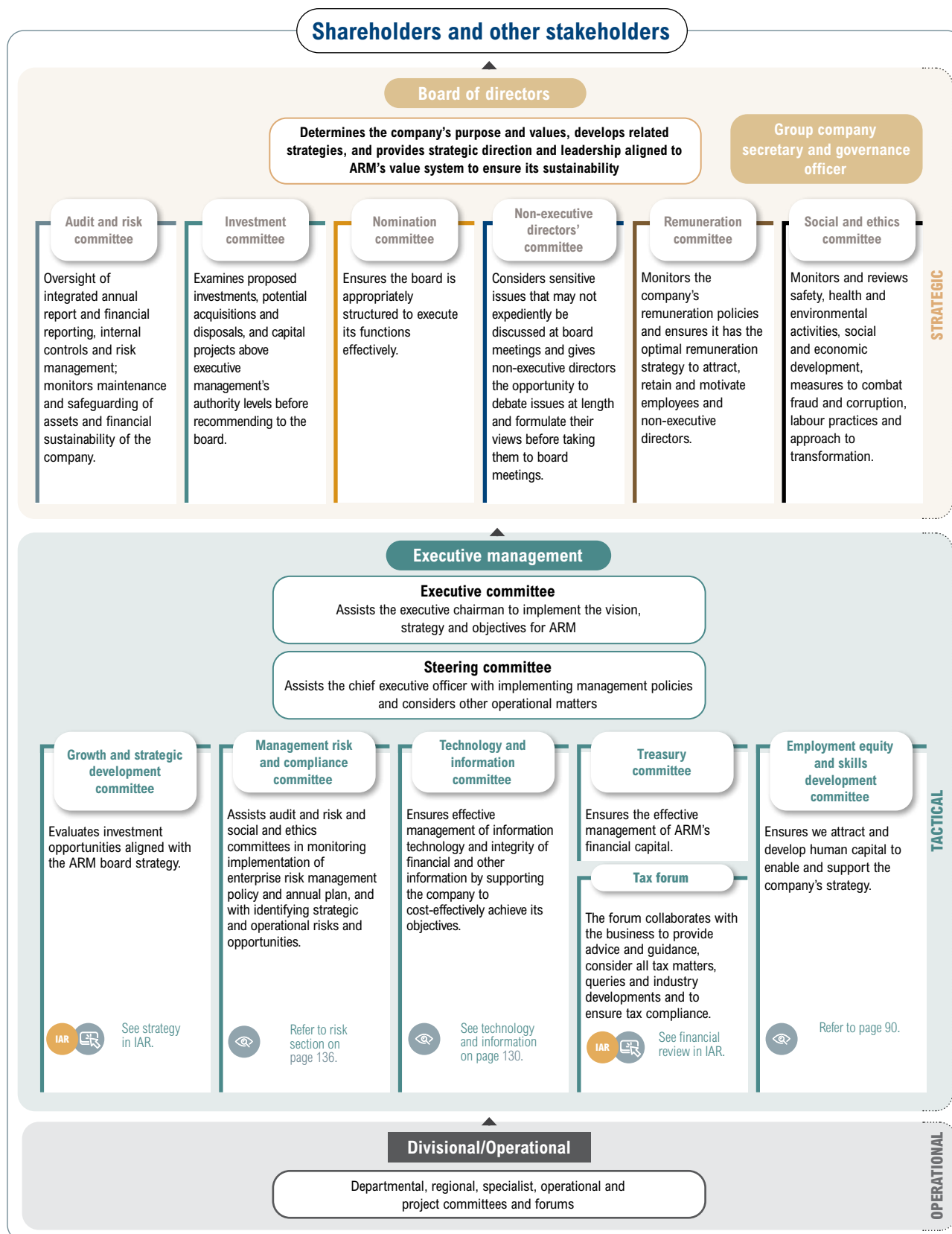
Carbon-emissions performance targets have been included in ARM's remuneration policy and in the conditional share plan for ARM executives, since F2019. The incentives are based on actual savings over three years, with a stretch target of 2%+ reduction from new and existing carbon-reduction initiatives still active since the 2018 base year. The approach is based on the GHG protocol's policy and action standard, available at <https://ghgprotocol.org/policy-andaction-standard>.

These incentives have been updated for the F2022 financial year. The incentives are based on actual savings (due to emission reduction initiatives) over three years, with a stretch target of equal to/greater than 3% further reduction in scope 1 and 2 emission levels at the end of the three-year performance period against the baseline at the beginning of the period.

Refer to the summarised remuneration report in the integrated annual report.



Climate change continued



King IV application register is on our website: www.arm.co.za and the assurance report on page 16 of the ESG report.

This year, we also completed our first climate scenario analysis and refined and rolled out our energy and carbon management system, which includes quarterly reporting to senior management.

These processes, together with preparations for the next phase of the carbon budget process in South Africa, will inform a specific decarbonisation pathway aligned with our long-term target. Following this work, we will explore appropriate executive incentives aligned with our long-term ambition.

Engineers and production staff are incentivised on energy efficiency per tonne of ore milled, time of energy use and use of alternative energy sources. Remuneration and incentive packages of production teams and other appropriate positions at the smelters include key performance indicators (KPIs) linked to emission-reduction initiatives.

TPI: Question 15



Refer to page 104 of the summarised remuneration report in the IAR



Climate change continued

Strategy

Our scenario analysis

In F2021, we assessed the resilience of our business to climate transition and physical risks under five different scenarios:

- 1.5°C – supportive
- 2°C – disorderly
- 3°C – too little, too late
- World transitions and South Africa lags
- Business-as-usual.

This process was undertaken in response to and in line with TCFD¹ recommendations, and because it is critical to informing our understanding of climate-change risks and opportunities, as well as the way they affect our strategy. We will incorporate climate scenarios into our strategic and operational planning processes again in F2022.

Approach

ARM's climate-change scenario analysis involved a series of workshops led by our CEO. Technical teams were established to explore transition risks and opportunities (more relevant at company level) and physical risks (more relevant at operational and division levels). Executive-level support and the involvement of key personnel were critical to the project's success.

Although an effort was made to draw on credible sources that project climate-related market, policy and legal, and technological and reputational changes, there are divergent views on these transition pathways. The evolution of policies and technology, and their impacts on supply and demand, is ultimately uncertain. We therefore engaged with the evidence but drew our own conclusions on the pathways we deem most likely.

The transition component of the analysis considered all ARM's operations, including Sakura and our investments in ARM Coal and Harmony Gold. The analysis leveraged the International Energy Association (IEA) global energy scenarios (including its recent net zero scenario) and work by the South African National Business Initiative (NBI). Various research reports relevant to mining value chain decarbonisation, evolving commodity markets, and the role of critical minerals in the transition to net zero were also used.

The physical component of the analysis, in contrast to the transition component, considered the operations over which we have operational or joint operational control.

ARM Coal and Sakura were excluded from this initial assessment. The analysis included a high-level assessment of the supply-chain implications for these operations, and the compilation and review of site-specific climate-change projections to establish a preliminary overview of current vs future climate-change exposure and potential impacts.

The analysis also focused on the Intergovernmental Panel on Climate Change's representative concentration pathway (RCP) 4.5, which assesses long-term changes in annual rainfall, rainfall intensity, the magnitude of flooding events, drought severity, annual dry days, and maximum and minimum temperatures. The median RCP 4.5 scenario was used as the most-likely climate scenario, with the 66th percentile upper and lower bounds used for the worst- and best-case scenarios.

To accommodate uncertainties on future GHG emissions and the success of mitigation measures, a scenario set of four possible future trajectories is commonly used for climate modelling. These four pathways are based on the main forcing agents of climate change: GHG emissions, GHG concentrations and land-use change. The need for interventions to adapt to climate change requires interventions now and over the next 10 to 20 years.

The analysis therefore matches these planning and adaptation horizons. A 30-year timeframe of 2020 to 2050, with a midpoint of 2035, is used for assessing near-future climate change, against a baseline of 1990 to 2020. Future anomalies are derived from this baseline. The data used for the spatial and statistical analysis came from Cordex, WorldClim and Aqueduct. Analysis is in line with international funding agency best-practice guidelines.



¹ <https://www.handbook.fca.org.uk/handbook/glossary/G3598t.html?date=2020-12-21>.

Our scenarios

Our scenarios describe a range of plausible futures with materially different implications for our business.

<p>1.5°C – supportive Net zero GHG by 2050</p> <ul style="list-style-type: none"> • 1.5°C average global temperature increase by 2100 (RCP 1.9) • Informed by IEA net zero 2050 and UN PRI inevitable policy response • Rapid changes to 2030 • Supportive environment: high availability of mitigation technologies, financial incentives for ARM, markets for low-carbon commodities and industrial products, more 'carrots' than 'sticks' • Low physical climate disruptions and associated costs 	<p>2°C – disorderly Net zero GHG by 2060/70</p> <ul style="list-style-type: none"> • 2°C average global temperature increase by 2100 (RCP 2.6) • Informed by IEA sustainable development scenario • Limited changes to 2030 and then drastic changes • Unsupportive environment: high transition costs, limited availability of feasible mitigation technologies, more 'sticks' than 'carrots' • Low to moderate physical climate disruptions and associated costs 	<p>3°C – too little, too late Target not met</p> <ul style="list-style-type: none"> • 2.7°C average global temperature increase by 2100 (RCP 4.5) • Informed by IEA stated policies scenarios and nationally determined contributions – low range • Moderate to high physical climate disruptions and associated costs • Social disruption is a significant risk 	<p>World transitions and South Africa lags The world shifts to net zero GHG by 2050 – South Africa continues on its business-as-usual path</p> <ul style="list-style-type: none"> • World: informed by IEA net zero 2050 and UN PRI inevitable policy response • Significant negative impact on demand for ARM Ferrous products (relatively carbon intensive) • Low physical climate disruptions and associated costs • Social disruption is a significant risk 	<p>Business-as-usual Dangerous climate change</p> <ul style="list-style-type: none"> • 4°C average global temperature increase by 2100 (RCP 8.5) • Informed by IEA stated policies scenarios and nationally determined contributions – high range • High physical climate disruptions and associated costs • Social disruption is a significant risk
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Key business impacts

The most material climate risks and opportunities facing ARM include:

- Shifting value pools in commodity markets: global climate action will have severe business impacts for mining groups, affecting global demand for several major commodities
- Increasing pressure from key stakeholders to decarbonise and reach net zero GHG emissions by 2050: new disclosure standards and activist investors, regulators and the public put pressure on companies to curb their own carbon footprints and develop resilience strategies
- Increasing costs associated with decarbonisation and zero-carbon energy
- Physical climate impacts affecting ARM's ability to operate efficiently due to volume and cost or margin impacts linked to operational disruptions and increased capital expenditure, and affecting markets through its negative impact on countries' GDP.

These risks and opportunities were considered in terms of the following impacts:

- Material risks to demand for our current portfolio of products due to changing demand for commodities associated with the energy transition, reduced GDP growth, higher product prices, and circular economy drivers, such as alternatives, efficiencies and recycling
- Material opportunities to increase demand for minerals associated with the climate transition, and demand for zero- and low-carbon mining and metals products
- Material risks to production volumes due to availability of resources and business disruptions, including community protests and social disruption
- Material risks to margins, such as the cost of capital, operating expenses and product prices
- Material opportunities to increase margins due to increased access to low-cost finance
- The potential impact on stranded assets and profitability of R&D into low-carbon processes and products.

Climate change continued

Transition climate impacts

The energy transition requires substantial quantities of critical minerals, and their supply emerges as a significant growth area. The total market size of minerals like copper, cobalt, manganese and various rare earth metals is expected to grow almost sevenfold between 2020 and 2030 in the 1.5°C – supportive scenario². This creates opportunities but also new energy security concerns, including price volatility and additional costs for transitions if supply cannot keep up with burgeoning demand.

Our scenario analysis shows that the future of thermal coal remains uncertain and there are divergent views from a Paris-aligned 1.5°C temperature change perspective. While some suggest coal cannot exist beyond 2050 if we are serious about climate change, others believe we will not be able to shake coal dependency based on current coal-use trends. In South Africa, Kusile, Medupi and new coal plants are planned to run beyond 2050. The reality of how soon coal will be transitioned out will probably depend on financial models that allow for the early closure of coal power stations.

Demand impacts		Implications for ARM
1.5°C – supportive	<div> ⬇️ Palladium: Significant drop in demand for autocatalysts </div> <div> ⬆️ Platinum: Significant growth of (green) hydrogen economy </div>	<ul style="list-style-type: none"> Positive outlook for ARM Platinum and Ferrous divisions. Focus on platinum group metals (PGM) assets with higher platinum ratios. A successful green steel industry in South Africa, if enabled by intentional industrial policy focused on green hydrogen production, would boost local demand for ARM products Very negative outlook for ARM Coal Significant opportunities to be explored in critical minerals for low-carbon transition An ambitious decarbonisation pathway is needed to compete in global markets
	<div> ⬆️ Iron ore: Growth in demand due to cost-effective green steel, enabled by measures supporting green hydrogen economy </div> <div> ⬆️ Manganese alloy and ore: Significant growth in demand for high-quality ore for battery storage </div>	
	<div> ⬇️ Thermal coal: No demand for thermal coal in 2050. Early closure of all coal-fired power stations in South Africa (before 2050) </div>	
	<div> ⬆️ Low-carbon technology minerals: Significant increase in demand for critical minerals for low-carbon transition, notably copper, lithium, cobalt, nickel and rare earth minerals </div>	
2°C – disorderly	<div> ⬇️ Palladium: Significant drop in demand for autocatalysts </div> <div> ⬆️ Platinum: Significant growth of hydrogen economy </div>	<ul style="list-style-type: none"> Positive outlook for ARM Platinum and Ferrous divisions. Focus on PGM assets with higher platinum ratios Sustained demand for coal in the short term but very negative outlook for ARM Coal towards 2050 Significant opportunities to be explored in critical minerals for low-carbon transition Decarbonisation efforts will need to ramp up significantly towards 2050
	<div> ⬆️ Iron ore: Growth in demand due to cost-effective green steel enabled by measures supporting green hydrogen economy </div> <div> ⬆️ Manganese alloy and ore: Moderate growth in demand for battery storage </div>	
	<div> ⬇️ Thermal coal: Sustained short-term demand but significant decrease in demand for thermal coal in 2050 </div>	
	<div> ⬆️ Low-carbon technology minerals: Significant increase in demand for critical minerals for low-carbon transition, notably copper, lithium, cobalt, nickel and rare earth minerals </div>	
3°C – too little, too late	<div> ⬇️ Palladium: Moderate drop in demand for autocatalysts </div> <div> ⬆️ Platinum: Moderate growth of hydrogen economy </div>	<ul style="list-style-type: none"> Negative outlook for ARM Platinum due to deployment of electric vehicles but limited expansion of hydrogen economy Sustained demand for coal in the short to medium term
	<div> ⬆️ Iron ore: Limited impacts </div> <div> ⬆️ Manganese alloy and ore: Limited impacts </div>	
	<div> ⬇️ Thermal coal: Sustained short-term demand but moderate to high decrease in demand for thermal coal in 2050. More investment in gas to close capacity gap left by renewables </div>	
	<div> ⬆️ Low-carbon technology minerals: Moderate increase in demand for critical minerals for low-carbon transition </div>	

² IEA, 2021. *The role of Critical Minerals in Clean Energy Transitions*. <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>.

Demand impacts		Implications for ARM
World transitions and South Africa lags	<ul style="list-style-type: none"> ⬇️ Palladium: Significant drop in demand for autocatalysts ⬆️ Platinum: Significant growth of (green) hydrogen economy 	<ul style="list-style-type: none"> • Positive outlook for ARM Platinum division • Negative outlook for carbon-intensive products supplied by ARM's Ferrous division, due to lack of local environment that enables decarbonisation. Engagement and lobbying required to mitigate this potential outcome • Sustained demand for coal in South Africa but very negative outlook for export market • Significant opportunities to be explored in critical minerals for low-carbon transition
	<ul style="list-style-type: none"> ⬇️ Iron ore: Decrease in demand for carbon-intensive iron ore produced in South Africa ➡️ Manganese alloy and ore: Moderate growth in demand for battery storage, in spite of carbon-intensive South African products 	
	<ul style="list-style-type: none"> ➡️ Thermal coal: No export market but sustained demand in South Africa 	
	<ul style="list-style-type: none"> ⬆️ Low-carbon technology minerals: Significant increase in demand for critical minerals for low-carbon transition, notably copper, lithium, cobalt, nickel and rare earth minerals 	
Business-as-usual	<ul style="list-style-type: none"> ➡️ Palladium: Moderate drop in demand for autocatalysts ➡️ Platinum: Limited growth of hydrogen economy 	<ul style="list-style-type: none"> • Impact of physical climate changes on country's GDP negatively impacts demand for mining products generally • Sustained demand for coal • Limited pressures to decarbonise to remain competitive
	<ul style="list-style-type: none"> ⬇️ Iron ore: Decrease in demand due to physical impacts of climate change on country's GDP ⬇️ Manganese alloy and ore: Decrease in demand due to physical impacts of climate change on country's GDP 	
	<ul style="list-style-type: none"> ➡️ Thermal coal: Sustained short-term demand but moderate decrease in demand for thermal coal in 2050. New coal additions in Asian markets but more investment in gas to close capacity gap left by renewables 	
	<ul style="list-style-type: none"> ➡️ Low-carbon technology minerals: Low to moderate increase in demand for critical minerals for low-carbon transition 	

Costs, reliability of supply and carbon intensity of key energy sources – notably coal, electricity and diesel – will have a material impact on our ability to produce and our margins.

The availability and cost of mitigation measures will have a material impact on our ability to achieve our climate-change mitigation targets, meet the expectations of our stakeholders, and be competitive in markets where border tax adjustments and changing preferences may reduce demand. A significant challenge is that around 15% of the emission reductions needed by 2030 are expected from technologies still under development. This figure jumps to almost 50% by 2050.

A carbon price is broadly regarded as a critical enabler to achieving global climate goals. Projections on the potential carbon price in different jurisdictions vary and there is considerable uncertainty on how governments will set

prices over time. It is expected that, even under business-as-usual conditions, carbon prices will translate into increased operating costs for ARM.

Capital is increasingly divesting from carbon-intensive activities and directing low-cost capital to activities aligned with global climate objectives.

Climate change can play a role in the stability of social systems, contributing to economic stresses like unemployment and inequality, and causing civil unrest and increased violence. Improving economic and environmental conditions can increase social cohesion and unity, leading to overall improved wellbeing. This driver could pose a material risk to ARM's ability to operate.

Climate change continued

Physical climate impacts

The impact of extreme weather events has already been noted across most of ARM's mining sites. It is clear that some of our operations will face increased exposure to climate-risk variables across the short, medium and long term.

Current and projected physical climate impacts in ARM's Ferrous division

	Current	Projected
Beeshoek	Peak rainfall from January to April Long-term average stays the same, but large annual variability. Recent years have seen a decrease of 14mm per decade Temperature increase of 0.14°C per decade Moderate drought and high seasonal variability risk Extremely high interannual variability risk	Decrease in precipitation of 1% by 2035 Increase in dry spells of 8 to 29% Small increase in aridity
	Peak intensity of 5.2mm/hour	Projected to increase 11% Overland flow projected to increase by 10 to 25%
	Current peak temperatures from December to January Increase of 0.23°C per decade Maximum temperatures from 34.5–36.5°C	Maximum temperatures increase 2.0–4.6°C 40 more days of extreme temperatures Increasing evapotranspiration by 13%
Black Rock	Peak rainfall from December to April Long-term average stays the same, but in recent years much more volatile annual rainfall Recent decades show a decrease of 23mm per decade Temperature increase of 0.14°C per decade Moderate drought and high seasonal variability risk Extremely high interannual variability risk	Decrease in precipitation of 2% by 2035 Increase in dry spells of 8 to 20% Small increase in aridity
	Peak intensity of 4.5mm/hour	Projected to increase 22% Overland flow projected to increase by 10 to 25%
	Current peak temperatures from December to March Increase of 0.23°C per decade Maximum temperatures from 33.5–35.5°C	Maximum temperatures increase 2.0–4.5°C 45 more days of extreme temperatures Increasing evapotranspiration by 12%
Khumani	Peak rainfall from January to March Long-term average decreases of 8mm per decade Temperature increase of 0.2°C per decade Moderate drought and high seasonal variability risk Extremely high interannual variability risk	Decrease in precipitation of 1% by 2035 Increase in dry spells of 2 to 31% Small increase in aridity
	Peak intensity of 5.1mm/hour	Projected to increase 7% Overland flow projected to increase by 10–25%
	Current peak temperatures from December to January Increase of 0.23°C per decade Maximum temperatures from 34.0–36.5°C	Maximum temperatures increase 2.2–4.5°C 43 more days of extreme temperatures Increasing evapotranspiration by 13%
Cato Ridge Works	Peak rainfall from December to March Long-term average decreases by 48mm per decade. Recent years have seen a decrease of 44mm per decade Temperature increase of 0.18°C per decade Moderate drought risk Low seasonal and interannual variability risk	Decrease in precipitation of 3% by 2035 Increase in dry spells of up to 23% Moderate increase in aridity
	Peak intensity of 7.2mm/hour	Projected to increase 4% Overland flow projected to increase by 0 to 10%
	Current peak temperatures from December to March Increase of 0.20°C per decade Maximum temperatures from 32.0–35°C	Maximum temperatures increase 1.8–3.0°C 30 more days of extreme temperatures Increasing evapotranspiration by 7%

Machadodorp Works	<p>Peak rainfall from November to March</p> <p>Long-term average decreases by 20mm per decade. Recent years have seen a decrease of 80mm per decade</p> <p>Temperature increase of 0.2°C per decade</p> <p>Moderate drought and seasonal variability risk</p> <p>Low interannual variability risk</p>	<p>Decrease in precipitation of 4% by 2035</p> <p>Increase in dry spells of 2 to 30%</p> <p>Small increase in aridity</p>
	<p>Peak intensity of 5.75mm/hour</p>	<p>Projected to increase 3%</p> <p>Overland flow projected to increase by 5 to 15%</p>
	<p>Current peak temperatures from December to January</p> <p>Increase of 0.18°C per decade</p> <p>Maximum temperatures from 29.5–31.5°C</p>	<p>Maximum temperatures increase 2.3–4.4°C</p> <p>35 more days of extreme temperatures</p> <p>Increasing evapotranspiration by 14%</p>

Current and projected physical climate impacts in ARM's Platinum division

	Current	Projected
Nkomati	<p>Peak rainfall from November to February</p> <p>Long-term average shows a decrease of about 48mm per decade</p> <p>Temperature increases of 0.21°C per decade</p> <p>Low/medium water risk due to drought variability and water depletion</p>	<p>Decrease in precipitation of about 4% by 2035</p> <p>Increase in dry spells of up to 10%</p>
	<p>Peak intensity of 6.5mm/hour</p>	<p>Projected to increase 9%</p> <p>Overland flow projected to increase by about 2%</p>
	<p>Current peak temperatures from December to March</p> <p>Increase of 0.23°C per decade</p> <p>Maximum temperatures from 25.5–28.0°C</p>	<p>Maximum temperatures increase 2.2–2.4°C</p> <p>14 more days of extreme temperatures</p> <p>Increasing evapotranspiration by 8.9%</p>
Two Rivers	<p>Peak rainfall from November to February</p> <p>Long-term average shows a decrease, but this accelerated in recent decades with a decrease of about 65mm per decade</p> <p>Temperature increases of 0.21°C per decade</p> <p>Low/medium water risk due to drought variability and water depletion</p>	<p>Large decrease in precipitation of about 6.5% by 2035</p> <p>Increase in dry spells of up to 5.3%</p>
	<p>Peak intensity of 6.5mm/hour</p>	<p>Projected to increase 3%</p> <p>Overland flow projected to increase by up to 26%</p>
	<p>Current peak temperatures from December to March</p> <p>Increase of 0.23°C per decade</p> <p>Maximum temperatures from 26–28°C</p>	<p>Maximum temperatures increase 2.5–2.7°C</p> <p>19 more days of extreme temperatures</p> <p>Increasing evapotranspiration by 9.8%</p>
Modikwa	<p>Peak rainfall from December to March</p> <p>Long-term average shows a decrease, but this accelerated in recent decades with a decrease of about 50mm per decade</p> <p>Temperature increases of 0.19°C per decade</p> <p>Medium water risk due to drought variability and water depletion</p>	<p>Large decrease in precipitation of about 10% by 2035</p> <p>Increase in dry spells of up to 11%</p>
	<p>Peak intensity of 6mm/hour</p>	<p>Projected to increase 8%</p> <p>Overland flow projected to increase by up to 35%</p>
	<p>Current peak temperatures from December to March</p> <p>Increase of 0.19°C per decade</p> <p>Peak temperatures from 28–30°C</p>	<p>Maximum temperatures increase 2.8–3.4°C</p> <p>22 more days of extreme temperatures</p> <p>Increasing evapotranspiration by 12%</p>

Climate change continued

These projected changes have the potential to affect ARM in a variety of ways, both directly and indirectly. They may:

- Damage fixed assets and equipment
- Compromise the operational performance of facilities with long life spans, such as tailings storage facilities (TSFs), water and waste-rock storage facilities
- Cause disruptions and damage to changes in output
- Disrupt supply chains
- Shift supply and demand patterns.

Our mines in the Northern Cape are partly supplied by Sedibeng Water, which sources water from the Vaal River. The rainfall regime in the Vaal catchment is projected to change over the medium to long term. There will be drying in the north and west parts of the catchment, but increased rainfall in the south and the east. This will shift hydrogeological balances in the catchment and lead to stress on these water resources. Further work and engagement is needed to understand the extent to which the relevant authorities have explored these projected

impacts on future supply, and what role ARM can play in ensuring appropriate response measures are put in place.

The results provide a foundation of evidence that will help us to establish critical thresholds, and to assess the increased frequency and intensity of threshold breaches in future (see page 42).



Response measures

The impact on ARM will be difficult to determine without knowing the cost structures of different producers, and therefore which producers might drop off, for example. Our focus is to be below the 50th percentile of the global cost curve per commodity. We will use the results of our scenario analysis to inform strategic decision-making regarding our portfolio and to explore opportunities to invest in low-carbon technology minerals. Additional areas of focus that will inform the development of ARM's long-term decarbonisation pathway are described below.



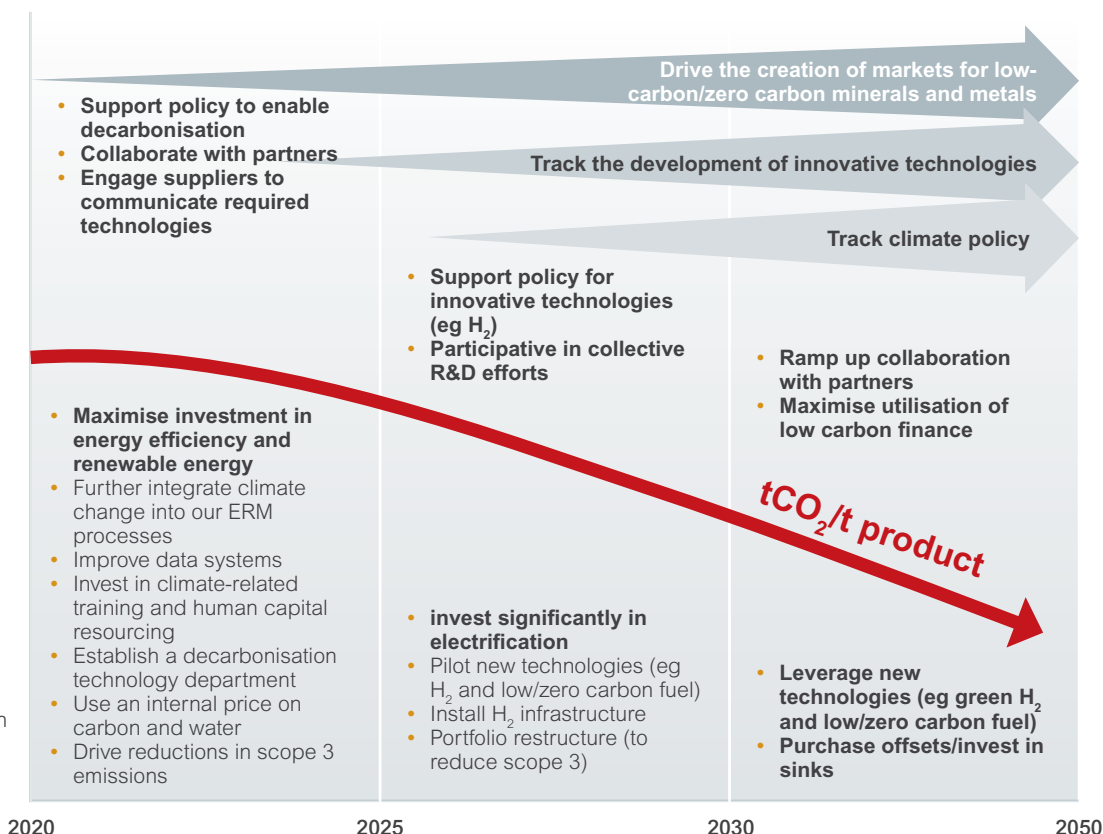
External activities

(Markets and enabling environments)



Internal activities

(Decarbonisation and system elements)



Following the scenario analysis, ARM has committed to a long-term target to achieve net zero GHG emissions from mining by 2050 (see page 36). We have also undertaken to further integrate climate change into our enterprise risk management (ERM) processes, incorporate financial metrics into our new energy and carbon management system, update our executive incentives to blend short-term targets into our medium- and longer-term climate goals, develop a long-term decarbonisation pathway, and to explore the impact of our GHG emissions across our value chain.

Integrating climate change into the business strategy

Our strategy is to deliver competitive returns and sustainable value by operating our portfolio of assets safely, responsibly and efficiently; applying disciplined capital allocation; and focusing on value enhancing and integrated growth. We have continually integrated climate-change considerations into our business strategy. Our emissions data and efficiencies are reported quarterly and assessed according to potential exposure, probability and consequences for the business.

In F2021, we implemented our new energy and carbon management system which helps operations report on energy consumption, carbon-emissions performance relative to interim targets, and agreed measures to reduce energy consumption and GHG emissions. This information is shared quarterly with the executives of each division.

Information on the level of risk or opportunity and capacity to manage these are reported to the ARM management risk and compliance committee and the social and ethics committee, whose outputs feed directly into the strategy development process. This will be improved in F2022 after our initial climate-scenario analysis and as we roll out our plans to further integrate climate change into our ERM processes. Climate-change issues are also a priority for the ARM board and executive committee, as well as strategic growth committee, and are addressed through other mechanisms that feed into our strategy development.

Managing rising operating costs due to climate risks is consistent with, and reinforces, our short-term strategy (F2021 to F2022). Our long-term strategy is influenced by expected long-term (beyond 2021 to 2050) changes in regulation that will affect costs and the supply of energy and water. Certain geographies are more likely to be affected by climate change and this will impact our ability to operate.

Producing higher-grade 'cleaner' products that produce fewer emissions gives us a competitive advantage in the growing Asian market. This trend was identified by the ARM and Assmang executive and marketing teams, and a premium on these products has been achieved in recent years. As the global economy becomes more carbon constrained, we expect this demand will become increasingly material.

As per our climate-scenario analysis, demand for manganese, for example, is projected to increase due to its use in lithium-ion batteries for mobile and stationary electricity storage applications. Platinum will have a key role in the hydrogen economy and it is expected that demand will increase, given climate-related drivers in the transport sector and in industry. Climate-change concerns are recognised to have a material impact on the market demand, supply and price of thermal coal going forward. We will incorporate climate scenarios into our strategic and operational planning processes again in F2022.

TPI: Question 16



Carbon pricing

In F2021, we also continued to explore the ways in which expectations were evolving beyond reporting, including the use of scenario planning and setting an internal price on carbon.

Carbon pricing is now universally accepted as a critical component in driving decarbonisation towards the global 1.5°C climate goal. Our first scenario analysis explicitly considered how different potential carbon prices affect the cost of supply of our commodities into global markets, their potential impact on demand for our products, and the possibility of border tariff adjustments to create level playing fields in these markets.

The actual carbon price in South Africa, reflected in the carbon tax, and the potential carbon prices modelled in our climate-scenario analysis, have been incorporated into our internal carbon price. This informs our strategy and long-term investment decision-making.

Climate change continued

CASE STUDY

Applying an internal carbon price

A carbon price is broadly regarded as a critical enabler to achieving global climate goals. Projections on the potential carbon price in different jurisdictions vary and there is considerable uncertainty on how governments will set prices over time. It is expected that, even under business-as-usual conditions, carbon prices will translate into increased operating costs for ARM.

We have therefore taken initial steps to establish an internal carbon price for evaluating new projects and acquisitions. A range of carbon prices has been applied to our prefeasibility studies on solar power and battery-storage systems at our Black Rock and Khumani mines in the Northern Cape, for example.

Our carbon-pricing assessment is a parallel process to the feasibility studies that demonstrate the internal rate of return when considering potential avoided carbon tax costs. The following ranges of internal carbon prices were assumed:

ARM range of assumed internal carbon prices in F2021 (US\$)

	2025	2030	2040	2050
South African carbon tax (business-as-usual scenario)	10	12	20	33
1.5°C – supportive	45	83	160	200

In the case of avoided power supplied by the Eskom grid, it is assumed that a carbon price could only be passed through the electricity price from F2023 at the earliest.

The pilot modelled a range of carbon tax pass-through costs, assuming a grid emission factor based on South Africa's integrated resource plan's technology mix, and a range of effective tax costs that could be passed by Eskom. Avoided costs, based on the zero-carbon electricity generated and consumed by our operations, was considered over the life of the assets to determine a range of impacts on the project's internal rate of return.

The pilot provided some insight into the financial implications of a project that reduces carbon-tax liability, and generated lessons for integrating an internal price of carbon into ARM's new projects and acquisitions. We will incorporate our range of carbon prices into subsequent feasibility studies at our Northern Cape operations to consider the potential reduction in carbon liability and the contribution to our GHG reduction ambitions on the overall feasibility of the project.

Our climate-scenario analysis identified a range of potential carbon prices relevant to developed country markets of US\$75 in 2025, US\$130 in 2030, US\$205 in 2040 and US\$250 in 2050. Further quantitative analyses will be undertaken to explore the implications on demand for our products as part of the next iteration of our climate-scenario analysis.

Our targets and performance

GHG emissions

Scope 1 and 2 emissions

Our GHG calculations are based on the GHG protocol, which was first published by the World Resources Institute and World Business Council for Sustainable Development in March 2004. Our data-collection process also complies with the data quality requirements set out in ISO 14044, as well as GRI Standards. Our scope 1 and 2 GHG emissions are externally assured each year.

Scope 1 and 2 emissions have been calculated on an equity-share basis according to the GHG protocol. Data is reported separately to the DFFE for operations where we have operational or joint operational control, and is based on a calendar year in line with regulatory requirements.

Given the growing emphasis placed on scope 3 emissions, and our policy commitment to engage with external parties to determine a preferred approach to reporting these emissions and to identify the appropriate role we should play in reducing them, we have committed to reviewing our organisational boundary in F2022 (see case study: Improving our GHG emissions accounting on page 40).

ARM's existing base year is F2018. Our target base year excludes Nkomati, which has moved to care and maintenance.

The emissions attributable to our operations primarily come from the consumption of electricity produced by coal-fired power stations and the combustion of fossil fuels during our mining, load-and-haul, materials handling and processing activities. We monitor and report on our emissions data internally every quarter, discuss it at operational sustainability meetings, and assess it as part of our quarterly risk management workshops.

Scope 1 emissions mainly relate to diesel consumption for load-and-haul activities and reductants, such as at Cato Ridge Works. Electricity consumption (scope 2 emissions) comprises 80% of our total carbon footprint.

The F2021 estimated carbon footprint (scope 1 and 2 attributable emissions) decreased 2% to 1.00 million equivalent tonnes of CO₂ (mtCO₂e) from 1.02mtCO₂e in F2020.

This represents a 3% decrease compared to our F2018 baseline and a 19% decrease on the previous baseline in F2014. Scope 1 emissions increased 2% year on year while scope 2 decreased 3% year on year. The Eskom grid emission factor decreased by 2%. A robust and transparent grid emission factor in South Africa remains a concern but collective efforts are under way to address the challenges. Our electricity consumption in MWh decreased by 1%.

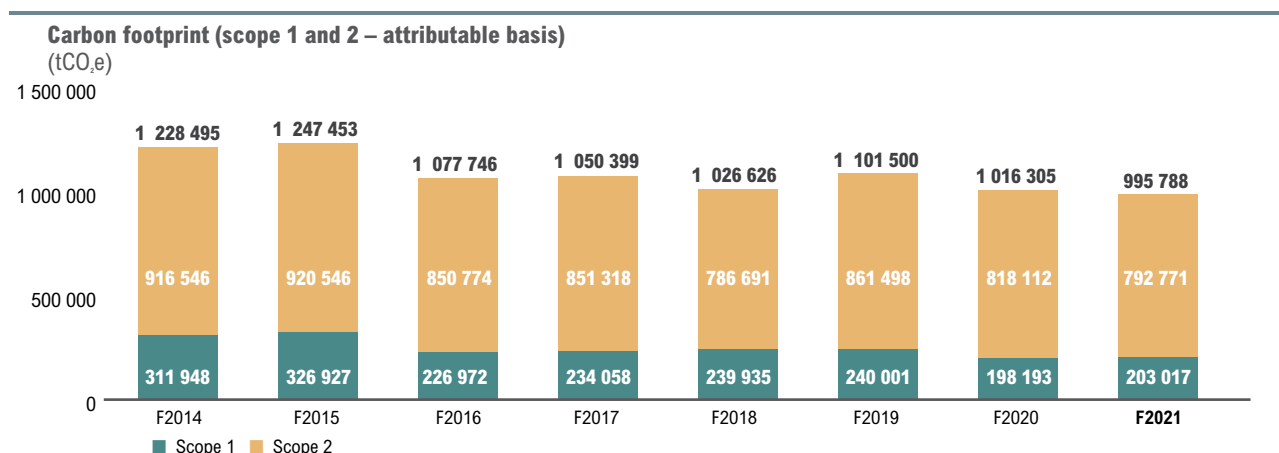
Changes in emissions year on year are primarily due to:

- **Reduced furnace efficiencies at Cato Ridge Works:** Lower-quality ore, sweeteners and changes to the BRIX materials, which are all related, resulted in reduced furnace efficiencies at the smelter. This has increased the amount of reductants needed per unit of final product. This in turn is the result of a strategic decision in F2021 to reduce the number of ore grades produced at Black Rock Mine. Cato Ridge Works therefore no longer receives the high-grade Black Rock ore that was previously available for its consumption.
- **Changes in production output:** Emissions from Nkomati continued to decrease as it was scaled down in preparation for care and maintenance, with the mine ceasing production at the end of March 2021. Ore mined at Nkomati decreased by 32% and concentrate produced by 14% compared to F2020. Production changes at various operations contributed to other changes over time. This includes a 0.02% reduction in platinum group metals or PGMs produced (the net result of a 12% reduction at Modikwa Mine and 9% increase at Two Rivers Mine), a 1% increase in iron ore produced (due to a 9% increase at Beeshoek Mine and 3% decrease at Khumani Mine), an 11% increase in manganese ore produced, and an 11% decrease in manganese alloy produced (due to processing lower-quality ores at Cato Ridge Works).
- **Electricity supply disruptions:** Loadshedding in 2021 necessitated the use of generator sets, particularly at Black Rock Mine, which has a 14MW-capacity diesel generator.
- **GHG emission-reduction initiatives:** Initiatives implemented since F2018 are still actively contributing to savings, with a saving of 32 129tCO₂e in F2021. This contributed a 1.8% reduction to the change in our scope 1 and 2 emissions compared to what they would have been had the initiatives not been implemented.

In F2021, Cato Ridge Works contributed 31% of the group's total scope 1 and 2 emissions. Khumani Mine contributed 16%, Nkomati Mine 14% and Two Rivers Mine 14%, mainly as a result of diesel consumption during mining, and load-and-haul activities in the open pits.

Climate change continued

Scope 1 and 2 carbon emissions (tCO₂e)



NOTE: Historical emissions (F2014 – F2020) have been restated following disaggregation of emissions data at Cato Ridge Works (CRW) and Cato Ridge Alloys (CRA) enabling the more accurate calculation of attributable emissions data based on ARM's equity share in each legal entity (50% in CRW and 25% in CRA).

	Scope 1 (tCO ₂ e)	Scope 2 (tCO ₂ e)	Scope 1 and 2 (tCO ₂ e)
Ferrous division			
Beeshoek Mine	19 871	20 261	40 132
Khumani Mine	54 101	100 997	155 098
Black Rock Mine	11 191	70 851	82 042
Cato Ridge Works	89 031	215 471	304 502
Machadodorp Works*	976	13 728	14 703
Total	175 170	421 307	596 477
Platinum division			
Nkomati Mine	13 573	124 942	138 515
Modikwa Mine	4 824	116 851	121 675
Two Rivers Mine	9 448	129 215	138 663
Total	27 845	371 008	398 853
ARM corporate office	2	455	458
ARM total	203 017	792 771	995 788

* 100% basis as Machadodorp Works is wholly owned by ARM.

GHG emissions intensity

Scope 1 and 2 carbon emissions per tonne of manganese alloy produced reported since F2017 included production from Sakura in error, as the operation is not included in reported scope 1 and 2 emissions. These numbers have been restated in the table below, together with prior reported numbers.

Scope 1 and 2 carbon emissions per tonne of manganese alloy produced	F2021	F2020	F2019	F2018	F2017	F2016
As previously reported		1.4	1.5	1.4	1.7	3.3
Corrected	3.6	3.3	3.4	3.1	3.3	3.4

Scope 1 and 2 emissions per tonne of iron ore produced are 0.025tCO₂e/tonne (F2020: 0.024tCO₂e/tonne). Scope 1 and 2 emissions per tonne of manganese ore produced decreased to 0.041tCO₂e/tonne from 0.043tCO₂e/tonne in F2020.

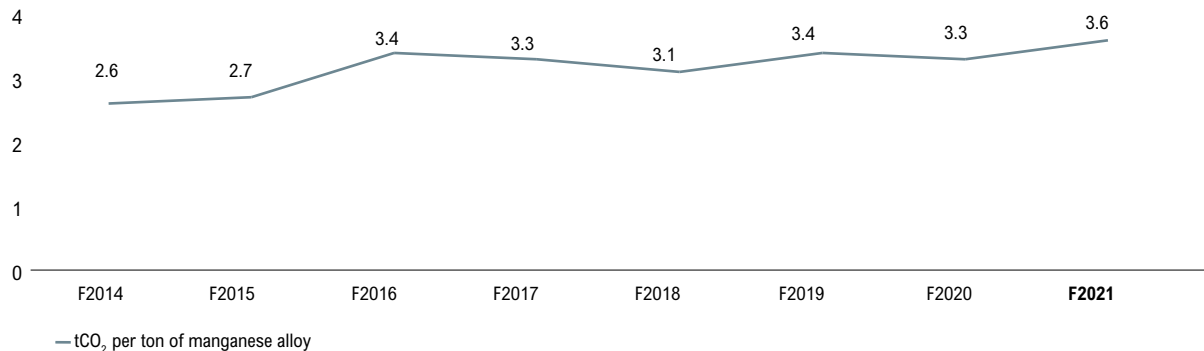
Carbon emissions per tonne of PGM ore milled at our two primary platinum mines, Modikwa and Two Rivers, decreased to 0.104tCO₂e/tonne (F2020: 0.106tCO₂e/tonne).

Scope 1 and 2 emissions per FTE (full-time employee) previously included only employees. From this year, we are including contractors to reflect workforce activity more fully. On this basis, emissions per person decreased 11% to 97.7tCO₂e (F2020: 109.6tCO₂e).

Scope 1 and 2 emissions per man-hour worked decreased to 48.2kg CO₂e (F2020: 53.7kg CO₂e).

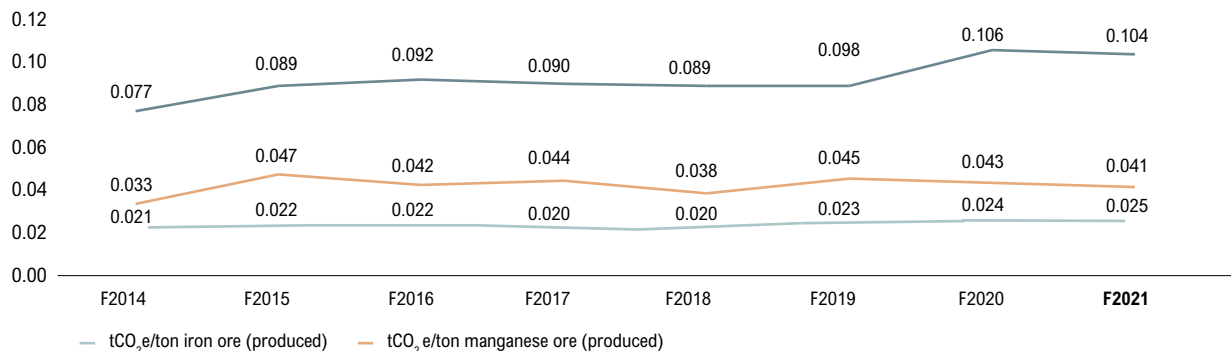
Scope 1 and 2 carbon emissions per tonne produced – smelters

(tCO₂e, attributable basis)



Scope 1 and 2 carbon emissions per tonne produced – mine

(tCO₂e, attributable basis)



Scope 3 emissions

The TCFD recommends that organisations should assess not only the potential direct effects of climate change on their operations, but also the potential second and third-order effects on their supply and distribution chains. It explicitly recommends that organisations disclose scope 3 emissions, which refer to indirect emissions not included in scope 2 that occur in the upstream and downstream value chains.

At ARM, we are assessing supply-chain risks and engaging with suppliers to mitigate carbon price pass-through effects, and to access goods and services that enable operations to reduce energy consumption and associated emissions. We also see downstream opportunities driven by the increasing demand for high-grade iron and manganese ore, PGMs and nickel, which are used in the growing deployment of low-carbon technologies.

Scope 3 emissions are calculated according to the GHG protocol – corporate value chain (scope 3) accounting and reporting standard. The latest UK Department for Business, Energy & Industrial Strategy's emission conversion factors are used, and other emission factors are sourced from organisations such as the World Steel Association and International Manganese Institute.

Source data is either gathered directly or estimated, depending on its availability or the materiality of the scope 3 category. Our approach to addressing scope 3 emissions is evolving and includes initiatives to improve data gathering and reporting. We also intend to focus on material sources in recognition of our promise to collaborate with stakeholders to reduce emissions.

Climate change continued

Performance

ARM has made significant strides in improving the completeness and accuracy of our scope 3 inventory. We have focused on our most material scope 3 categories: emissions associated with the use and processing of products (notably iron ore, manganese ore and ferromanganese) and emissions associated with our investments (notably our investments in thermal coal with Glencore and our investments in gold with Harmony Gold). We will continue to improve our scope 3 inventory in F2022 while working closely with our joint-venture partners to ensure risks are mitigated.

This year, we have reported all scope 3 emissions on an attributable basis, requiring a restatement of F2020 and F2019 numbers (previously reported on 100% basis).

		Scope 3 (attributable basis) (tCO ₂ e)		
	Category	F2021	F2020	F2019
1	Purchased goods and services	47 611	48 793	61 955
2	Capital goods			Relevant – not calculated
3	Fuel and energy-related activities	105 314	97 461	104 787
4	Upstream transport and distribution	479 191	425 694	516 014
5	Waste generated in operations	782	618	805
6	Business travel	1 106	1 080	754
7	Employee commuting	14 465	14 031	14 610
8	Upstream leased assets*	–	–	–
9	Transport and distribution of sold products	161 918	183 682	189 682
10	Processing of sold products**	27 979 959	16 796 249	11 878 642
11	Use of sold products*	–	–	–
12	End-of-life treatment of sold products*	–	–	–
13	Downstream leased assets*	–	–	–
14	Franchises*	–	–	–
15	Investments	759 885		Relevant – not calculated

* Not relevant or not material. ARM makes limited use of leased assets and associated emissions are estimated to be immaterial (category 8). ARM's products feed into various end uses, many are recycled and we have limited influence over the end-use (categories 11 and 12). ARM has no leased assets (category 13). ARM does not have any franchises (category 14).

** Previously we reported on emissions associated with the use of sold product. As part of improvements in the current reporting year, these are more aligned with the definition of emissions associated with the processing of sold products and have been included in category 10. Additionally, F2021 includes emissions associated with processing manganese ore (excluding ore from Black Rock Mine processed at Cato Ridge Works, included in ARM's scope 1 and 2 emissions) and emissions associated with processing ferromanganese alloy; whereas F2020 and F2019 only included emissions associated with processing iron ore.

Emissions associated with capital goods are relevant, particularly given the investments in the Northern Cape and at Two Rivers Mine. These include commissioning a new cell in the tailings (paste) storage facility, start of construction on three additional lined water-storage dams at Khumani Mine in F2019 and investing in a new lined tailings facility at Two Rivers Mine.

Most significantly, we have continued to modernise and expand Black Rock Mine. The project began in 2013 and will be completed in mid-2022, increasing production from 2.6m tonnes to 4.6m tonnes of manganese ore. The commissioning of a new lined tailings facility at the mine is included, as is investment in Black Rock Mine's private rail facilities.

Going forward, we will assess emissions associated with capital goods that form part of our initiatives to integrate carbon pricing into our investment decisions. To date, we have not experienced carbon price pass-through that has materially impacted the feasibility of our current and planned capital investments.

In F2021, we included emissions associated with transmission and distribution losses (part of category 3: fuel and energy-related activities), and have restated F2020 and F2019 to include these sources.

CASE STUDY

Assessing attributable emissions associated with the processing and use of our products

In the reporting year, ARM assessed scope 3 categories 10 (processing of sold products) and 11 (use of sold products). This is in line with the ICMM climate change position statement to engage with external parties to determine a preferred approach to reporting scope 3 emissions.

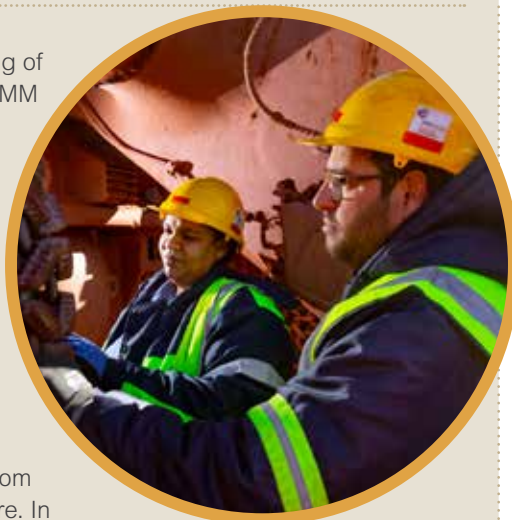
We previously reported on emissions associated with processing iron ore using a methodology that draws on the work of the decarbonisation and energy efficiency roadmap for the iron and steel sector for the UK government (WSP Parson Brinckehoff, 2015). This included emission factors associated with primary steel production, such as coking, sintering and iron-making using a blast furnace.

The amount of iron ore required to produce a tonne of hot rolled coil from the blast furnace was used to determine emissions per tonne of iron ore. In F2021, we used this methodology but adjusted it to newer conversion factors to estimate the amount of iron ore used in steel. We also used the average emission factor for global steel production provided by the World Steel Association. The association estimates emission factors based on data supplied by 104 steel companies and associations based on basic oxygen furnace and electric arc furnace production technology routes.

To further improve the accuracy of emissions associated with the processing of sold products, we also investigated emissions associated with the processing of manganese ore and ferromanganese in F2021. Our manganese ore is sold to be further processed into manganese alloys, including high-carbon ferromanganese, medium-carbon ferromanganese and silicon manganese.

The emissions associated with processing manganese ore to manganese alloys was estimated using data from the International Ferromanganese Institute, which conducted a life-cycle assessment of global manganese alloy production in 2014. Its findings are based on global manganese alloy production modelled from a compilation of manganese smelter site models. They include both the conversion factor to estimate how much manganese ore is needed to produce ferromanganese, and the GHG emissions associated with this process, including upstream production and transport (ore processing, sintering, smelting, refining, crushing and screening).

Ferromanganese is used to influence the strength, toughness and hardness of steel. The emissions associated with the use of ferromanganese were determined by estimating the amount of ferromanganese used in steel and the emissions associated with steel production. The input assumptions for ferromanganese into steel were sourced from the Journal of The South African Institute of Mining and Metallurgy (Steenkamp and Basson, 2013), and emissions associated with steel production were from the World Steel Association, as used above for steel production using manganese ore.



Climate change continued

CASE STUDY

Reporting on ARM's attributable GHG emissions associated with investments in coal

Category 15 (investments) includes emissions associated with our direct investment in coal, our investment in ARM Coal and our equity share in Harmony Gold.

For the second year, we are reporting GHG emissions associated with our effective 20.2% investment in the Participative Coal Business (PCB) and our effective 26.01% investment in Goedgevonden (GGV). PCB includes Impunzi and Tweefontein. Glencore has management control and reports its GHG emissions to the DFFE, as part of reporting on all its operations in South Africa.

Following engagement with Glencore, we have received GHG emissions-related data for the operations relevant to us. Data is associated with Glencore's financial year (1 January to 31 December 2020) but is included in ARM's financial year reporting (1 July to 30 June).

Operation	F2021 direct (tCO ₂ e attributable)	F2021 indirect (tCO ₂ e attributable)	F2021 total (tCO ₂ e attributable)	F2020 total (tCO ₂ e attributable)
PCB	49 352	42 094	91 445	106 592
GGV	29 314	16 750	46 064	54 484
Total	78 666	58 843	137 509	161 076

Emissions include the following sources for each operation:

- Direct emissions (scope 1 for the operations): Fugitive methane – production (underground) using an emission factor of 0.77m³ CH₄ per tonne; fugitive methane – post-mining (underground) using an emission factor of 0.18m³ CH₄ per tonne; and diesel (mobile) using an emission factor of 0.00315tCO₂e/litre for mobile combustion and 0.00268tCO₂e/litre for stationary combustion
- Indirect emissions (scope 2 for the operations): Purchased electricity using a grid emission factor of 1 040g CO₂/kWh.

Liquefied petroleum gas (LPG), petrol and explosives are not included as they are deemed, by our partner, as immaterial to the footprint.

Emissions have been attributed to ARM, based on our effective shareholding in each operation.

CASE
STUDY

Reporting on emissions associated with ARM's investment in Harmony

We have a 12.12% investment in Harmony Gold. Emissions attributable to ARM have been calculated based on this shareholding and are included in our scope 3 inventory (under investments category).

	F2021 attributable emissions (tCO ₂ e)
Direct (Harmony scope 1)	16 499
Indirect – purchased electricity (Harmony scope 2)	515 228
Indirect – value chain (Harmony scope 3)	90 660
Total	622 386

Harmony's scope 1 emissions include emissions associated with diesel, petrol, explosives and fuel/heating oil, calculated using DEFRA 2020 emission factors.

Harmony's scope 2 emissions include emissions associated with purchased electricity in South Africa (calculated based on 1.04kg CO₂/kWh) and in Papua New Guinea (PNG) (calculated based on 0.68kg CO₂/kWh).

Harmony's scope 3 emissions include emissions associated with a range of purchased goods and services (embodied emissions in explosives, cement, timber/lumber, cyanide, caustic soda and lime), fuel and energy-related activities (transmission and distribution losses in South Africa and PNG), and business travel (rental vehicles, and domestic and international air travel).

Scope 2 emissions account for the bulk (83%) of Harmony's emissions. This is aligned with energy consumption in South Africa, where energy is sourced from the power utility, Eskom.

Harmony monitors and reduces energy use and GHG emissions. In line with its short- and medium-term business strategy for the next five years to move towards an alternative energy supply mix, it is actively reducing its grid-electricity consumption and GHG emissions with both year-on-year and multi-year targets. Harmony is also finalising its application for a 30MW solar facility to substitute fossil consumption in Welkom.

Climate change continued

Energy

The primary sources of energy consumed in our value chain are electricity and diesel. Electricity is used in mining activities to power ventilation fans, pumps for processing and dewatering, conveyor belt motors and machines that crush and mill ore. The energy used for heating is one of the biggest cost inputs in the smelting process at Cato Ridge Works.

Total energy consumed in F2021 was 8 416 483GJ (including diesel, electricity, LPG, petrol, acetylene and paraffin).

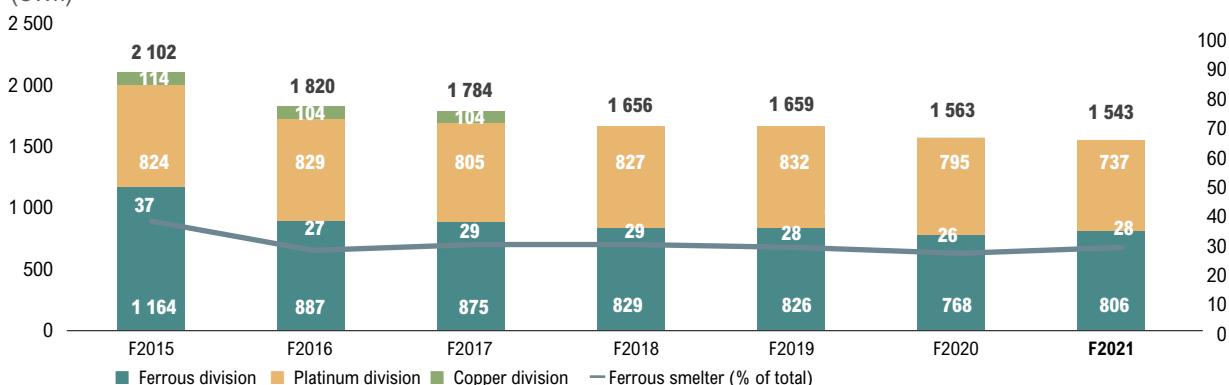
The ARM Platinum division contributed 48% to total group electricity consumption, the three ARM Ferrous mines 24%, Cato Works Ridge Works 27% and Machadodorp Works 1%.

Total electricity consumed by the operation was 1 543GWh (100% basis), a decrease of 1.3% compared to F2020 (1 563GWh). Modikwa Mine accounted for 17% of total electricity consumption, Nkomati Mine 15%, Two Rivers Mine 14%, Khumani Mine 12%, and Cato Ridge Works 27%.

Diesel is used to power mobile equipment (trackless machines and vehicles used for mining, loading, hauling and logistics) and standby electricity generators. Diesel consumption contributed 54% to total scope 1 carbon emissions in F2021 (100% basis). Total group diesel consumption decreased 5% to 78.9 million litres in F2021 (F2020: 82.6 million litres). Khumani (47% of total group diesel use), Beeshoek (18%) and Nkomati (12%), now on care and maintenance, are large open-pit mines that use diesel mainly to haul run-of-mine material to the concentrator plants.

Electricity consumption (100% basis)

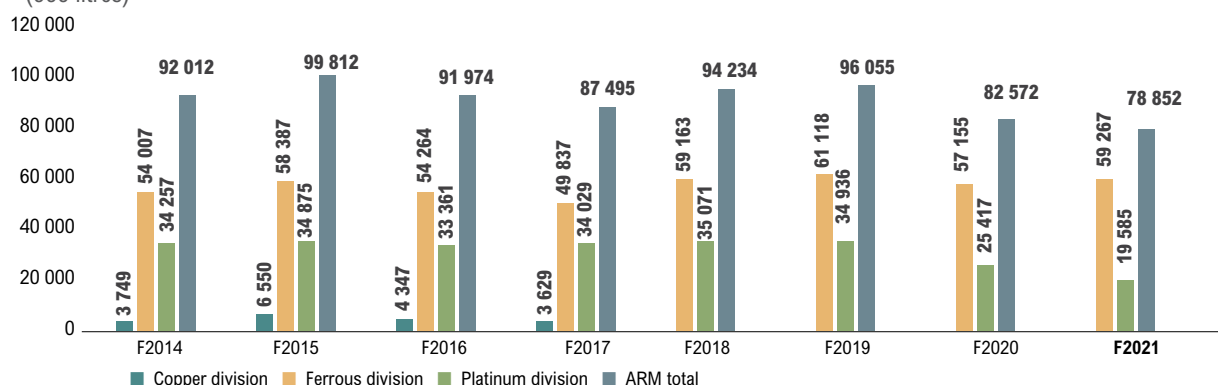
(GWh)



* Smelting operations at Cato Ridge Works accounted for 27% of the electricity consumption while metal recovery at Machadodorp Works consumed ±1%.

Diesel consumption by division (100% basis)

(000 litres)



Energy consumption intensity (100% basis)

Energy consumption per unit of output has been reported for the first time this year.

Iron ore	0.17	GJ/tonne iron ore
Manganese ore	0.19	GJ/tonne manganese ore
Manganese alloy	4.46	GJ/tonne FeMn (HC, MC and recovered metal)
PGMs	19.09	GJ/tonne PGM concentrate
Nickel	10.36	GJ/tonne nickel concentrate

Energy consumption is expected to increase at many of ARM's operations. Khumani and Beeshoek are mining at deeper levels and mining lower-quality ore, which increases stripping rates.

Modikwa is building a new chrome plant. Two Rivers has invested in a new mill, which increases energy demand by 3.5MW; more ancillary equipment; and a new TSF, which has increased electricity for pumping requirements by 1.7MW.

The decision to mine the Merensky Reef will result in a significant increase in energy consumption (from 35MVa to 64MVa by 2024). Two Rivers' electricity demand is set to increase from 35MVa to 40MVa in the next year. The grid infrastructure cannot accommodate this increased demand in the short term and the mine will need to run diesel generator sets, which will increase diesel consumption. The mine is currently engaging with Eskom to supply the required capacity by the end of 2022.



Climate change continued

Exploring renewable energy opportunities

To take meaningful steps towards our long-term GHG reduction ambition, we are continually exploring options to invest in renewable energy-generation technologies or to buy electricity from renewable sources.

Our feasibility considerations include capital and operational costs, electricity generation relative to our operations' load requirements, GHG and environmental impacts, and the remaining economic lives of our assets. The last point – aligning green investments with the remaining life of our operations – is particularly important as operations with a short life-of-mine are not suitable candidates.

Options are available to buy renewable energy from independent power producers through arrangements that wheel power through the grid. We are in conversation with a renewable energy company to explore opportunities to wheel renewable power to Two Rivers Mine, for example. We do not yet know the proportion of the mine's electricity requirement that could be met through this arrangement, but we are aiming for it to be significant.

Eskom is currently building a new transmission line to meet increased electricity requirements associated with the Merensky project at the mine, and we are pushing Eskom to meet the end-2022 completion deadline. This investment in network infrastructure would further contribute to the potential for wheeling renewable power to the mine.

Eskom has indicated that the transmission network in the Northern Cape cannot support wheeling to our ferrous mines. Because of this limitation, we are exploring the

potential of renewable energy and storage capacity at each mine, including the capacity for black starts (repowering the system when there is no power from the grid) at Black Rock Mine.

We commissioned an initial prefeasibility study in F2020 to assess options for installing solar photovoltaic (PV) plants with battery storage at our Black Rock and Khumani mines. We have subsequently commissioned an independent engineering firm to explore potential solutions at Black Rock, Khumani and Beeshoek mines. The study will recommend the capacities for each solution, potential financial models and will include our range of internal carbon prices to consider the potential reduction in carbon liability and the contribution to our GHG reduction ambitions on the overall feasibility of the project. We are also considering the possibility of co-owning the systems with communities.

Eskom has recently announced its intention to sell 'green energy' that it has purchased through South Africa's renewable energy independent power procurement programme. Initial proposals suggest that a renewable energy certificate could be purchased at a premium of 5c per kWh associate. This could enable ARM to quickly increase our share of renewable energy consumption across all our operations in South Africa.

Assurance

ARM's annual total scope 1 and 2 emissions are assured by a third party. Scope 3 emissions are not externally assured.

IBIS ESG Assurance Proprietary Limited provides independent assurance over selected environmental, social and governance (ESG) performance information in our ESG report, in line with the AccountAbility AA1000AS guidelines (assurance type II, moderate). This includes a review of the reporting process and assessment of the report against AccountAbility's guiding principles of inclusivity, materiality, responsiveness and impact.

Additional climate change-related indicators assured include electricity consumption, total diesel consumed, total volume of water withdrawn and total volume of water discharged.

ARM's independent assurance statement is on page 16 of the 2021 ESG report, available on our website at www.arm.co.za.



CASE STUDY

Third-party assurance on carbon-reduction initiatives

Our performance on our short-term GHG reduction target and the associated executive share incentive is based on actual (reported) emission reductions relative to a business-as-usual baseline. Carbon-reduction initiatives implemented over a particular period are included in the scope but only if they are active at the end of the period.

The target is at a company level. This means there are no operational targets, but savings from our operations are aggregated to determine company-wide performance. For the first time this year, we have included emissions savings associated with reduction initiatives in the scope of our third-party assurance.



TPI: Question 9

GHG emission-reduction target

Current target: 4% absolute reduction of scope 1 and 2 emissions by F2023 against F2018 baseline through emission-reduction initiatives (excluding divestments and Nkomati Mine).

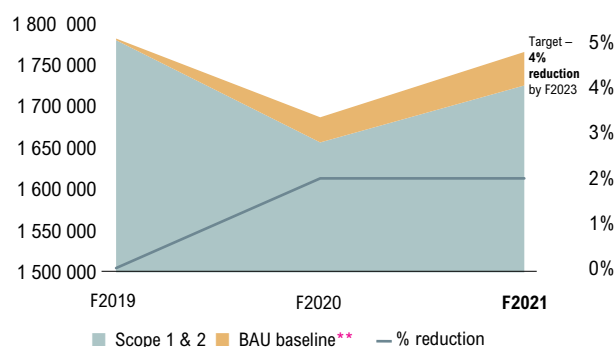


In F2020, we set a revised carbon emission-reduction target. This was based on both a bottom-up assessment of opportunities we identified to reduce GHG emissions at our operations, and a top-down assessment that included benchmarking against peer-company targets and stakeholder expectations.

This data was collated and carefully assessed to determine an appropriate, more ambitious GHG reduction target at company level. Our target considers the GHG emission-reduction initiatives we have implemented since F2018, while still aiming to actively reduce emissions in the target year. The 'ex-post' or business-as-usual baseline shows what would have been emitted had the emission-reduction initiatives not been implemented, in line with the GHG protocol's policy and action standard.

Progress

ARM GHG emissions performance



Note: Scope 1 and 2 emissions and reductions achieved are the total emissions resulting from operations where ARM has operational or joint operational control (excluding Nkomati, which is under care and maintenance).

* The business-as-usual baseline reflects what ARM would have emitted had it not implemented emission-reduction initiatives (referred to as an ex-post baseline according to the GHG protocol policy and action standard).

ARM has achieved a 1.8% absolute reduction of scope 1 and 2 emissions against a 2018 baseline, relative to what emissions would have been without implementing its emission-reduction initiatives (excluding Nkomati Mine). New initiatives implemented in F2021 are described on page 38.

ARM invested in a BRIX plant at Cato Ridge Works, which enables optimal reduction conditions, in December 2019. The process includes bonding 'bricks' that contain nine streams, including metal fines, in optimal ratios. The bricks enable consistent sizing, which optimises air flow for the reduction of manganese. This has improved furnace efficiencies, and contributed to a reduction of 25 643tCO₂e in F2020 relative to F2018.

Climate change continued

The decision to process lower-quality ores in F2021 reduced some of the efficiency benefits associated with the BRIX plant. That said, the operation was still able to reduce emissions by 21 615tCO₂e in F2021, relative to what emissions would have been had the initiative not been implemented.

One component of the modernisation and expansion project under way at Black Rock Mine is to move ore-tipping faces closer to loading areas. This has reduced haul distances significantly, saved costs, and reduced energy consumption and associated GHG emissions.

Black Rock's investment in private rail facilities has also resulted in a shift from road to rail product transport.

A number of new initiatives that will deliver additional savings started in F2021 and are planned for the next two years. Some reduction opportunities involve capital investment and a budgeting process over more than one financial year.

During the year, we continued to identify measures that save energy through our new energy and carbon management system, where the primary driver was to measure related operational efficiencies.

CASE STUDY

Setting a new long-term GHG emission-reduction target

Achieving net zero is not feasible at the ARM individual company level for two primary reasons: technologies are not currently available to reach net zero and no markets are willing to pay the premium associated with producing zero-carbon commodities. The costs of decarbonisation would therefore be borne by ARM and would not be economically viable until markets and prices adjust.

Addressing these constraints requires collective actions across markets and value chains. This is especially the case given the expectation that ARM includes material scope 3 emissions in a net zero commitment.

Following our first climate change-scenario analysis, we have set the following long-term target: ARM aims to achieve net zero GHG* mining by 2050.

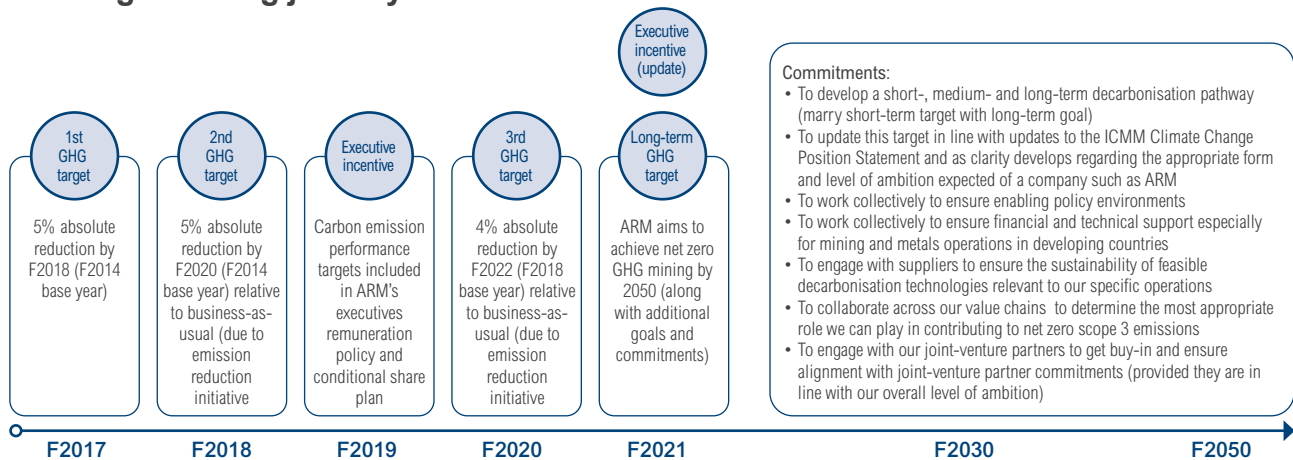
Long-term commitments and goals

We commit to the following actions to deliver on our long-term ambition:

- Update this target in line with updates to the ICMM climate-change position statement and as clarity develops on the appropriate form and level of ambition expected of a company such as ARM
- Work collectively to ensure enabling policy environments
- Work collectively to secure financial and technical support, especially for mining and metals operations in developing countries
- Engage with suppliers to ensure the availability of feasible decarbonisation technologies relevant to our specific operations
- Collaborate across our value chains to determine the most appropriate role we can play in contributing to net zero scope 3 emissions
- Engage with our joint-venture partners to get buy-in and ensure alignment with their commitments, provided these are in line with our overall level of ambition.

*This includes ARM's scope 1 and 2 emissions associated with operations under direct or joint direct operational control.

Our target-setting journey



TPI: Questions 4,7 and 14

GHG emission-reduction initiatives

Our strategic focus on cost efficiencies and operational cost-reduction projects support our efforts to reduce energy consumption and emissions. Our energy and climate-change strategy aims to identify and develop opportunities for long-term achievable emission reductions. It does this by investigating energy-efficiency initiatives, alternative energy sources, new technologies, and considering our diversification into less energy-intensive products.

This process, which involves feasibility or product comparison, followed by budgeting and capital allocation and finally procurement or construction, depending on the nature of the project, spans over multiple financial years.

We drive investment in emission-reduction activities in the following ways:

- Incentives:** Our 2018 conditional share plan connects corporate executive share incentives to our GHG emission-reduction target. The plan has been updated to include yearly executive incentive targets towards achieving a 4% reduction by the end of F2023. At our operations, remuneration and incentive packages for engineers and production staff are linked to energy efficiency and GHG emission reductions
- An internal carbon price:** We have taken initial steps to establish an internal carbon price for evaluating new projects and acquisitions. A range of carbon prices has been applied to our feasibility studies for solar power and battery-storage systems at our Black Rock and Khumani mines in the Northern Cape, for example. The pilot provided some insight into the financial implications of a project that reduces carbon tax liability, and generated lessons for integrating an

internal carbon price into our new projects and acquisitions

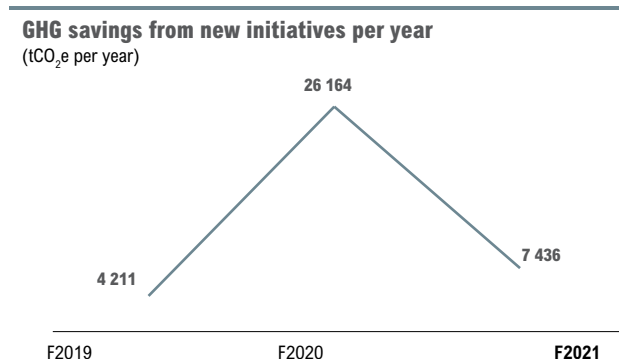
- Climate-scenario analysis:** This analysis demonstrated the importance of identifying an appropriate decarbonisation pathway in line with the global 1.5°C climate goal
- Dedicated budget:** We have a capital allowance for energy-efficiency projects at our operations
- Energy-efficiency plans:** The ARM Ferrous division has an energy-efficiency charter that includes targets for efficient practices. Energy-reduction plans are also in place at the operations in our Platinum division
- Engagement workshops:** Annual climate and water workshops at our operations focus on identifying and implementing GHG emission-reduction initiatives. In F2021, these workshops helped to improve reporting systems in preparation for our revised carbon budget, updated the conditional share plan incentives, and set our long-term GHG reduction target
- Leveraging incentives and innovative models:** We have benefited from the section 12L energy-efficiency incentives offered by the South African government, and we continue to explore direct support opportunities and engage with third parties on innovative models for procuring renewable energy
- Research and development (R&D) and supply-chain engagement:** We are exploring, internally and with our partners, innovative technologies that deliver low-carbon products or help our operations by indirectly reducing their energy consumption and environmental impacts.

ARM has been tracking and reporting on GHG emission-reduction initiatives to the CDP since 2010. Performance, as measured by emission reductions achieved, improved

Climate change continued

between F2013 and F2018 but slowed in F2019 due to challenging market conditions, limited viable options, the implementation of many 'quick-win' initiatives, and the financial and governance processes associated with capital investments. However, due to additional investments and improved measurement and reporting, we registered significant additional emission savings in F2020 and F2021, despite the challenging market conditions associated with Covid-19.

GHG savings from new initiatives per year



Various saving and carbon emission-reduction initiatives were implemented in F2021.

New initiatives implemented in F2021	Additional savings per year (tCO ₂ e)
Khumani Mine has optimised fleet usage through a mine star system that identifies vehicles that can be parked when not required for production, optimised transport by reducing overload spent and replaced several geysers	7 166
Beeshoek Mine has installed more efficient air-conditioners	149
Black Rock Mine has installed additional LED strip lights and reduced haul distances	122

Some projects have a payback period of less than three years. Additional projects being developed include:

- Investigating the feasibility of solar PV plants with battery storage in the Northern Cape and the potential to wheel renewable energy to Two Rivers Mine
- Reducing vehicles required. Beeshoek Mine will replace trucks to reduce the size of the fleet while handling the necessary tonnages. Two Rivers Mine

is exploring centralised loading underground to reduce the number of load-dump-haul (LDH) vehicles required

- Energy efficiency: We are moving fans closer to working places, installing motion detectors for LED lights, automatically stopping conveyors when not in use, investing further in LED lighting, and installing vent fans with variable speed drives, such as at Black Rock Mine
- Optimisation: We are looking into surface fan relocation, right-sizing hauling vehicles (for example, improved road conditions, reducing idling time, using batteries to support air-conditioning systems and lighter bowls to reduce diesel consumption at Khumani Mine) and replacing haul roads with underground conveyor belts (such as at Modikwa Mine)
- Reducing energy requirements for haulage: Khumani Mine is investing in a discard spreader system that will replace haul trucks with conveyors. This will reduce diesel consumption, increase electricity consumption and result in a net savings in GHG emissions from February 2022. Modikwa and Black Rock mines are exploring leaving vehicles underground by investing in underground workshops
- Reducing water-pumping requirements
- Reducing emissions in our value chain (scope 3 – transportation)
- Exploring the potential of liquid natural gas (LNG) vehicles: Khumani Mine is considering the use of LNG in vehicles, with suppliers claiming a potential 30% reduction in energy consumption
- Piloting electric vehicles with multiple benefits (see ARM's F2020 supplementary report on climate and water)
- In F2021, ARM's Cato Ridge Works commissioned a study to explore the potential of using biomass as a reductant in the ferromanganese smelting process. This would contribute to a reduction in scope 1 process emissions. It is understood that there is adequate supply available to use biomass at scale and could work in theory. The study is still under way and, if laboratory results are positive, the operation will explore a pilot. We need to understand what level of substitution is possible within the specific Cato Ridge Works context.

CASE STUDY

Rolling out our energy and carbon management system

In F2020, we started to develop a formal system that identifies, prioritises, implements and reports on measures that save energy and GHG emissions.

The need for this system emerged from a variety of regulatory and voluntary drivers related to decarbonisation and energy management. The carbon budget, for example, requires a pollution prevention plan (PPP) that outlines planned measures and reports on implementation performance, while carbon tax requires an indication of efforts to reduce taxed emissions and mitigate costs.

In terms of our voluntary decarbonisation objectives, we knew that we needed to develop a decarbonisation pathway to achieve our long-term GHG reduction target, and to inform the short-term milestones of our executive share incentive. Reporting on our progress in terms of our existing target, and the points above, is also critical, as is continually finding ways to reduce energy costs and mitigate climate-transition risks.

The system has since been developed, and is based on existing processes and on elements of the ISO 50001 energy management system. We will evaluate the benefit of a formal ISO 50001 implementation based on our experience with this initial roll-out.

This year, our operations agreed to implement measures to achieve our current target. This will inform our second GHG PPP, which was submitted to and approved by the DFFE in F2021. These measures included assigning clear roles and responsibilities for implementation, performance measurement and reporting.

A new reporting system was also developed that helps operations report on energy consumption, carbon-emissions performance relative to interim targets, and the agreed measures to reduce energy consumption and GHG emissions. This information is shared with the executives of each division quarterly.

In addition, our Platinum division has started completing energy and carbon audits to identify areas where energy efficiency can be improved and carbon emissions reduced. Based on the outcomes of these audits, our operations will recommend energy-saving opportunities and carbon emission-reduction initiatives that will be included in an energy and carbon management plan. This will be linked to our operational energy and carbon targets.



Climate change continued

CASE STUDY

Improving our GHG emissions accounting

One of the areas we are focusing on as we work to contribute to mitigating climate change is improving our accounting and reporting processes.

Improved emissions accounting at Cato Ridge Works

ARM's process emissions at Cato Ridge Works represent 44% of our scope 1 emissions and 8% of our scope 1 and 2 emissions on an operational control basis.

Mandatory GHG reporting regulations require that we adopt a tier 3, or mass balance, accounting methodology for the source of these emissions. The carbon tax requires that Cato Ridge Works and Cato Ridge Alloys, as separate legal entities, disclose emissions and pay carbon tax separately.

While we have historically applied a tier 3 approach to calculating process emissions at Cato Ridge Works, we have been unable to split Cato Ridge Works (CRW) and Cato Ridge Alloys (CRA) using this approach. We have therefore used a tier 1 approach, which deals with default emission factors, in complying with the regulations.

This year, we implemented measures to enable a tier 3 approach to calculating process emissions at these separate entities. This involved disaggregating process inputs and moving to a monthly reporting schedule to ensure that carbon content factors per input were accounted for more accurately. We did this to account for improved furnace efficiencies and other measures we are implementing to reduce emissions with greater accuracy. We also apportioned other scope 1 and scope 2 emissions to each separate entity. Historical emissions at the operation have also been disaggregated.

Disaggregated emissions data at CRW and CRA enabled a more accurate calculation of attributable emissions based on ARM's equity share in CRW (50%) and CRA (25%). Previously we reported 50% of emissions for the whole operation (including CRW and CRA emissions). Historical emissions have been restated to account for improved accuracy as a result of this disaggregation.

Improved scope 3 accounting

In F2020, we assessed scope 3 category 10 (processing of sold products) and made significant strides in improving the accuracy of these emissions categories.

In F2021, we continued with this work by including

emissions associated with the processing and use of manganese ore and ferromanganese.

In response to our stakeholders' request that we disclose GHG emissions related to our investments, we included ARM's attributable GHG emissions from coal investments under scope 3 category 15 (investments) for the first time in F2020. This year, we included reporting for Harmony Gold on the same basis.

We also included emissions associated with transmission and distribution losses (part of category 3: fuel and energy-related activities), and have restated F2020 and F2019 to include these sources.

All categories of scope 3 emissions are reported on an attributable basis (previously reported on 100% basis).

Interrogating our GHG accounting organisational boundary

During our F2020 annual general meeting (AGM), shareholders questioned our application of the equity-share approach in setting our organisational boundary. This applies to disclosing emissions associated with our investments in ARM Coal and Harmony Gold as part of our scope 3 inventory.

From 2016, the South African government's carbon budget and mandatory reporting requirements have required an operational control approach. We have therefore been able to voluntarily report our carbon footprint using the equity-share approach, while complying with the regulatory requirements using the operational control approach (mandatory reporting requires calendar year reporting). Our scope 1 and 2 carbon footprint has undergone third-party assurance.

Given the growing emphasis placed on scope 3 emissions, our policy commitment to engage with external parties to determine a preferred approach to reporting scope 3 emissions and to identifying our role in reducing these emissions, we have committed to reviewing our organisational boundary in F2022.

CASE STUDY

Investments in low-carbon R&D

Over the past six years, ARM has been developing a new smelting technology for ferroalloys. The new technology reduces electrical energy requirements and CO₂ emissions by around 40%. The potential of this new technology led ARM to buy the remaining share of the Machadodorp Works smelter from Assore, its joint-venture partner, in F2019.

Total funding to commercialise this project is estimated at R1.2 billion, including operational costs. Some R167 million has been spent to date on developing the technology. Pilot plant test work has been successful.

A feasibility study for the conversion of the first furnace has been completed. Additional furnaces will be converted once the first conversion has proven successful.



Climate change continued

Risk management

Integrating climate change into the risk management process

Our processes for identifying, assessing and managing climate-related issues are integrated into our overall risk management process and our ERM policy. We are committed to developing, embedding, implementing and continuously reviewing our ERM processes at all levels in our organisation.

The timing of our climate-change risk management process is aligned with our assurance and corporate governance requirements. Climate risk management, however, is not an activity that takes place periodically, but continuously through all phases of our work and with every major change in our business and operations.

All ARM-managed operations and divisions conduct quarterly risk reviews, which are supported by six-monthly corporate risk reviews and an annual group-level risk workshop. Climate-specific processes to augment these steps include annual climate and water risk assessments and management workshops with the divisions and operations, as well as climate scenario analyses to explore the long-term transition and physical risks associated with different climate futures. The first climate scenario analysis was completed in F2021.

The management risk and compliance committee (a subcommittee of the audit and risk committee) coordinates and monitors our ERM process, which includes climate-change risks.

Company-level risks, such as the evolving climate-change mitigation regulations (including the carbon tax and carbon budgets), are tracked by the chief risk

CASE STUDY

Mainstreaming climate-change risk into ARM's ERM processes

In F2021, we undertook a physical climate-risk assessment as part of our climate-change scenario analysis. This analysis was designed to assess the resilience of our strategy, and involved examining our physical climate risks, including temperature, precipitation, and the occurrence of extreme weather events and their impact on mining.

During the process, it became clear that climate risks have real financial implications for our business, both through the potential capital investments we may require to continue operating, as well as the disruptions they may cause to our operations. It was apparent that identifying, evaluating and managing these risks required detailed quantified information. We also realised that a well-developed risk scale, able to incorporate climate risk, was necessary to communicate physical climate risks at corporate level.

As a result, ARM decided that this work could not move ahead outside of the corporate ERM process, and that a complete integration of climate change into the ERM process was necessary. The ERM impact scale was flagged for enhancement and the team identified that climate change needed to be included in the risk analysis process.

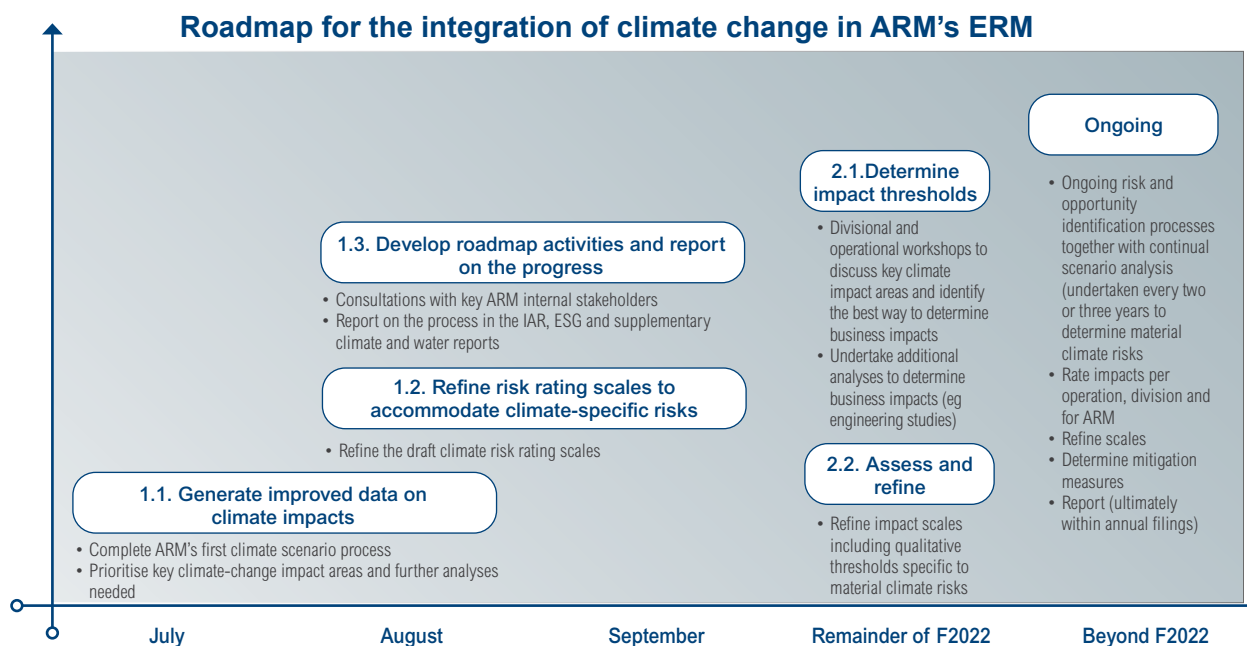
The enhancement will build on existing processes that identify material climate risks and opportunities, explore long-term climate-change scenarios, assess their implications for business, and look into developing appropriate response measures. It will also build on initial work that informed our ERM policy, risk appetite and tolerance standard, risk assessment standard, and initial steps to translate previous climate-change risk disclosures into the ERM framework.

Climate risks will be assessed in all aspects of ARM where climate risk and climate resilience are relevant, including existing processes, practices, standards and guidelines, from planning to operations to closure. Ultimately, these climate-change risks and opportunities will also be integrated into mainstream filings, including income statements, cash flow statements and balance sheets.

A roadmap to integrate climate change fully into our ERM process was finalised in August 2021. This roadmap includes improving data on climate impacts, and refining risk rating scales to accommodate climate-specific impacts. It will also assess climate impact thresholds at operations and determine mitigation measures to negate risks. Once the roadmap has been approved, it will be implemented from F2022. Updates on this process will be included in future public reports.

officer, the executive: technical services, the group electrical engineer, executive: sustainable development, the environmental specialist, divisional safety, health, environment and quality (SHEQ) managers, and engineering managers. A bottom-up assessment of mitigation potential is used to inform engagement with government and the development of our GHG emission-reduction target.

This process is supplemented by board and management discussions, stakeholder needs and concerns raised, peer reporting, guidelines and frameworks, legislation, industry initiatives, climate-change advocacy and media monitoring.



ARM climate and water compliance and reporting programme

In 2017, we launched a programme to comply with new climate-change regulations, as well as non-negotiable but voluntary requirements and reporting expectations related to climate change and water. The regulatory and voluntary requirements are related, and our goal was an integrated approach to developing systems, reporting and building capacity to meet current and evolving requirements.

The programme aimed to comply with the requirements to submit a GHG pollution-prevention plan and our GHG emissions to the DFFE; identify gaps in climate and water risk assessment, management and reporting; and comply with the ICMM member commitments on climate change and water. It has since evolved and phase 5 of the programme, which we conducted in F2021, was

informed by a variety of climate change-related drivers affecting our business. Specific objectives included:

- Working towards a long-term GHG target
- Undertaking our first climate-scenario analysis
- Further steps to formally integrate climate change into our ERM
- Piloting an internal price on carbon
- Improving GHG accounting and reporting, including compliance with mandatory reporting and submission of ARM's GHG pollution-prevention plan progress report, process emissions accounting at Cato Ridge Works, and our scope 3 emissions accounting
- Rolling out our GHG and carbon management and reporting system
- Complying with the next phase of GHG mitigation regulatory measures being implemented by the DFFE and the carbon tax
- Exploring carbon offsets
- Moving towards setting context-based water targets
- Improving ICMM water reporting.

Climate change continued

Annual climate change and water workshops

As part of our climate and water compliance and reporting programme, ARM conducts annual climate change and water workshops with each division and operation. Representation at these includes senior management, engineers and environmental managers on-site, together with the executive: sustainable development and divisional SHEQ managers. These sessions are facilitated by an external specialist consultant.

In these workshops, we explore evolving climate change and water risks and opportunities. We specifically look at upstream risks in our supply chain that have the potential

to impact our operations directly through production stoppages or increased costs, for example, and risks that affect our stakeholders. The latter particularly explores the availability of water in our communities.

Due to the increased material importance of both climate change and water management, particularly the former, we have started to address these issues separately in our workshops. This is to ensure that focused attention is paid to each topic and all the necessary resources are made available.

As a result of Covid-19, our F2021 workshops once again took place online.

Past workshops

The focus of workshops undertaken to date include:

Date	Topic	Objectives	Outcomes
May 2017	Water risk assessments and reporting, water and carbon goal setting	<ul style="list-style-type: none"> Assess current processes Identify gaps in relation to stakeholder requirements Move towards developing revised targets 	<ul style="list-style-type: none"> Water goals set at operational level Operational data secured to inform water target Agreed on a process for managing water risks in supply chains Gathered data and enhanced strategies for stakeholder engagement Gathered data to inform revised GHG corporate
Feb, Nov, Dec 2018	GHG mitigation analysis, target setting and PPP compliance	<ul style="list-style-type: none"> Take steps to implement the ICMM position statement on water stewardship, focusing on ICMM metric definitions Determine considerations of all GHG mitigation options at each operation Agree on water target Gather climate and water data for reporting purposes 	<ul style="list-style-type: none"> Initial application of consistent and comparable reporting using standardised metrics complete Revised GHG target and agreed on water target Completed final GHG PPP Gathered and reported relevant data
February 2019	Implementing ICMM member commitments related to water	<ul style="list-style-type: none"> As point one above 	<ul style="list-style-type: none"> Application of consistent and comparable reporting using standardised metrics complete
Jun – Jul 2020	Preparation for next phase of GHG mitigation-related regulatory instruments and reporting	<ul style="list-style-type: none"> Meet GHG requirements and expectations Improve GHG management and reporting systems Update water target Gathering data on climate change and water-related risks 	<ul style="list-style-type: none"> Improved reporting of GHG reduction initiatives Agreement on system for improved reporting of GHG reduction initiatives Inputs secured for updated GHG and water targets

Workshops in 2021

In March 2021, ARM put steps in place to decarbonise in line with net-zero ambitions. We achieved our aim to develop a long-term GHG reduction target, to improve our reporting of GHG emissions and reduction initiatives, and to improve our identification of climate risks and opportunities. In July 2021, we expanded on our F2020 efforts to set context-based water targets (see page 77).

Considering climate-change risks in ARM's investments

ARM Coal

ARM Coal has a 20% share in PCB and a 51% share in Goedgevoonden. Glencore Operations South Africa owns the remaining stakes.

Goedgevoonden is an open-pit mine producing around 7Mt of saleable thermal coal per year and has a life of 20 years. PCB includes Impunzi, an open-pit operation, and Tweefontein, an open-pit mechanised and underground operation. PCB produces some 15.3Mt of saleable thermal coal per year and has a life of 15 years. Export coal is marketed and sold by Glencore to various markets, mainly in India.



Information on coal resources and reserves appears on page 98 of ARM's integrated annual report.

Goedgevoonden is governed by a management committee controlled by ARM Coal, with ARM and Glencore representatives. Operational management is contracted to Glencore. PCB is governed by a supervisory committee with representatives from both ARM and Glencore. The operational management of PCB mines is contracted to Glencore.

Climate-change risks are assessed and tabled as appropriate at quarterly steering committee meetings. GHG emissions associated with the operations are measured and Glencore consolidates these in reporting on all its operations in South Africa as part of mandatory reporting regulations. ARM has reported on GHG emissions attributable to its investment in coal (see page 30).

Glencore has committed to deliver a 40% reduction in total emissions by 2035 (on 2019 levels) and, within a supportive policy environment, to be a net zero total emissions company by 2050. It has also undertaken a climate-scenario analysis and formulated a new climate strategy in partnership with key stakeholders.

Glencore has made the strategic decision to continue to operate its coal mines until they reach the end of their

lives. It continues to invest in efforts to decarbonise its operations, including PCB and Goedgevoonden. This includes collaborating with supply chains, supporting uptake and integration of abatement, using technologies to improve resource efficiency, and being transparent in reporting on progress and performance.

ARM recognises that global emission-reduction initiatives and the move to cleaner mobility and energy are expected to put pressure on demand for PGMs and thermal coal but create opportunities for other commodities in our portfolio, including bulk and base metals.

Harmony

ARM owns 12.12% of Harmony's issued share capital. Harmony is run by its own management team who are responsible for its mineral resources and reserves, which it reports on in its annual report. As part of engaging with Harmony to report on our scope 3 emissions attributable to this investment, we explored Harmony's approach to identifying and managing climate-related risks.

Over many years, the company has prioritised making its operations more energy efficient to reduce the consumption of fossil fuel-generated energy and limit its emission of GHGs. More recently, Harmony committed to a more carbon-neutral future with the strategic decision to build its own solar plant, which will provide 30MW of renewable energy to its operations in the Free State province of South Africa.

The company has also undertaken a climate-scenario analysis and determined that water is the primary medium through which it will feel the physical effects of climate change. Second to that is the increase in temperatures, which could affect underground ambient temperatures, particularly in its deeper-level operations. It has also identified climate-transition risks that could increase business costs and undermine the long-term viability of operating deep-level mines. Harmony continues to undertake robust business planning that considers these risks.

In F2021, Harmony published its second report on climate change in line with TCFD requirements.

ARM's risk processes do not include African Rainbow Capital and African Rainbow Energy and Power. They are separate companies with their own processes for assessing and managing climate change-related risks and opportunities.

TPI: Question 12



Climate change continued

Material climate-change risks

Transition risks

Policy and legal risk	
Risk	Response
<p>Carbon tax: The Carbon Tax Act was introduced on 1 June 2019. Carbon tax, at a rate of R120/tCO₂e, must be levied in respect of the sum of the scope 1 GHG emissions of a taxpayer. The carbon tax rate will increase by the amount of the consumer price inflation (CPI) of the preceding tax period plus 2% until 31 December 2022, thereafter only by the CPI of the preceding tax period.</p> <p>Through Assmang, our joint venture with Assore, we pay direct carbon tax. Our operations in the Northern Cape (Beeshoek, Black Rock and Khumani mines) collectively trigger the 10MW energy generation threshold, requiring us to pay direct carbon taxes (Black Rock alone has a backup diesel generation capacity of 14MW). Cato Ridge Works, and the separate joint venture, Cato Ridge Alloys, conduct an activity (ferroalloy and other metal production) that requires us to pay direct carbon taxes.</p> <p>Two Rivers Mine will need to increase diesel generator capacity to cover power needs until the Eskom grid can meet the demands associated with the new Merensky project. This will trigger the energy generation capacity threshold and require Two Rivers Mine to register and pay direct carbon tax in future.</p> <p>In addition, 7c/l on petrol and 8c/l on diesel are passed on through the fuel levy as an indirect carbon tax. There is no electricity pass-through cost in the first phase.</p> <p>Our other operations do not, as legal entities on their own, trigger the 10MW energy generation capacity threshold and are therefore not subject to direct carbon taxes. These operations do pay indirect carbon tax through the tax levied on liquid fuels. The impact in the first phase (combined direct and indirect liability of below R10 million for 2019, increasing to an estimated maximum of R16 million in 2022) is not expected to be significant. From 2023, with electricity price pass-through, costs could exceed R290 million a year, based on current emissions.</p>	<ul style="list-style-type: none"> • We have set a short-term GHG reduction target, set a long-term target, allocated budget to implement emission-reduction initiatives, established incentives for executives linked to reduction initiatives as part of the GHG reduction target, and set incentives related to energy efficiency for engineers and production staff (at the mines) and related to GHG emission reductions for production teams (at the smelters) • We are also actively exploring opportunities to invest in renewable energy technologies or to procure clean energy from renewable sources. This includes current feasibility studies for solar PV and storage capacity in the Northern Cape and the potential to wheel renewable energy to Two Rivers Mine • We are engaging transparently with government • We have developed a climate-change and energy working group and we conduct annual workshops at our operations, which include assessments of energy-reduction opportunities and reporting • We are evaluating carbon tax pass-through risks in our supply chain and are actively engaging with suppliers to mitigate risk and enable operations to reduce their own energy consumption and GHG emissions.

Risk	Response
<p>Carbon budgets and associated mitigation plans: The South African government published a draft climate change bill in 2018. The bill aims to develop an effective climate-change response and to achieve the long-term, just transition to a climate-resilient and lower-carbon economy and society. The bill includes, in line with achieving the country's targeted national GHG emissions trajectory, the establishment by government of sectoral emission targets, sectoral emissions-reduction plans and associated budgets that will be allocated to companies (a cap on emissions at the company level).</p> <p>The voluntary first phase of the carbon budget process ran from January 2016 to December 2020 and was used as a pilot to test the system and structures required to move to a mandatory phase. The DFFE has agreed and gazetted a transition phase (phase 1 extension) running from January 2021 to December 2022. Thereafter, the mandatory phase 2 will run from January 2023 to December 2027 and will be aligned with the carbon tax.</p> <p>ARM will be required to submit data in late 2021 and will be allocated a revised budget. There will be a process to review and refine budgets in 2022 ahead of the mandatory phase. Uncertainty remains on the methodology for setting the budgets and how these will be integrated with the carbon tax. Linked to the budget is a requirement to submit a GHG mitigation plan (previously a pollution prevention plan (PPP)) and to report on progress annually.</p>	<ul style="list-style-type: none"> • ARM submitted a proposed carbon budget for 2016 to 2020 and this was approved by government. The benefits of participating in the first phase include a 5% tax-free allowance for the first phase of the carbon tax. ARM developed and submitted a GHG PPP that was also approved by government. The PPP progress reports were submitted in March 2019 and 2020 • ARM has submitted a GHG PPP for the phase 1 extension and this has been approved. The new energy and carbon management system will be used to identify new measures to reduce emissions to inform our future submissions ahead of the mandatory phase. The system will also include operation-level carbon budgets to ensure that ARM, at company level, does not exceed our budget • Various efforts to reduce GHG emissions (as listed above) also mitigate risk associated with carbon budgets and the GHG PPP • Active engagement with government and, as a member of industry associations such as Business Unity South Africa, Minerals Council South Africa and National Business Initiative, create awareness of the latest developments and enable us to share and learn from peers.

Climate change continued

Policy and legal risk	
Risk	Response
<p>Global policies and measures to reduce GHG emissions:</p> <p>The launch of the Paris Agreement in 2020 led to a groundswell of climate momentum around the world. A call was made for countries to update their first nationally determined contribution (NDC) with increased ambition by COP26, which will be held in Glasgow in November 2021, and many countries, companies and organisations have now committed to net zero emissions by the second half of the century.</p> <p>South Africa is finalising its NDC update, which will be submitted ahead of COP26. The draft commitment to reduce GHG emissions sees the country's emissions profile largely plateauing from now until 2025 and then decreasing. What is unknown at the moment is which emissions are specifically to be reduced and what sectors will be allowed to emit in future.</p> <p>As part of the consultation process, calls have been made in South Africa for the newly formed presidential commission on climate change, which comprises representatives from business and civil society, to set a net zero aspiration in the future.</p> <p>Malaysia, which also committed to fighting climate change by signing the Paris Agreement, has not updated its NDC. Malaysia's commitment in 2006 was a 45% reduction of GHG emissions intensity of GDP by 2030, compared to its GHG emissions intensity in 2005. A 35% reduction is required on an unconditional basis and 10% will be committed to if outside support is provided.</p> <p>This means that Malaysia expects to decouple its GDP growth from GHG emissions in future. To achieve the 45% reduction in emissions intensity will require a reduction in absolute emissions. The exact way emissions will be reduced is not outlined.</p>	<ul style="list-style-type: none"> • We will continue our initiatives to reduce direct and value-chain emissions in line with policies in South Africa and Malaysia • We will engage with suppliers through collective industry initiatives and communicate the technologies we require to meet our GHG reduction objectives over time • We are investing in research and development to significantly reduce the climate impacts of our products and processes. This includes developing technology that will enable a significant reduction in GHG emissions from smelting and offer further potential cogeneration benefits, exploring alternate processing technologies that could reduce our reliance on grid electricity, and looking at processing waste streams that might enable more efficient production. We will consider participating in collective R&D efforts to advance low-carbon technology that benefits our operations. • The ERM process continuously monitors developments in climate-related domestic policy in the areas in which we operate as well as in primary customer markets • Our climate-scenario analysis explored the implication of different climate policy developments on our costs and our ability to competitively respond to market demands.

Risk	Response
<p>Mandatory reporting regulations: The DFFE introduced the national GHG emission reporting regulations on 3 April 2017, and requires that data be submitted at the end of March each year.</p> <p>In September 2020, the government gazetted amendments to the regulations and released a draft validation and verification guideline for the national GHG emissions reporting system (NGERS) for comment. The Department of Mineral Resources and Energy indicated that it was developing regulations that will require companies to measure and report energy as well as develop and submit energy management plans, but there have been no further developments in F2021.</p>	<ul style="list-style-type: none"> • We have submitted our GHG data to the DFFE in March 2018, 2019, 2020 and 2021 and have a mature GHG reporting system that will enable ongoing reporting that complies with regulations. The expansion of Two Rivers Platinum Mine will require additional diesel generator capacity until the Eskom network can be upgraded. This triggers the 10MW energy generation capacity threshold and will require the mine to register and submit GHG data in F2022 • The ARM Ferrous division, through our joint venture with Assore, is part of the Energy Intensive Users' Association and has an energy efficiency charter in place that includes targets for energy-efficient practices • Energy-reduction plans for the ARM Platinum division were established in F2015.
Technology risk	
Risk	Response
<p>Technology substitution (electric vehicles): Decarbonisation measures will particularly impact demand for palladium and rhodium, in the internal combustion engine automotive sector (roughly 40% of PGM production). Our 1.5°C – supportive scenario sees an 18x increase in electric car sales by 2030 relative to 2020 (subject to availability of critical minerals). Even in our business-as-usual scenario, we see growth in electric vehicle deployment affecting demand for palladium and rhodium in autocatalysts.</p>	<ul style="list-style-type: none"> • Strategically, ARM would need to move towards more platinum production (for example, at Two Rivers). But Modikwa is at risk as it produces a relatively high proportion of palladium and is labour intensive • Any additional investments in PGMs will consider operations that produce relatively more platinum than palladium.

Climate change continued

Reputational risk	
Risk	Response
<p>Increased stakeholder concern or negative stakeholder feedback: There is a reputational risk associated with not adequately responding to evolving, and increasing, climate change-related stakeholder expectations. Failure to demonstrate positive climate-change performance would damage our reputation and impact our relationships with customers, investors, business partners, regulators and broader society.</p> <p>We are facing growing pressure from investors, in particular, to proactively manage climate-change risks and opportunities, which are increasingly seen as material to shareholder value.</p> <p>In 2019, the Raith Foundation and Just Share raised a number of questions and concerns related to climate change. These included: the fact that our GHG emission reporting excludes all the emissions from our investment in ARM Coal, which is managed by Glencore; alleged non-compliance with water use licence conditions at Tweefontein and Goedgedvonden mines, which form part of ARM Coal; and a request to clarify our position on the concerted campaign by Business Unity South Africa to persuade the government to defer the implementation of the carbon tax.</p>	<ul style="list-style-type: none"> • We have been admitted to the FTSE4Good Emerging Markets Responsible Investment Index since inception. ARM's ESG practises are recognised by our continued inclusion in the FTSE/JSE Responsible Investment Top 30 Index, and we were previously included in the JSE Socially Responsible Investment Index. The FTSE/JSE Responsible Investment Index Series has been designed to identify South African companies with leading ESG practices and to facilitate investment in those companies • To manage our overall sustainability performance, we regularly engage with stakeholders and we produce an annual integrated ESG report. Additionally, in 2017, we launched a programme to comply with new climate-change regulations, as well as non-negotiable but voluntary requirements and reporting expectations on climate change and water. The regulatory and voluntary requirements are related, and we are implementing an integrated approach to developing systems, reporting and building capacity to meet current and evolving requirements. This report represents one output of that process • We engaged with the Raith Foundation and Just Share and have responded to formal requests for information. As part of the request to disclose GHG emissions related to our investments in coal, we asked Glencore, with management control of the ARM Coal operations, to provide emissions data for those operations, and these were reported for the first time in F2020. The GHG emissions attributable to ARM's investment in these coal operations are reported here again, as well as attributable GHG emissions associated with our investment in Harmony Gold, which are reported for the first time • Communities receive additional benefits from the mines and smelters through our corporate social investment (CSI) and local economic development (LED) investment programmes. In F2021, ARM spent a total of R170.4 million on CSI and LED. R3.9 million was provided to water-related projects facilitated by the ARM Rural Upliftment Trusts. R12.5 million was spent on a municipal electrical support project and R1.5 million on a municipal water truck at Black Rock Mine. Beeshoek Mine spent R5.7 million on a street light project in Postmasburg. Two Rivers Mine spent R2.3 million to repair illegal electricity connections. Modikwa Mine spent R9.7 million on community water infrastructure.

Risk

Shifts in consumer preferences: Global climate action will have severe business impacts for mining groups – affecting global demand for several major commodities. Our scenario analysis shows that the future of thermal coal remains uncertain and there are divergent views from a Paris-aligned 1.5°C temperature change perspective, which suggest coal cannot exist beyond 2050 if we are serious about climate change, and others who believe coal dependency cannot be shaken based on current coal-use trends. In South Africa, for example, Kusile, Medupi and any new coal-fired power is planned to run beyond 2050. The reality of how soon coal will be transitioned out will probably depend on financial models that allow for the early closure of coal power stations.

Response

- We will use the results of our scenario analysis to inform strategic decisions on our portfolio
- We are developing an ambitious decarbonisation pathway to ensure that our products can compete in global markets increasingly demanding zero or low-carbon mining products.



Climate change continued

Physical risks

Acute risk

Risk

Increased severity of extreme weather events (affecting water availability): Drought due to climate change is a material risk where water is a critical resource for operations. In locations where ARM currently operates, water is a scarce resource, particularly in the Northern Cape and Limpopo provinces. The availability of water determines our ability to continue operating and expanding mining, beneficiating and smelting operations sustainably. Drought coupled with periods of extreme rainfall (a risk in the Northern Cape) also poses the risk of sinkholes with the potential to affect production.

The Khumani and Black Rock operations in the Northern Cape have already identified water as a strategic business risk and, due to regional water infrastructure problems, lack of access to water has the potential to impact the business significantly. Projected climate scenarios indicate a long-term decrease in annual precipitation and a likely increase in aridity for much of South Africa. This is particularly prevalent in the Northern Cape where conditions are already harsh. Recent drought conditions may be more prevalent and severe in the medium-term future and lower rainfall years will be the new normal rather than an anomaly.

There is also a projected increase in rainfall intensity and magnitude of return events which may result in more severe flash-flooding. Two Rivers and Modikwa mines also face long-term supply risks and would be susceptible to drought causing production disruptions. Investments in bulk water infrastructure result in higher water costs. If extreme climatic events do worsen as predicted by the climate models, further proactive management and mitigation measures will have to be taken to ensure operations do not experience business interruption and loss of production.

Response

- ARM anticipates greater investment in bulk water infrastructure as part of industry/government collaboration
- Sedibeng (utility service provider) is responsible for supplying potable water from the Vaal Gamagara Water Supply Scheme (VGGWSS) to our Northern Cape mines. Mines are expected to fund a significant portion of the scheme. A Mines' Leadership Forum was established in the Northern Cape as a principal committee of the Minerals Council South Africa to collaboratively and proactively engage on the appropriate design and cost of the VGGWSS (see page 83)
- An ARM executive participates on the Lebalelo Water User Association (LWUA), a section 12 entity set up by mining companies operating in the area. The association acts as a water utility, supplying bulk raw water to member mines and other clients from the Olifants River and the Flag Boshielo Dam (and De Hoop dam in future) (see page 79)
- Various investments have taken place at mine level. For example, Khumani Mine funded the upgrade of the Olifantshoek bulk-water infrastructure and various investments in maintenance. Investment in on-site water storage; reduced consumption through efficiencies (eg reduced water consumption for mining activities by using additives); lining dams and tailings facilities and improving return-water infrastructure (see page 84).

Risk	Response
<p>Increased severity of extreme weather events (increasing the risk of discharges): Climate change will likely result in an increase in the severity of extreme rainfall events. These storm events will have a higher flood peak and a shorter lag time. They will therefore occur faster with less warning. As such, extreme rainfall events could affect mining operations and result in operations having to discharge excess water into the environment. This could result in legal non-compliance and potential fines, which will have both reputational and financial consequences.</p> <p>Implications for the operations are, for example, greater investment in dewatering, increased capital costs to build water-related infrastructure with larger retention capacity and possibly increased requirements for water treatment facilities to treat process/mine water that may need to be discharged to the environment after extreme rainfall events. This is a potential risk for our Nkomati Mine and Machadodorp Works.</p> <p>Reduced production activities due to economic and market conditions have impacted the system at Machadodorp Works. Due to reduced reuse and consumption, any rainwater poses a potential risk of controlled discharge and associated non-compliance with the waste management and water use licences.</p>	<ul style="list-style-type: none"> • ARM manages water use at all its operations proactively and in line with its water use licences and regulatory environmental commitments. All operations run closed water circuits. The operations have developed management tools such as water balances to allow them to further optimise the use and management of water. Discharges only take place in line with permits in times of extreme precipitation or in emergency situations and these are reported to authorities as required • Nkomati is exploring all options to mitigate the potential discharge of water during care and maintenance phase and as the mine moves towards closure • Machadodorp Works established a water management project team and has constructed cut-off trenches to capture any dirty run-off water and redirect it to the sump and then to the stormwater dams.
Risk	Response
<p>Increased severity of extreme weather events (affecting electricity costs and supply): The long-term cost and lack of security of a reliable and adequate supply of electricity is a top ten group risk. Climate change has the potential to exacerbate this risk. Climate-related regulatory burdens could place additional pressure on the constrained national electricity-generation utility, affecting maintenance and investment in new generation capacity.</p> <p>Additionally, physical climate-change impacts could affect the supply of coal (and other products used in generating power) and damage infrastructure which, given the lack of reserve margin, could exacerbate power-supply risks. Loadshedding in South Africa also creates an indirect climate-change risk as ARM is forced to use backup generators. Increased loadshedding during the year has had a significant impact on diesel consumption, particularly at Black Rock which operates a 14MW backup generator.</p>	<ul style="list-style-type: none"> • ARM has invested in diesel generators to mitigate loadshedding and unplanned electricity supply constraints. • Emergency plans and monitoring systems are in place. • ARM engages in quarterly liaison meetings with Eskom. The group electrical engineer is the dedicated liaison person. He remains in constant communication with Eskom and is made aware of possible power outages that may affect the various operations. • There is ring-feed power supply at the operations. Khumani, Beeshoek, Two Rivers, Modikwa and Nkomati mines as well as Cato Ridge Works have ring-feed capabilities and projects are under way at Black Rock Mine to improve power-supply contingencies. • A service level agreement is in place with Eskom and joint-venture partners for the provision of generator capacity from Black Rock Mine when available. • ARM is exploring various options to secure renewable power on site.

Climate change continued

Chronic risk	
Risk	Response
<p>Changing rainfall patterns in the Vaal catchment: Our Northern Cape operations are supplied in part by Sedibeng Water, which sources water from the Vaal River. The rainfall regime in the Vaal catchment is projected to change. There will be drying in the north and west part of the catchment, but increased rainfall in the south and east. This will shift hydrogeological balances in the catchment and lead to stress on these water resources, threatening our long-term security of supply.</p>	<ul style="list-style-type: none"> ARM is contributing to collective investments in the VGGWSS. Further work and engagement is needed to understand the extent to which the relevant authorities have explored these projected impacts on future supply from the Vaal and what role ARM can play in ensuring appropriate response measures are put in place.
Risk	Response
<p>Rising mean temperatures affecting our workforce: South Africa's dynamically downscaled projections from the long-term adaptation scenarios indicate that temperatures will continue to increase in the near to long term by 2.5°C to 5°C by the end of the century. There is also a projected increase in the occurrence, duration and magnitude of heatwaves. The risk of rising temperatures impacts water requirements for the Northern Cape operations as the higher the temperature, the greater the evaporative losses.</p> <p>Higher temperatures could disrupt work as staff may suffer from heat stress. For example, at Beeshoek, historical data shows that weather patterns locally have changed considerably over time. The site experienced a high of 41°C in F2013, which was the highest temperature recorded in ten years. It was indicated by the Beeshoek Mine team that temperatures rising to 45°C may result in the site stopping work or, at least, need to rotate staff to prevent heatstroke.</p> <p>For Black Rock Mine in the Northern Cape, higher temperatures may also necessitate additional cooling requirements in the underground workings where applicable. In all the Northern Cape operations, additional air-conditioning for offices and buildings could lead to increased costs from additional energy, and result in rising GHG emissions.</p>	<ul style="list-style-type: none"> Operating sites monitor weather data continually. Should temperatures exceed a threshold, action will be taken to ensure staff are not exposed to heat stress. To mitigate the risk to water supply in water-scarce areas, it is likely that technology using less water than conventional tailings disposal (which entails slurring waste in high volumes of water) will be investigated and implemented more frequently (eg paste disposal as at Khumani Mine) Various other water conservation measures are described on page 84 The preliminary results of the climate-scenario analysis will be used to inform more robust climate-impact assessments as we further integrate climate change into ARM's ERM processes.

Risk

Increasing social unrest related to inadequate water service delivery (exacerbated by climate change):

Climate change will affect the livelihoods and wellbeing of vulnerable communities. The effect of reduced food security, negative health implications, higher costs and destruction of assets could indirectly influence our ability to source local skills, secure our mining rights and exacerbate employee relations issues, leading to industrial action and production losses.

Response

- We attempt to mitigate this risk through our employee relations policies, engagement with communities, government and other stakeholders, investments in line with our social and labour plans, BBBEE compliance, and our broader contribution to economic development in the country
- Our climate-scenario analysis highlighted this as a material long-term risk and we are investigating ways in which we can leverage our social economic development and corporate social investment spending to enhance community resilience to climate change.

Risk

Changes in precipitation patterns and extreme variability in weather patterns affecting ARM's suppliers:

Droughts and extreme rainfall events have the potential to impact our value chain. Our Northern Cape operations experienced floods in F2016, following a drought period. This combination resulted in sinkholes that affected mine logistics. For example, suppliers to Black Rock Mine had to travel an additional 100km for a period of four days. In F2016, nickel and chrome concentrate sales were affected by poor weather conditions that delayed shipments from Maputo Port.

Response

- ARM has not identified our supply chain as presenting a material water-related risk to our organisation, based on experience and initial investigations into potential risks in future (other than the need to secure the supply of water for the operations). Substitutes for critical supplies are available and water costs still represent a relatively small proportion of the cost of purchased goods and services. The most immediate concern relates to extreme weather events (floods and droughts) affecting logistics and the ability to receive goods and services timeously
- We recognise the need to better inform our assessment of supply-chain risk and will extend our initial assessment in F2022 (see page 59)
- ARM also actively engages with key suppliers (see page 59).

Climate change continued

Material climate-change opportunities

Opportunity	Strategy to realise the opportunity
<p>Resource efficiency incentives: There are a number of tax incentives and cash grants in the area of energy and climate change that we could take advantage of:</p> <ul style="list-style-type: none"> • The Department of Trade, Industry and Competition (dtic) runs the manufacturing competitiveness enhancement programme, which aims to provide enhanced manufacturing support, including green technology and resource efficiency • The section 12L tax incentive is managed by the Department of Mineral Resources and Energy (DMRE) and provides tax-reduction incentives for businesses to claim if they can show measurable and verifiable savings in all energy forms • The tax relief was increased in 2016 to a 95c deduction on taxable income per kilowatt-hour of energy saved. This incentive has been extended until the end of the first phase of the carbon tax (31 December 2022) in line with requests from stakeholders • Section 12B allows companies to deduct the cost incurred from investing in assets that are used directly for producing renewable energy from their taxable income. 	<ul style="list-style-type: none"> • As energy consumption and management is so important, tax incentives and grants will be investigated to support implementation of further energy-efficiency measures. • A project was implemented to secure section 12L benefits for the two initiatives at Cato Ridge Works in F2014 (installing two variable-speed drives on suction fans serving the tapping room of electric furnaces). These initiatives saved 11 093MWh of electricity, with a net saving of over R8.4 million in F2021.
<p>Access to growing markets for high-quality iron and manganese ore: Lumpy iron ore enable steel producers to reduce energy consumption and GHG emissions by about 10%. For every 1% of iron content above 62%, carbon emissions from the sintering process are reduced by a further 2–3%.</p> <p>The 65% lumpy iron ore and the 64.5% iron ore fines that ARM produces can reduce carbon emissions from the steel-making process by 17.5% and 6.25% respectively.</p> <p>Lumpy ore attracts a lump premium of about 15% and an additional grade premium of about 4.8%, with the grade premium for iron ore fines 4% over the base price for 62% fines.</p> <p>High-grade manganese ore also enables smelters to use less energy. In China, authorities have stopped local miners from mining low-grade manganese. This is the result of air pollution, energy-efficiency and climate-change drivers. This has led to an increase in imports of the type of high-grade ore that ARM produces.</p>	<ul style="list-style-type: none"> • Assmang has positioned itself to meet developments in demand in this market • Lumpy iron ore is upgraded to 65% (the industry benchmark is 62%); 56% of the total iron ore product is lumpy • Iron ore fines are upgraded to 64.5% (the industry benchmark is 62%); 44% of the total iron ore product is fines • The climate-related drivers increasing demand for ARM's high-grade manganese ore in China contributed to our decision to modernise and expand Black Rock Mine.

Opportunity

Access to new markets (platinum): Hydrogen (H₂) is seen by most analysts as playing a critical role in the climate transition. Despite existing barriers, energy companies continue to invest in green hydrogen as it is seen as a clear long-term option for achieving our global climate goal. Many countries are already launching ambitious hydrogen strategies and creating a unique momentum for the emergence of a global hydrogen economy.

Platinum will have a key role in the hydrogen economy. It is expected that demand will increase, given climate-related drivers in the transport sector (rising demand for fuel cell electric vehicles) and in industry (increasing demand for hydrogen as a clean energy source, as a feedstock for zero-carbon fuels and chemicals, and as a reductant that can reduce process emissions).

Strategy to realise the opportunity

- ARM monitors developments in the platinum market as well as initiatives to stimulate and support the hydrogen economy
- We will use the results of our scenario analysis to inform strategic decision on our PGMs.

Opportunity

Access to new markets (critical minerals for the energy transition): The energy transition requires substantial quantities of critical minerals, and their supply emerges as a significant growth area. The total market size of critical minerals like copper, cobalt, manganese and various rare earth metals grows almost sevenfold between 2020 and 2030 in the 1.5°C – supportive scenario. This creates opportunities to include these commodities in our portfolio.

Strategy to realise the opportunity

- We will use the results of our scenario analysis to inform strategic decisions on our future portfolio.



Climate change continued

The impact of risks and opportunities on business and financial planning

In the review period, our operations, suppliers and communities experienced a number of disruptions related to climate change. One of the most significant was a heavy rainfall event at Two Rivers Mine, which disrupted production and resulted in a R15.9 million loss of revenue. Loadshedding in F2021 required greater use of backup generators that support critical functions, such as ventilation fans, which increased diesel consumption and emissions.

Social unrest and strikes have impacted the resilience of our operations and of the communities in which we operate. The Lebalelo pipeline was damaged in 2015 by local communities that had social funding expectations beyond the prescripts of mines' social and labour plans. Incidents continue sporadically, but not as significantly as those in 2015.

On the positive side, market trends driven by climate change, among other issues, have seen an increase in demand for certain commodities. We continue to invest in PGMs and anticipate an increase in demand for platinum associated with hydrogen to reduce GHG emissions in the transport and hard-to-abate industrial sectors.

Assmang has also recorded higher demand for better-quality iron and manganese ores as steel producers are driven to reduce their GHG emissions. Steel producers in China, for example, have increased consumption of high-quality ores to improve efficiencies, reduce emissions and curb air pollution.

Climate-change risks and opportunities have also contributed to the impetus to invest in innovation. We are investigating and testing technology that may reduce energy requirements in the smelting process.

China manganese imports



Engagement on climate change

Value-chain engagement

Supply-chain engagement

We have always worked closely with our key suppliers, not only to ensure that we collectively work to mitigate climate risks in our supply chain, but to ensure we remain abreast and use the best technology available. Relevant and new technology might help our operations to increase energy efficiency, reduce our GHG emissions, or increase our resilience to physical climate-change risks.

We are engaging with our suppliers to reduce diesel consumption at our mines, for example, and are looking into ways to reduce our transport-related emissions while accommodating increased production at Black Rock Mine.

In F2019, we assessed each of our operation's top five suppliers by spend to understand their climate change-related performance. We found that, while information was available on larger suppliers, limited public information could be obtained for smaller, more local suppliers. Our larger suppliers also did not provide information on emissions at a product level.

In F2021, we included a preliminary assessment of supply-chain risk in our climate-scenario analysis. This will be used as a basis for further evaluating climate and water-related supply-chain risks and appropriate response measures in F2022.

The security of electricity supply in South Africa is a material risk, specifically the reliability and cost of power from Eskom, our primary supplier of electricity, which has demonstrated and reported problems in its financial and operational management. Uncertainty on the utility's future, high level of debt, and lack of proven historical reduction in emissions, present significant risk to our GHG reduction target and long-term objectives. To mitigate this, quarterly liaison meetings are held with Eskom representatives.

Going forward, we will identify additional suppliers to engage with directly. There is a need to consider the best way in which to gather data on suppliers that produce material GHG emissions to adequately and continually assess climate-related risks in our supply chain.

ARM also measures upstream emissions (scope 3) associated with purchased goods and services (currently limited to water treatment and the supply and production of explosives), fuel-related and energy-related activities and the purchase of transport services (associated with some goods purchased and the transport of product by third parties) (see page 27).

Customer engagement

We encourage the responsible use, reuse, recycling and disposal of our products. In our engagements with industrial customers, we discuss and address material climate-change mitigation risks associated with the use of our products.

Ore and Metal, the marketing company for Assore (trading as Assmang, our joint-venture partner in the ARM Ferrous division), monitors changes in national and international legislation that could influence the mining, beneficiation, sale or transportation of its products and proactively responds as necessary. Ore and Metal also facilitates customer ESG audits of operations as required.

We engage indirectly with partners through Assmang's participation in industry associations such as the life-cycle assessment (LCA) study on manganese commissioned by the International Manganese Institute (IMnI) and the International Chrome Development Association (ICDA) LCA study on chrome. The intended application of acquiring life-cycle inventory and impact data, as well as a global average for benchmarking, is to be able to communicate the aspects and impacts of manganese production with downstream steel producers, governments, key stakeholders and the general public.

An outcome of the IMnI LCA study in which Assmang participated was the agreement that detailed LCA data, including GHG emissions, could be shared among other member organisations for all parties to better understand the impacts associated with their value chains.

Climate change continued

Public policy engagement

ARM supports the move to a low-carbon economy and is committed to constructive engagement with government on measures aimed at achieving this. Important issues to consider in South Africa, however, would be the use of carbon tax to support targeted mitigation actions, alignment with other mechanisms such as carbon budgets, and clarity on how these mechanisms will integrate.

ARM has engaged directly with the DFFE and has been supportive in disclosing information that fed into the design of various climate-related policy developments. There is also further engagement in these processes through industry associations.

Participation in business and industry initiatives enables collective engagement with regulators and stakeholders, promotes benchmarking and sharing of good environmental practice. ARM participates in a number of initiatives, including the Minerals Council South Africa (and its environmental policy committee), Business Unity South Africa (BUSA), Ferroalloy Producers' Association and the ICMM.

Stakeholders and various reporting frameworks have highlighted the importance of ensuring consistency between our climate-change policy and positions taken by industry associations to which we belong. Involvement in these associations also serves as a sharing and learning opportunity in addition to being an advocacy mechanism for engaging with climate-policy development processes.

As a member of ICMM, we commit to publicly disclosing where our position differs to that of the ICMM on climate change. We continue to engage as an active member of the ICMM through the climate-change working group. We have provided feedback and comments on proposed additions to the climate change position statement as part of the ICMM's enhanced collective leadership. Our policy and commitments are aligned with the ICMM and we have further committed to updating our long-term target in line with pending updates to the ICMM climate change position statement.

In F2022, we will review our industry associations' positions on climate change. This will consider our direct and indirect lobbying on climate-related topics to ensure alignment with our new long-term ambition. Key issues to consider will include identifying issues of concern and developing appropriate response measures, engaging the association where policy change is required or considering suspending our membership where material misalignment exists.

TPI: Question 10, 11 and 19



Engaging with our partners

We work with our joint-venture partners to collectively assess and mitigate climate-change risks and capitalise on climate-related opportunities. This includes ongoing management interactions during the ordinary course of business, monthly executive management meetings and quarterly board meetings.

Our joint-venture partnership with Assore provides access to important industry initiatives such as the life-cycle assessment and life-cycle inventory studies, waste management initiatives, and the energy-efficiency initiatives of the IMnI and the ICDA.

In F2020, we disclosed the GHG emissions from our direct investment in coal and in ARM Coal operations, managed by Glencore, for the first time. In F2021, we expanded disclosure to cover our interest in Harmony Gold.

We hold ourselves to the highest ethical and governance standards in dealings with all stakeholders, including our joint-venture partners.

Future climate-change focus areas

F2021/F2022 focus areas	Progress
Undertake a climate-scenario analysis to assess the resilience of ARM's strategy.	Complete: We have successfully completed our first, largely qualitative, climate-scenario analysis.
Proactively prepare for the interim carbon budget extension in preparation for the second phase of the carbon budgets from 2024.	On track: Work is under way and ARM is on track to meet DFFE deadlines for supplying relevant information. The roll-out of ARM's new energy and carbon management system supports this process.
Implement the new system for identifying, preparing, implementing and reporting on measures that save energy and reduce GHG emissions.	Complete: We have refined and started to roll out the new system (see case study on page 39).
Collaborate to refine our scope 3 approach and understanding of our role in reducing those emissions. This should be progressed to the point where we can integrate scope 3 emissions in our strategic processes by including, for example, scope 3 emissions in our future GHG emission-reduction targets.	On track: We have improved our scope 3 emissions accounting and reporting (see page 40). We also continue to engage, via the ICMM climate change working group, on the most appropriate role that we, and the broader mining industry, can play in reducing emissions associated with the use and processing of our sold product. We have not yet included scope 3 in our short- and long-term GHG reduction targets.

F2022



Areas of focus in F2022 and F2023 include:

- Complying with the South African carbon budget phase 1 extension and phase 2 requirements
- Incorporating financial metrics into our new energy and carbon management system, to inform the prioritisation of decarbonisation measures and feed into developing our long-term decarbonisation pathway
- Continue to collaborate to refine our scope 3 approach and understanding of our role in reducing those emissions
- Developing a long-term decarbonisation pathway, building on initial work as part of our climate-scenario analysis
- Interrogating our GHG accounting organisational boundary
- Investigating ways in which we can leverage our socio-economic development (SED) and CSI spending to enhance community resilience to climate change
- Leveraging preliminary results of the climate-scenarios analysis to inform a revised assessment of water and climate-related risks in our supply chain
- Review our industry associations' positions on climate change to ensure alignment of our direct and indirect climate-related lobbying with our new long-term ambition.



Climate change continued

TCFD INDEX

The table below provides references for our disclosures in terms of the TCFD recommendations.

TCFD Recommendation	Reference to disclosure	Page
GOVERNANCE – Disclose the organisation’s governance on climate-related risks and opportunities		
a) Describe the Board’s oversight of climate-related risks and opportunities.	Governance Board level oversight and management responsibility	13
b) Describe Management’s role in assessing and managing climate-related risks and opportunities.	Governance Board level oversight and management responsibility	13
STRATEGY – Disclose the actual and potential impacts of climate-related risks and opportunities on the organisation’s business, strategy and financial planning where such information is material		
a) Describe the climate-related risks and opportunities the organisation has identified over the short-, medium- and long-term.	Risk management Material climate change risks Material climate change opportunities	42
b) Describe the impact of climate-related risks and opportunities on the organisation’s business, strategy and financial planning.	Risk management The impact of risks and opportunities on business and financial planning	58
c) Describe the resilience of the organisation’s strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.	Our scenario analysis	16
RISK MANAGEMENT – Disclose how the organisation identifies, assesses and manages climate-related risks		
a) Describe the organisation’s processes for identifying and assessing climate-related risks.	Risk management Integrating climate change into the risk management process	42
b) Describe the organisation’s processes for managing climate-related risks.	Risk management Integrating climate change into the risk management process	42
c) Describe how processes for identifying, assessing and managing climate-related risks are integrated into the organisation’s overall risk management.	Strategy Integrating climate change into the business strategy Carbon pricing Risk management Integrating climate change into the risk management process	16
METRICS AND TARGETS – Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material		
a) Disclose the metrics used by the organisation to assess climate-related risks and opportunities in line with its strategy and risk management process.	Metrics and targets GHG emissions	25
b) Disclose Scope 1, Scope 2 and, if appropriate, Scope 3 GHG emission and the related risks.	Metrics and targets GHG emissions Energy Verification	25
c) Describe the targets used by the organisation to manage climate-related risks and opportunities and performance against targets.	Metrics and targets GHG emission reduction target Emission reduction initiatives	35



Water management

The global pressure on life's most important resource cannot be overemphasised. All over the world, water systems are under threat from rising consumption, pollution, weak governance and climate change. We are seeing shifting weather patterns, changes to water supplies, and an increase in extreme weather events such as floods and droughts.

Water is essential to all mining and metals operations. Without access to water, ARM cannot function. We are exposed to increased water-related risks that could affect production, increase costs, constrain growth, disrupt our supply chains and place our communities under strain. We therefore need to continually contribute to, and focus on, ensuring a water-secure future that is socially and culturally equitable, environmentally sustainable and economically beneficial.



Water management

Our position on water stewardship

The global pressure on life's most important resource cannot be overemphasised. All over the world, water systems are under threat from rising consumption, pollution, weak governance and climate change. We are seeing shifting weather patterns, changes to water supplies, and an increase in extreme weather events such as floods and droughts.

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Our water stewardship policy recognises that:

- Water is a precious shared resource with high social, cultural, environmental and economic value. Access to water is recognised as a human right that is integral to the wellbeing and livelihoods, as well as spiritual and cultural practices, of many communities. It is also essential to the healthy functioning of ecosystems and the services they provide
- Water is a vital input for all mining and metals operations. It is required for the health and wellbeing of employees and at every stage of an operation's life cycle, including closure. The dependency and impact on a shared resource creates a material risk for ARM's operations that requires effective management
- Water challenges are increasing around the world. Freshwater resources are finite and under pressure from industrialisation, urbanisation, climate change, and the needs of a growing global population
- These challenges are shared across countries, industry sectors, and society. To meet demand, a change is needed in the way water is used, managed and shared. This will require collaboration and concerted action from all parties, including government, civil society, business and local communities
- Through the United Nations' Sustainable Development Goals, world leaders have publicly acknowledged the urgency of using and managing water sustainably. ARM can play a significant role in supporting this approach, including ensuring access to clean water, sanitation and hygiene (WASH) for employees in the workplace. There is further opportunity to support government initiatives by leveraging capital or expertise to improve community WASH and other water-related outcomes

- Water-related risks and impacts are predominantly experienced by people and ecosystems at the local/catchment level. Therefore, we look beyond traditional operations-based water management to the dynamics and interactions of water users in the wider catchment
- ARM has an important role in the sustainable management of water resources where we operate. Proactive and holistic water-management strategies will create substantial competitive advantage by reducing water-related risks, identifying opportunities, attracting investment and building trust through improved transparency.

We also commit to:

- Applying strong and transparent corporate water governance by:
 - Publicly disclosing our approach to water stewardship through this report as well as our ESG and integrated annual reports
 - Allocating clear responsibilities and accountabilities for water – from the board to our operations (see page 13)
 - Integrating water considerations in business planning – including ARM's strategy, life of asset and investment planning (see page 76)
 - Publicly reporting our water performance, material risks, opportunities, and management response using consistent industry metrics and recognised approaches (see page 70 and 80)
- Managing water at our operations effectively by:
 - Maintaining a water balance and understanding how it relates to the cumulative impact of other users at each operation. All operations maintain a water balance, considered in the context of a catchment balance (see page 69 and 80)
 - Setting context-relevant water targets or objectives for operations with material water-related risks (see page 78)
 - Proactively managing water quantity and quality to reduce potential socio-environmental impacts and realise opportunities. ARM began reporting publicly on water quality in F2019 (see page 80)
 - Ensuring all our employees have access to clean drinking water, gender-appropriate sanitation facilities and hygiene at their workplaces. WASH facilities are in place for all our employees (see page 65)
- Collaborating to achieve responsible and sustainable water use by:
 - Identifying, evaluating, and responding to catchment-level water-related risks and opportunities (see page 71)
 - Identifying and engaging proactively and inclusively with stakeholders who may influence or be affected

Water management continued

by our operations' water use and discharge (see page 82)

- Actively engaging on external water governance issues, with governments, local authorities and other stakeholders, to support predictable, consistent and effective regulation that underpins integrated water-resource management (see page 82 and 83)
- Supporting water-stewardship initiatives that promote better water use, effective catchment management and by contributing to improved water security and sanitation (see page 76).

We support the ICMM position statement on water stewardship and report our performance against the commitments in this report.

How we use and manage water

At ARM's operations, water is used in milling, beneficiation, cooling and for dust suppression during blasting, on haul roads, and at ore-transfer points. Our employees need access to water for drinking and WASH purposes, and it is a critical component in our supply-chain commodities, including electricity, chemicals and explosives. Water is also essential for users in our wider catchments.

Water is primarily consumed through evaporation, water entrained in tailings, and interstitial water in product, seepage and outputs to third parties. Evaporation is high at Cato Ridge Works, which requires water to cool its furnaces. However, only three of the six furnaces at Cato Ridge Works are currently operating. Our ARM Ferrous Northern Cape mines record high evaporation rates and a number of these operations supply water to third parties, such as villages and farms, within their operational boundaries (they are thus not classified as diversions).

While all operations run closed water circuits to maximise recycling and reuse, discharges are unavoidable in certain instances, such as during heavy rainfall. Discharges occurred in F2021 and were reported to the relevant authorities.

Water uses at our operations have not changed significantly over time, except at Machadodorp Works where no smelting operations have been conducted since F2016, and Nkomati Mine, which has moved to care and maintenance.



Main operational water activities at ARM's operations

Operation	Catchment	Main operational water activities
Beeshoek Mine (iron ore)	Vaal Water Management Area (WMA)	<ul style="list-style-type: none"> • Dewatering • Dust suppression • Ore processing • Tailings management
Khumani Mine (iron ore)	Vaal WMA	<ul style="list-style-type: none"> • Dust suppression • Ore processing • Tailings management
Black Rock Mine (manganese ore)	Vaal WMA	<ul style="list-style-type: none"> • Dewatering • Dust suppression • Mining, screening and washing • Tailings management • Domestic use (village and irrigation)
Cato Ridge Works (ferroalloys)	Pongola-Uzimkulu WMA	<ul style="list-style-type: none"> • Cooling • Dust suppression • Scrubbing (air-quality requirement) • Jigging (in metals recovery plant)
Machadodorp Works	Inkomati-Usuthu WMA	<ul style="list-style-type: none"> • Jigging (in ferrochrome metals recovery plant) • Dust suppression
Nkomati Mine (nickel, PGMs and chrome)	Inkomati-Usuthu WMA	<ul style="list-style-type: none"> • Dewatering • Ore processing (stopped in the last quarter of F2021) • Dust suppression (ad hoc, under care and maintenance) • Tailings management
Modikwa Mine (PGMs)	Olifants WMA	<ul style="list-style-type: none"> • Dewatering • Dust suppression • Ore processing • Tailings management • Domestic use in mine villages and farms/third parties
Two Rivers Mine (PGMs)	Olifants WMA	<ul style="list-style-type: none"> • Dust suppression • Ore processing • Tailings management

Water metrics and targets

Operations withdraw water from a range of sources defined in the terms of their water use licences (WULs), which include rivers, boreholes and municipal supplies.

The second phase of implementing the ICMM's A Practical Guide to Consistent Water Reporting (2017), based on the water accounting framework (WAF) developed by the Minerals Council of Australia (MCA), was completed in F2019. We have begun the process of reporting on F2022 data according to the revised ICMM water accounting framework guideline.

In F2021, water withdrawal decreased by 1% to 20 million m³ (F2020: 20.3 million m³) due to decreased activity in the last quarter after mining stopped at Nkomati.

Further improvements in the implementation of the WAF, together with greater efforts to reuse water, resulted in an overall water reuse efficiency of 78% (up from 72% in F2020), and is a key performance indicator in monitoring and managing consumption and losses. This increase reflects improved performance as well as improved measurement, particularly after installing additional water meters at Black Rock Mine.

The most material year-on-year differences include:

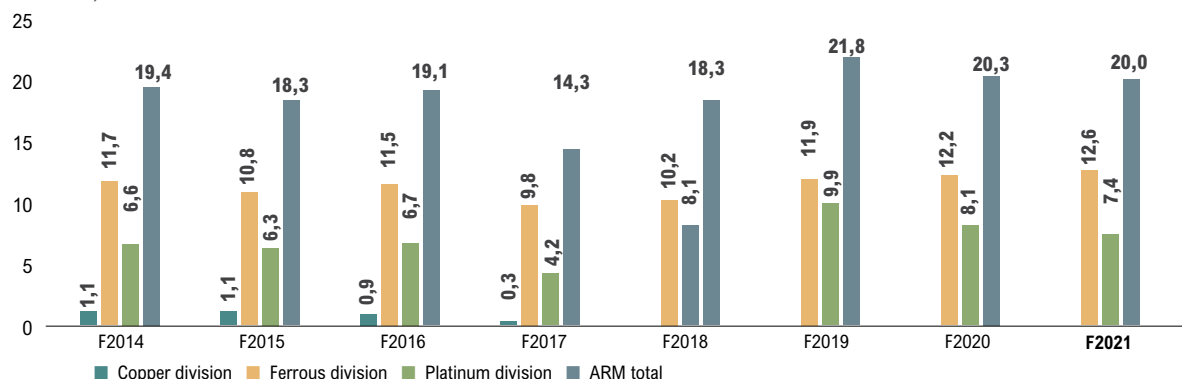
- Reduced withdrawals and diversions at Nkomati due to the mine's move to care and maintenance
- Reduced groundwater and municipal water abstraction in the Northern Cape due to high rainfall and management challenges at Sedibeng
- Increased evaporation at Modikwa and Beeshoek
- Decreased consumption at Beeshoek due to improved flow metering and better water-return practices.

Water management continued

Water withdrawal by division (100% basis)

Water withdrawal by division (100% basis)

(m³ million)



Beeshoek Mine accounted for 29% of total group water withdrawal, Khumani Mine 24% and Modikwa Mine 18%. Water withdrawal by the ferrous division increased 4% to 12.6 million m³ (F2020: 12.2 million m³) due to increased production, but decreased 9% in the platinum division to 7.4 million m³ (F2020: 8.1 million m³) on lower production at Nkomati Mine.

Water outputs include flows to surface water, groundwater, and supply to third parties as per ICMM definitions (volume of water removed from the operational facility after it has been through a task, treated or stored for use). Discharges in this report refer to discharges at operations as defined in their WULs. This is a narrower metric that only includes unauthorised flows into the natural environment.

Discharges at operations are reported to the relevant authorities in terms of quality and volumes, while clean-up and rehabilitation processes are initiated immediately, documented and reported comprehensively to the respective internal governance structures as well as authorities. Incidents in F2021 are described below.

Operation	Incident
Two Rivers Mine	On 4 September 2020, sewage overflowed into the natural environment due to sewage-handling incapacity contributing to pump failure and malfunctioning in the system. The sewage was cleaned up and the incident reported to the Department of Water and Sanitation (DWS).
	On 4 November 2020, the pollution-control dam overflowed into the natural environment during heavy rainfall. Upstream and downstream samples from the Kleindwars River to check pollution showed no traces of the spillage. The incident was reported to the DWS.
	Heavy rainfall led to the pollution-control dam overflowing into the natural environment on 15 and 16 February 2021. Water samples taken from the Kleindwars River upstream and downstream from the overflow point after each incident showed no traces of the spillage. Both incidents were reported to the DWS.
Black Rock Mine	On 12 November 2020, a sewage discharge occurred towards the Gamagara rehabilitation area due to tampering with the panel that controls the pumping of effluent to the sewage treatment plant. No clean-up was necessary as only grey water was spilled. Remedial steps were taken to prevent recurrence and the incident was reported to the DWS.
	On 27 January 2021, prolonged heavy rainfall over seven days led to a discharge of dirty water from the manganese stacking floors. An impermeable earth berm will be constructed adjacent to the mine fence/boundary to prevent recurrence. The incident was reported to the DWS.
Nkomati Mine	The positive water balance and heavy rainfall in January 2021 led to overflows of rainwater, stormwater run-off and seepage water from the pit 2 storage facility and Onverwacht return-water dam on 24 January 2021. The water discharged into the adit stream, a tributary of the Gladdespruit and surrounds. Immediate measures were taken to stop the spillage and water samples were taken upstream and at various locations downstream of the spillage and submitted for analysis by an external laboratory. Water quality of samples taken at Nkomati Mine's compliance point was within compliance parameters stipulated by the WUL. The incident was reported to the Inkomati-Usuthu Catchment Management Agency (IUCMA) as required.

Consumption includes evaporation and transpiration, water incorporated into product and/or waste streams, and other operational losses.

Reuse efficiency is the volume of untreated water used in tasks that has already been worked by the site as a percentage of total volume of all water used in tasks. Reuse efficiency varies across the operations and is underreported as some operations do not measure flows

of worked water back into tasks. Some operations supply water to neighbouring communities, farms and other users. This is water not intended for primary mining activity use and is classified as a diversion.

We aim to continually improve our measurement and reporting of water metrics according to the new ICMM framework and significant expenditure has been committed to installing flow meters.

ARM water balance summary

Metric	Source/destination/type	Volume of water by quality			Volume of water by quality		
		F2021			F2020		
		High (m³)	Low (m³)	Total (m³)	High (m³)	Low (m³)	Total (m³)
Withdrawal	Surface water	4 998 050	3 025 314	8 023 364	4 757 629	2 708 867	7 466 496
	Groundwater	7 725 369	4 285 871	12 011 240	7 088 971	5 712 200	12 801 171
	Total withdrawal	12 723 419	7 311 185	20 034 604	11 846 601	8 421 067	20 267 668
Output	Surface water	16 305	779 974	796 279	22 250	955 777	978 027
	Groundwater	—	33 151	33 151	—	23 427	23 427
	Supply to third party	33 281	3 840	37 121	40 354	3 840	44 194
	Total output	49 586	816 966	866 552	51 870	993 777	1 045 647
Consumption	Evaporation	274 419	5 496 504	5 770 923	201 745	4 876 586	5 078 331
	Entrainment	—	4 273 007	4 273 007	—	3 325 107	3 325 107
	Other	—	108 840	108 840	—	132 098	132 098
	Total consumption	274 419	9 878 351	10 152 770	201 745	8 333 791	8 535 536
Re-use efficiency	Total of all flows to tasks (m³/a)	14 529 040	74 907 494	89 436 534	16 021 124	58 992 638	75 013 763
	Total worked water flows to tasks (m³/a)	n/a	69 359 203	69 359 203	n/a	53 693 478	53 693 478
	Reuse efficiency (%)	n/a	n/a	78%	n/a	n/a	72%
Diversions	Water diverted to neighbouring communities, farms and other users	359 953	293 723	653 676	586 190	714 249	1 300 439

* Reported according to ICMM water reporting metrics.

Water management continued

Water challenges and opportunities

Some of our operations face significant catchment-level water risks due to poor existing infrastructure, lack of funding and capacity to deliver new infrastructure, and the impacts of climate change on water supply. We regard water availability, consumption and pollution as key risks and include them in both our operational and corporate risk registers. We have identified water-related opportunities, particularly through collective action at the catchment level.

Material water risks

Water is a material matter across the group, although for different reasons at different operations. Some of the key risks to our business value and performance relate to potential non-compliance with WULs, especially where mines have a positive water balance and risk discharge events; adequate water supply; and climate and water-related disruptions that may result in production stoppages.

Our primary concerns are the availability of water, uncertainty in the existing policy environment, the state of existing water infrastructure, and the socio-economic impacts of these risks. The security of water supply in the Northern Cape is classified as a top ten risk, or high residual risk, at group level.

We anticipate that the likelihood and impact of our water-related risks will increase over time as climate change results in more extreme weather events and drought. We continue to take steps to mitigate these risks.

Corporate level

At corporate level in the Northern Cape, we have played a leading role in securing long-term bulk-water supplies (see page 83). This is in addition to our operations' investment in water purification and storage, and the various efficiency measures they have implemented.

Operational level

Seven of the eight operations under our direct or joint control are in water-stressed areas:

- Beeshoek, Khumani and Black Rock (representing 85% of EBITDA and 38% of ARM's operations by number) are in the Northern Cape and part of the Vaal WMA
- Two Rivers and Modikwa (representing 17% of EBITDA and 25% of ARM's operations by number) are in the Olifants WMA
- Nkomati Mine and Machadodorp Works (representing 25% of ARM's operations by number) are in the Inkomati-Usuthu WMA.

Cato Ridge Works, which is in the Pongola-Uzimkulu WMA, is not in a water-stressed area.



Operation	Water management area (WMA)	Catchment stress	Operational water risk rating
Beeshoek Mine	Vaal WMA	Moderate	High
Black Rock Mine			High
Khumani Mine			High
Two Rivers Mine	Olifants WMA	Moderate	High
Modikwa Mine			High
Nkomati Mine	Inkomati-Usuthu WMA	High	High
Machadodorp Works			High
Cato Ridge Works	Pongola-Umzimkulu WMA	Not water stressed	N/A

Summary: Catchment and operational risks in the Vaal WMA

Catchment stress	<ul style="list-style-type: none"> Moderate according to the water risk filter* (risk rating 3.4) ARM's company-specific risk assessment rates the basin risk higher, as the Sedibeng pipeline infrastructure requires investment and the source catchment faces water stress There is limited catchment management as there is no catchment management agency (CMA). Operations technically need to contribute to the establishment and effective functioning of a CMA as part of their WULs, but failed to achieve this because of governance challenges and capacity constraints of the regulator. <p>This issue therefore does not present a non-compliance risk but rather a risk in terms of effective catchment management, which is mitigated to some extent by the Tshiping Water Users Association (WUA).</p>
Beeshoek Mine	<ul style="list-style-type: none"> Overall risk rating (water risk filter): 3.9 (high) Primary risk – physical: water shortage (need for long-term supply and storage); regulatory: reliance on an agreement that neighbouring Kolomela Mine, which has reduced Beeshoek Mine's groundwater supply by dewatering, provides water to the mine via Sedibeng (this agreement is not included formally in each mine's WUL) Secondary risk – physical: flooding (resulting in production disruptions) and other extreme weather events and periodic excess of supply.
Khumani Mine	<ul style="list-style-type: none"> Overall risk rating (water risk filter): 4.0 (high) Primary risk – physical: water shortage (need for long-term supply and storage) Secondary risk – regulatory: limited catchment management.
Black Rock Mine	<ul style="list-style-type: none"> Overall risk rating (water risk filter): 4.0 (high) Primary risk – physical: water shortage (including future depletion of underground source – particularly in shallow aquifers (boreholes)) Secondary risk – regulatory: limited catchment management, pending WUL amendments; heavy rainfall events leading to surface-water contamination affecting neighbouring farmers; flooding affecting bulk-water infrastructure.

* WWF's water risk filter (<https://waterriskfilter.panda.org/>) is an online tool that helps companies and investors assess and respond to water-related risks facing their operations and investments across the globe. The tool rates operational and basin risk on a scale of 1 to 5.

At our Beeshoek, Black Rock and Khumani mines in the Northern Cape, issues with water scarcity have the potential to affect current operations and future expansion or growth plans. There is also the relatively minor risk of flooding during extreme weather events. Water is a core concern for our local communities and employees.

Beeshoek has an agreement that secures water from neighbouring Kolomela Mine. If Kolomela experiences challenges, this can affect the supply of water to Beeshoek Mine via Sedibeng. This happened in F2021. Good relationships and communication with Kolomela Mine, together with work to formalise this agreement in each mine's WUL, are aimed at mitigating this risk.

Water management continued

Water-supply restrictions at Khumani have affected the mine's ability to pursue capacity expansion. As a result, Assmang has offered to contribute a portion of the capital required for the Sedibeng infrastructure upgrade (see page 83).

Due to this capital infrastructure cost, our Northern Cape mines are trying to reuse water as much as possible. Black Rock Mine is focused on getting the villages, which currently consume around 50% of the potable water supplied by Sedibeng, to use water that has been treated by the mine's reverse osmosis plant. This must be approved as part of our WUL by the DWS. The mine has submitted its application and is awaiting approval.

In F2021, Black Rock Mine had to institute water restrictions in the villages. Extreme rainfall events at the mine contaminated surface water flowing into a neighbouring farm. The event was reported to the authorities. Flooding affected the Sedibeng infrastructure and resulted in two weeks of no water supply. Black Rock

Mine invested R700 000 in pump infrastructure to resolve the issue. This did not impact production, but bottled drinking water had to be supplied underground.

There is limited catchment management in the area. However, in March 2021, the minister of water and sanitation signed the gazette for amendments to the Vaal River CMA water management area by extending boundaries and areas of operation to include the Orange water management area. A proposed implementation plan has been submitted for approval, which includes operational integration, integrated water resource planning and economies of scale.

While the Tshiping WUA mitigates this risk, there is not a good understanding of the catchment-level water balance. This is evidenced by instances where Sedibeng is unable to supply water to meet mine allocations (in addition to instances caused by infrastructure and management challenges). There are concerns that future supply from the Vaal River is not well understood.

Summary: Catchment and operational risks in the Inkomati-Usuthu WMA

Catchment stress	<ul style="list-style-type: none"> • High according to the water risk filter* (risk rating 4) • The catchment has one of the few effective CMAs in the country and this helps mitigate overall catchment risk .
Machadodorp Works	<ul style="list-style-type: none"> • Overall risk rating (water risk filter): 3.8 (high) • Primary risk – physical: surface-water contamination (limited production activities to manage high rainfall events).
Nkomati Mine	<ul style="list-style-type: none"> • Overall risk rating (water risk filter): 4.0 (high) • Primary risk – physical: surface-water contamination (too much water, inadequate storage/space); regulatory: challenge in obtaining an amended WUL as the mine has moved into care and maintenance • Secondary risk: reputational: managing stakeholder concerns on care and maintenance and ultimately closure.

* WWF's water risk filter (<https://waterriskfilter.panda.org/>) is an online tool that helps companies and investors assess and respond to water-related risks facing their operations and investments across the globe. The tool rates operational and basin risk on a scale of 1 to 5.

As a result of Nkomati Mine's location, it has a net positive water balance. With the ramp-down in production, the mine faces some water-management challenges. The excess water that accumulates at Nkomati Mine will ultimately need to be discharged. The mine is exploring all alternative options, including nature-based solutions such as passive treatment. The closure will include rehabilitation and capping of waste-rock dumps and tailings facilities to minimise the volume and improve the quality of water that will report to the external environment.

Further, managing water would require energy, adding to the long-term operating cost challenges. Currently excess water is accumulating in the pit and is being actively monitored. Long-term monitoring and modelling will be needed to understand the impacts on quantity and quality to determine the ultimate solution required.

Reduced production activities due to economic and market conditions have put pressure on the system at Machadodorp Works. Reuse and consumption have been reduced and any rainwater therefore runs the risk of controlled discharge and associated non-compliance with waste management and the WUL.

Summary: Catchment and operational risks in the Olifants WMA

Catchment stress	<ul style="list-style-type: none"> Moderate according to the water risk filter (risk rating 3.4) There is limited catchment management (no CMA). Operations technically need to contribute to the establishment and effective functioning of a CMA as part of their WULs, but failure to achieve this is due mainly to governance challenges and the capacity constraints of the regulator.
Modikwa Mine	<ul style="list-style-type: none"> Overall risk rating (water risk filter): 4.0 (high) Primary risk – physical: water shortage (driven more by socio-economic dynamics in access to water and services rather than drought) Secondary risk – physical: underground flooding due to positive water balance underground Secondary risk – regulatory: lack of established CMA Secondary risk – reputational: vandalism of pipeline.
Two Rivers Mine	<ul style="list-style-type: none"> Overall risk rating (water risk filter): 4.1 (high) Primary risk – physical: water scarcity; extreme weather events, including increased spillages Secondary risk – regulatory: lack of established CMA, poor catchment management (the mine tried to develop a sub-catchment balance but other users were reluctant to contribute).

Water availability is at risk at Modikwa Mine for socio-economic reasons rather than drought. Community unrest and vandalism could impact water supply to the mine. Inadvertent discharge also presents a regulatory and reputational risk.

Two Rivers Mine is less exposed to water-supply risks, but the area faces poor catchment management and efforts to develop a sub-catchment balance have been unsuccessful. In F2020, water in the Dwarsrivier River, the mine's main source of water supply, fell to very low levels, and a pipeline was installed to secure an alternative water supply. The new Merensky project requires additional water and the mine has entered into an agreement to be supplied 5ML per day from the Lebalelo pipeline.

Joint-venture and investment level

ARM has an effective 20.2% share in PCB and an effective 26.01% share in Goedgevonden. Glencore Operations South Africa owns the remaining stakes. Where appropriate, water risks are considered and reported on during PCB and Goedgevonden's quarterly steering committee meetings.

Material water opportunities

Our focus on improving operational efficiencies includes identifying opportunities to reduce water use. While investing in bulk-water schemes has the potential to increase costs between four and fivefold, reducing water consumption decreases the need for this investment and its associated costs.

Group operations are increasingly looking beyond our operational borders to contribute to collective action at catchment level. Ensuring an adequate supply of water builds community resilience, which is especially important as we adapt to a changing climate and its impact on water availability. We recognise this as an opportunity to improve community relations and strengthen our social licence to operate.



Water management continued

In the first half of F2020, a capital user charge on water of R6/t became effective when the Vaal Gamagara water system was upgraded. This contributed to above-inflation increases in on-mine unit production costs at Khumani Mine. Assmang, as part of the Mine Leadership Forum, is proposing the establishment of a section 21/special purpose vehicle. The special purpose vehicle will act as the forum's funding vehicle and will ensure financial and commercial governance standards are maintained at all times.

Water and tailings

We have 11 TSFs at our operations: four at Nkomati Mine, three at Black Rock Mine, and one each at our Beeshoek, Khumani, Two Rivers and Modikwa mines. We take the potential impacts on human health or water ecosystems associated with our TSFs seriously, and manage these risks at operational and corporate levels.

Tailings storage facilities*

	Catchment	Number of tailings dams in operation	Number of inactive tailings dams	
	↓	↓	↓	
South Africa	Vaal WMA	5	0	This includes tailings dams at Beeshoek (one active), Khumani (one active) and Black Rock mines (three active, including a new TSF operational from March 2019)
	Pongola-Uzimkulu	0	0	This includes Cato Ridge Works, which does not have any tailings dams
	Inkomati-Usuthu	2	2	This includes Machadodorp Works (no tailings dams) and Nkomati Mine (two active and two inactive). One of the inactive facilities at Nkomati Mine has been closed
	Olifants WMA	2	0	This includes Two Rivers (one active and a new tailings dam under construction) and Modikwa mines (one active)

We remain committed to ensuring the stability of our TSFs. A professional engineer is appointed by each operation to perform annual structural stability audits and quarterly monitoring of the safety and stability of each TSF. The latest structural stability reports confirm the TSFs at ARM's managed operations as stable.

In 2019, we commissioned an independent external review of the TSFs in line with global best practice to enhance our TSF management systems. This review, which included management systems and governance processes, is complete and we are implementing recommendations for improvement at operational and corporate level.

In addition, ARM has completed dam-breach analyses of our TSFs to ensure a comprehensive understanding of the potential impact on stakeholders, including communities, the environment and infrastructure. These reports inform enhanced emergency response planning.

ARM is implementing the global industry standard on tailings management (GISTM). Accountable executives have been appointed and implementation plans developed for each operation and are in progress.

Recent international catastrophic failures of TSFs have increased the focus of investors, non-governmental organisations (NGOs) and other stakeholders on responsible tailings management. In 2016, the ICM published a position statement on preventing catastrophic failure of tailings storage facilities that

includes a TSF governance framework. This framework enhances focus on the key management and governance elements necessary to maintain the integrity of TSFs and minimise the risk of catastrophic failures.

As a member of the ICMM, we reviewed our TSFs according to this framework and included results in the annual review of management controls at ARM-managed TSFs, which was run by a multidisciplinary internal team. This process has subsequently been replaced by external reviews, which were commissioned in 2019 following the tragic failure of a TSF in Brumadinho, Brazil. After this incident, the Investor Mining and Tailings Safety Initiative called for a new independent and publicly accessible international standard for TSFs.

In February 2019, the ICMM council committed to convening an independent review of global tailings management practices, along with co-convenors, the United Nations Environmental Programme and the Principles for Responsible Investment. The outcome of this global tailings review process was the GISTM, with its main objective being the safer operation of tailings facilities. ARM has been actively involved in the process

and welcomes the GISTM, which was launched on 5 August 2020.

We drafted a TSF management standard aligned with the GISTM, which was approved in May 2021. Our operations have developed TSF implementation plans to comply with the ARM TSF standard/GISTM by August 2023. TSF dam-break analysis and technical reviews have been completed at all operations.

At our platinum operations, consequence classification was completed by August 2021. Liquefaction studies will be completed by April 2022. At our ferrous operations, consequence classification has started at Black Rock. Khumani and Beeshoek are appointing consultants. All operations are on track for compliance to GISTM by August 2023.

The chief executives of our Platinum and Ferrous divisions have been appointed as accountable executives for TSF in their divisions. Further information on TSF management appears on page 60 of the 2021 ESG report.

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Water management continued

Water-related detrimental impacts

ARM recorded the following material detrimental water-related impacts in F2021:

- Khumani Mine lost 631 hours of production at the plant when it did not receive its full water allocation from Sedibeng in F2021. Flooding also impacted production at the mine. Although these instances have affected production, the mine has been able to meet market demands
- Beeshoek's water supply from Sedibeng was interrupted for an hour when the neighbouring Kolomela Mine was not able to supply water into the system. Heavy rains resulted in flooding at Beeshoek that caused 24 production disruptions in F2021. The mine was able to run additional shifts and catch up this lost production time
- Flooding of Sedibeng infrastructure resulted in a two-week water supply disruption at Black Rock Mine, requiring the supply of bottled drinking water underground.

Commitment and response

At ARM, we believe that water-related challenges should be owned collectively. These issues are shared and require collaboration by governments, civil society, the private sector and local communities to be properly resolved. We therefore continue to manage water impacts at our operations, and regularly engage with our partners and other stakeholders on water stewardship and holistic risk mitigation at the catchment level.

Responsibility for water

The ARM board, through the social and ethics committee, has ultimate responsibility for water management. The responsibility for implementing this work rests with the CEO, who delegates to the chief executives of each division and the executive: sustainable development. This executive is responsible for reviewing ARM's sustainable development policies, strategies and targets, including our revised GHG reduction target, and ensuring they are aligned with the board's commitment to zero tolerance for harm to employees, host communities and the environment. The ARM social and ethics committee provides oversight.



Water is recognised in our ERM system as a principal risk with associated opportunities and is therefore a key input to our sustainable business strategy, which is ultimately the responsibility of the CEO.

Our social and ethics committee monitors and reports on the manner and extent to which we protect, enhance and

invest in the wellbeing of the economic, social and natural environments in which we operate.

Our governance and reporting structure appears on page 13.



Assmang, a joint venture between ARM and Assore Ltd, has established a social and ethics committee that monitors environmental performance in the ARM Ferrous division. It is chaired by the ARM executive director: new business development and investor relations and reports to the ARM social and ethics committee. In the ARM Platinum division, every operation has a sustainable development committee, chaired by the ARM executive: sustainable development, and reports to the executive committee or board of the respective joint ventures, as appropriate, and to the ARM social and ethics committee.

The responsibility for implementing climate and water-related activities rests with the CEO and chief executives of each division and the executive: sustainable development, who reports to the CEO of ARM with oversight from the social and ethics committee. The executive: sustainable development also reports to the management risk and compliance committee, a subcommittee of the audit and risk committee of the board, on matters and activities related to water as a standard agenda item.

ARM does not currently have incentives for executive employees or board members related to water performance. Water management forms part of the KPIs of relevant engineers at the operations. For example, the moisture content in tailings is linked to employee bonuses at Khumani Mine.

Integrating water stewardship into our strategy

At ARM, water stewardship is integral to our business strategy. We consider water-related risks and opportunities at company and asset levels, and measure and manage our water withdrawals, consumption, outputs and reuse efficiency. Information on the level of risk or opportunity, and our capacity to manage these, are tabled and discussed at our management risk and compliance committee as well as social and ethics committee meetings. Outputs from these meetings feed directly into the strategy development process.

Our proactive and holistic water management strategy facilitates how we sustainably manage our water resources. It is built around identifying and mitigating water-related risks, exploring opportunities and engaging with partners to achieve collective action. We focus on water balances, a hierarchy of water uses, and

minimising withdrawal of clean, potable or municipal water. Our goal is to recycle 100% of water – excluding losses due to evaporation, seepage and entrainment – and to have no discharges (see page 66).

Our revised approach to water stewardship is more catchment-based and aims to be more collaborative in delivering on our strategic objectives. For example, at Khumani Mine, we engage in project management and engineering and maintenance issues for the provision of water, which supports our growth objectives.

Where water is material, relevant KPIs have been introduced at operational level. Operations invest in technology to reduce their water requirements, and consider these as part of new or expansion projects to reduce our water dependency and competition with other water users. Khumani Mine was designed with severely restricted water availability as a material consideration. As a result, its tailings paste-disposal facility was designed to minimise water use and discharge, ensure maximum recycling, and significantly reduce evaporation losses compared to a conventional tailings disposal facility.

In F2021, we also conducted a climate-scenario analysis to understand the impact of climate change on the resilience of our business. This included considering different water-related futures influenced by climate change (see page 16).

Our water target

Current target: To reduce withdrawals of potable water (surface and municipal sources) by 15% by F2021 relative to F2011 (excluding Machadodorp Works and divested operations).

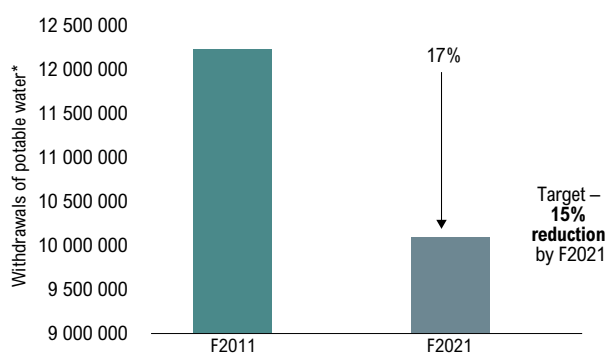


We set an initial target to reduce withdrawals of potable water (surface and municipal sources) by 10% by F2020 relative to F2011. As part of annual workshops at our operations, focusing on climate and water compliance, we explored the development of a new water target related to withdrawals. Operations were consulted on what would constitute an appropriate water target for ARM based on site-specific considerations of what is realistic but ambitious. A realistic target was then set and represented the first step on the water target-setting journey. We exceeded our F2020 water target, achieving a reduction of 14% compared to F2011.

In F2020, we began the process of setting context-based water targets. Because this process takes time, in the interim we decided to extend, but ratchet up, the target and focus on setting a more appropriate suite of targets.

Progress towards ARM's water target

Progress towards ARM's water target



* Potable water includes surface and municipal surface water (excluding precipitation and runoff).

We exceeded our F2021 target and achieved a reduction of 17% relative to the F2011 base year. The main contributors to achieving the target include:

- Nkomati Mine decreased withdrawals from the Gladdespruit River after scaling down activities in preparation for care and maintenance. It ceased production at the end of March 2021
- Cato Ridge Works recorded a 32% decrease in municipal water withdrawals due to fewer furnaces in operation in F2021 compared to F2011
- Modikwa Mine has recorded a 23% decrease in water withdrawals from Lebalelo since F2011 due to higher groundwater withdrawals and increased reuse as a result of various interventions
- Beeshoek Mine has recorded a 20% decrease in water withdrawals from Sedibeng since F2011 due to implementing an optimised water-management system, increased stormwater use and a shift from monthly to daily monitoring, enabling faults to be resolved faster.

Water management continued

CASE STUDY

Moving towards context-based water targets

ARM has committed to setting context-relevant water targets or objectives for operations with material water-related risks. We started this process in F2020 but faced several challenges. The first challenge relates to the baseline. F2019 was the first year that ARM reported according to the WAF in line with the ICMM water position statement, which significantly improved reporting.

Further improvements were achieved in F2020. However, Covid-19 had a significant impact on our water withdrawals, to the extent that a company-level target based on an F2020 baseline is unlikely to be appropriate. After further improvements were made in F2021, we have an appropriate baseline for most operations. This is not the case for Black Rock Mine, which is installing new flow meters to cover its expansion, and will only be able to set an accurate baseline in F2023.

During engagements with operations in the annual climate and water workshops, it emerged that a number of targets will be needed to accommodate location and process-specific contexts. For example, Beeshoek, Khumani and Black Rock mines are in the same catchment but face different challenges.

Dewatering by a nearby mine led to an arrangement where that mine pays for Beeshoek Mine's withdrawals from Sedibeng. Beeshoek Mine is incentivised to reduce withdrawals for the benefit of other users but is not

incentivised from a cost perspective. Khumani Mine is incentivised to reduce withdrawals from a cost perspective but is already very water efficient. Black Rock Mine does not get its full allocation and is therefore seeking permission to use its reverse osmosis plant to increase treatment and reuse to ensure that the villages, in particular, have adequate potable water.

In F2021, we went through a process with each operation to:

- Prioritise shared-water challenges in each operational catchment, and understand operational risks, dependencies and impacts
- Understand the desired catchment condition and determine our contribution to the desired conditions for each priority shared-water challenge
- Set draft targets with the aim of contributing to existing efforts to meet desired conditions, determine implementation strategies, and measure progress towards meeting targets.

In F2022, the draft targets will be discussed and refined at division and company level. Where these relate to collective action and catchment-level commitments, they will be shared with stakeholders for their inputs and to create buy-in. In line with ICMM guidance, these include process-orientated targets on increased transparency, commitments to more stakeholder engagement and collective action to address community access to water.

While we progress to finalising our context-based targets in F2022, we will continue to drive efforts to reduce potable water consumption. We have set an interim target to maintain our consumption of potable water at 17% below F2011 levels.

New target: To reduce withdrawals of potable water (surface and municipal sources) 17% by F2022 relative to F2011 (excluding Machadodorp Works and divested operations).

A catchment-based approach

We have adopted a more catchment-based approach and aim to be more collaborative in delivering on our strategic objectives. For example, at Khumani Mine, we engage in project management and engineering and maintenance issues around the provision of water, which supports our growth objectives. Water efficiencies achieved are aligned with our strategic operational efficiencies and relevant KPIs have been introduced at operational level.

At the corporate level, we recognise the strategic imperative in understanding bulk-water suppliers and, as a result, participate in active platforms. Our operations engage with catchment-level forums that estimate current and future catchment balances. The Inkomati-Usuthu CMA, where Nkomati Mine operates, is effective in facilitating this. Tshiping WUA in the Northern Cape serves this function reasonably well, but other forums or CMAs are less effective and catchment-level water availability and quality are not as well understood.

CASE STUDY

Viable public-private partnership helps meet catchment needs

Demand for potable water at ARM's Modikwa and Two Rivers mines is expected to increase by almost 6% a year combined. This is primarily due to the increase in production from the Merensky project at Two Rivers Mine. To maintain and expand their operations, these mines need bulk raw water at a transparent, predictable and cost-effective tariff.

Currently Modikwa Mine gets some of its water from the Lebalelo Water Users Association (LWUA) scheme. Two Rivers has invested in the LWUA scheme and an additional pipeline is being developed to supply the 5ML of water required daily for the Merensky project. The water allocations from the LWUA will provide future water needs for both Modikwa and Two Rivers mines.

ARM is represented on the LWUA on behalf of both Two Rivers and Modikwa mines. We are interested in securing adequate water supply for our mines and other users in the catchment, ensuring the mines are not burdened with unnecessary costs and that costs are appropriately apportioned. Involvement in the LWUA is also important from a strategic expansion perspective, as it provides the potential flexibility to enable our growth in the area.

CASE STUDY

Building community resilience to physical climate-change and water risks through the LWUA

To improve our local communities' resilience to climate-change and water risks, we have developed a socio-economic development solution through the LWUA. The solution has three proposed outcomes that are intended to stabilise and stimulate growth in the region:

- Accelerate the supply of potable water to some 380 000 people in the areas that Limpopo province has identified as having pressing water needs
- Create about 42 000 jobs in the region, developing local skills through associated capital and operational programme spend, which will run through a dedicated skills development fund and training platform
- Develop local businesses through a focused sustainable enterprise development fund and platform. This fund will contribute an estimated R2 billion to average annual household incomes, some 34% of which will flow into low-income households, and will add an average GDP of R3.1 billion per year.

The operations engage with the DWS, local communities, local, provincial and national authorities, irrigation boards, catchment management agencies, and other industry users to ensure the sustainability of water resources for all stakeholders. We have also invested in borehole sinking and equipping for local social use through the ARM Rural Upliftment Trusts' water provision projects.

The future impacts of climate change are expected to affect the availability of water which, in river basins where we share water resources with other users, has the potential to create conflict with local communities. Future changes in the availability, quality and price of water and the associated impacts on communities are assessed as part of risk management and strategic planning processes. Appropriate technology is considered during feasibility studies to reduce our own water requirements.

CASE STUDY

Community water

In F2021, we invested in 27 new community boreholes at a cost of R3.9 million, facilitated by the ARM Rural Upliftment Trusts. Black Rock Mine provided a municipal water truck to Joe Morolong local municipality. Modikwa Mine invested in water infrastructure (tanks, boreholes, purification systems, pipelines, taps, etc) to provide clean drinking water to households in six local communities.

Metrics

This is the third year ARM has reported data according to the definitions and formats prescribed by the ICMM. ARM's aggregated water reuse efficiency for sites in water-stressed areas is 78%.

Water management continued

Water balance summary for ARM operations in the Vaal WMA*

Metric	Source/destination/type	Volume of water by quality			Volume of water by quality		
		F2021			F2020		
		High (m³)	Low (m³)	Total (m³)	High (m³)	Low (m³)	Total (m³)
Withdrawal	Surface water	2 951 752	1 085 407	4 037 159	2 989 235	504 509	3 493 744
	Groundwater	6 787 934	1 481 289	8 269 223	6 289 703	2 036 356	8 326 058
	Total withdrawal	9 739 686	2 566 696	12 306 382	9 278 938	2 540 865	11 819 803
Output	Surface water	—	134 566	134 566	—	181 377	181 377
	Groundwater	—	33 151	33 151	—	23 427	23 427
	Supply to third party	—	3 840	3 840	—	3 840	3 840
	Total output	—	171 557	171 557	—	208 644	208 644
Consumption	Evaporation	84 181	2 161 602	2 245 783	—	2 145 676	2 145 676
	Entrainment	—	1 621 164	1 621 164	—	2 231 610	2 231 610
	Other	—	108 840	108 840	—	132 098	132 098
	Total consumption	84 181	3 891 606	3 975 787	—	4 509 384	4 509 384
Re-use efficiency	Total of all flows to tasks (m³/a)	12 544 020	53 874 770	66 418 790	11 690 518	35 781 888	47 472 407
	Total worked water flows to tasks (m³/a)	n/a	55 533 806	55 533 806	n/a	39 297 912	39 297 912
	Reuse efficiency (%)	n/a	n/a	84%	n/a	n/a	83%
Diversions	Water diverted to neighbouring communities, farms and other users	359 953	—	359 953	586 190	—	586 190

* Includes Beeshoek, Khumani, and Black Rock mines.

Water balance summary for ARM operations in the Pongola-Uzimkulu WMA* total

Metric	Source/destination/type	Volume of water by quality			Volume of water by quality		
		F2021			F2020		
		High (m³)	Low (m³)	Total (m³)	High (m³)	Low (m³)	Total (m³)
Withdrawal	Surface water	252 768	—	252 768	265 829	—	265 829
	Groundwater	—	—	—	—	—	—
	Total withdrawal	252 768	—	252 768	265 829	—	265 829
Output	Surface water	16 305	—	16 305	22 250	—	22 250
	Groundwater	—	—	—	—	—	—
	Supply to third party	—	—	—	—	—	—
	Total output	16 305	—	16 305	22 250	—	22 250
Consumption	Evaporation	190 238	59 781	250 019	190 649	49 546	240 195
	Entrainment	—	—	—	—	—	—
	Other	—	—	—	—	—	—
	Total consumption	190 238	59 781	250 019	190 649	49 546	240 195
Re-use efficiency	Total of all flows to tasks (m³/a)	252 768	59 791	312 559	265 829	49 546	315 375
	Total worked water flows to tasks (m³/a)	n/a	59 791	59 791	n/a	49 546	49 546
	Reuse efficiency (%)	n/a	n/a	19%	n/a	n/a	16%
Diversions	Water diverted to neighbouring communities, farms and other users	—	—	—	—	—	—

* Includes Cato Ridge Works (note that the operation is not in a water-stressed area).

Water balance summary for ARM operations in the Inkomati-Usuthi WMA* total

Metric	Source/destination/type	Volume of water by quality			Volume of water by quality		
		F2021			F2020		
		High (m³)	Low (m³)	Total (m³)	High (m³)	Low (m³)	Total (m³)
Withdrawal	Surface water	15 105	592 397	607 502	158 332	498 110	656 442
	Groundwater	729 955	742 822	1 472 777	609 861	1 271 277	1 881 138
	Total withdrawal	745 060	1 335 219	2 080 279	768 193	1 769 387	2 537 580
Output	Surface water	—	644 773	644 773	—	686 484	686 484
	Groundwater	—	—	—	—	—	—
	Supply to third party	—	—	—	—	—	—
	Total output	—	644 773	644 773	—	686 484	686 484
Consumption	Evaporation	—	651 506	651 506	—	802 480	802 480
	Entrainment	—	46 181	46 181	—	54 993	54 993
	Other	—	—	—	—	—	—
	Total consumption	—	697 687	697 687	—	857 473	857 473
Re-use efficiency	Total of all flows to tasks (m³/a)	500 443	7 596 528	8 096 971	340 579	11 339 754	11 680 333
	Total worked water flows to tasks (m³/a)	n/a	4 333 923	4 333 923	n/a	6 269 876	6 269 876
	Reuse efficiency (%)	n/a	n/a	54%	n/a	n/a	54%
Diversions	Water diverted to neighbouring communities, farms and other users	—	293 723	293 723	—	714 249	714 249

* Includes Machadodorp Works and Nkomati Mine.

Water balance summary for ARM operations in the Olifants WMA* total

Metric	Source/destination/type	Volume of water by quality			Volume of water by quality		
		F2021			F2020		
		High (m³)	Low (m³)	Total (m³)	High (m³)	Low (m³)	Total (m³)
Withdrawal	Surface water	1 778 425	1 347 510	3 125 935	1 344 233	1 706 248	3 050 481
	Groundwater	207 480	2 061 760	2 269 240	189 408	2 404 568	2 593 975
	Total withdrawal	1 985 905	3 409 270	5 395 175	1 533 641	4 110 815	5 644 456
Output	Surface water	—	635	635	—	87 916	87 916
	Groundwater	—	—	—	—	—	—
	Supply to third party	33 281	—	33 281	40 354	—	40 354
	Total output	33 281	635	33 917	40 354	87 916	128 270
Consumption	Evaporation	—	2 623 615	2 623 615	11 096	1 878 884	1 889 980
	Entrainment	—	2 605 663	2 605 663	—	1 038 504	1 038 504
	Other	—	—	—	—	—	—
	Total consumption	—	5 229 278	5 229 278	11 096	2 917 388	2 928 484
Re-use efficiency	Total of all flows to tasks (m³/a)	1 231 809	13 376 405	14 608 214	3 724 198	11 821 450	15 545 648
	Total worked water flows to tasks (m³/a)	n/a	9 431 683	9 431 683	n/a	8 076 144	8 076 144
	Reuse efficiency (%)	n/a	n/a	65%	n/a	n/a	52%
Diversions	Water diverted to neighbouring communities, farms and other users	—	—	—	—	—	—

* Includes Modikwa and Two Rivers Mines.

Water management continued

ARM is not currently able to report on the proportion of sites with water performance targets as the existing water target applies only at the ARM level. Although the target is informed by site-level assessments, the approach is intended to enable flexibility to accommodate different operational and market contexts that influence our operations' ability to reduce withdrawals of potable water. This will be possible once ARM has set a more appropriate suite of context-based water targets (see page 78).

Assurance

ARM's annual total volume of water withdrawal and total volume of water outputs are assured by a third party. IBIS ESG Assurance Proprietary Limited provided independent assurance over selected ESG information in our ESG report in line with the ICMM SD framework: assurance procedure and AccountAbility AA1000AS (2008) with 2018 addendum (type II moderate level requirements). This includes a review of reporting process and an assessment of the report against AccountAbility's guiding principles of inclusivity, materiality, responsiveness and impact.



ESG report

The independent assurance statement appears on page 16 of the 2021 ESG report.

Engagement on water

There is growing awareness of the need for collective action to reduce water use. This includes using water more efficiently, repairing leaks, restoring ecosystem health, and identifying and managing water risks through stakeholder engagement. Investors and other stakeholders are increasingly calling for greater insight on catchment-level water balances, including projected demand and supply, as well as water-quality elements.

ARM's commitment to water stewardship drives our engagements with various stakeholders to find solutions appropriate to all water users' needs and to ensure the sustainability of water resources. These stakeholders include the DWS; local communities; authorities at local, provincial and national levels; water forums; irrigation boards; catchment management agencies; farmers and other industry users.

Engagements with communities help us understand and mitigate their concerns, identify how we can contribute to community water security, and increase transparency on our operations. We partner with local and regional government structures, where appropriate, to mitigate water risks outside our mine boundaries.

Our operations participate in forums that discuss issues on sustainable water supply in their regions. These include the potential influence of climate change and

potential shifts in regulation could have on the supply and cost of water.

Our operations also engage with catchment-level forums that estimate current and future catchment balances. The Inkomati-Usuthu CMA where Nkomati Mine operates is effective in facilitating this. Tshiping WUA in the Northern Cape serves this function reasonably well, but other forums or CMAs are less effective and catchment-level water availability and quality are not as well understood.

The executive: sustainable development is a member of the ICMM water working group, which considers emerging issues driven by new legislation or society and translates this into the need to develop collective industry good practice, policy or position statements, as appropriate.

At the Black Rock and Khumani mines, there are concerns about the security of water supply. Sedibeng Water is unable to supply the operations with contracted volumes due to the condition and capacity of infrastructure, as well as managerial challenges of the pipeline. This is impacting Khumani's ability to meet business objectives. Assmang, under the leadership of ARM Ferrous division, and other stakeholders are engaging with Sedibeng Water and the DWS for a plausible and sustainable solution.

Khumani has had some engagements with Kumba Iron Ore to use some of its excess water for dust suppression. This would require amendments to licences for both parties. Beeshoek also regularly engages with Kolomela Mine to ensure that any challenges at that mine with the potential to disrupt water supply to Beeshoek Mine can be addressed as early as possible.

Following our climate-scenario analysis, we are investigating opportunities to enhance community resilience to water-related impacts through our SED and CSI spend programmes.

Water-related forums in which ARM operations participate or interact include:

- Gladdespruit Forum
- Tubatse Environmental Forum
- LWUA
- Olifants River Water Resources Development Project
- Tshiping WUA
- Manganese Leadership Forum (engaging on the appropriate design of the Vaal Gamagara water supply scheme)

**CASE
STUDY**

Leading collective investments in bulk-water infrastructure in the Northern Cape

The increasing cost and unreliable supply of water in the Northern Cape presents a material risk to our operations in the area. We have been leading a process to proactively mitigate this risk. The Vaal Gamagara water supply scheme (VGGWSS) refurbishment project was started in 2016 to ensure adequate water supply to communities and mines in the area.

In F2017, Assmang was instrumental in setting up the Mines Leadership Forum (MLF) as a platform for engagement among Northern Cape mines, the Minerals Council of South Africa and Sedibeng Water. Funds were raised through the forum to support ongoing technical, legal and financial engagements with Sedibeng Water.

Phase 1 has been implemented by Sedibeng Water, with funding from the DWS. It is due to be completed by November 2021 after funding-related delays and an associated overspend of R600 million. The total funding required for the project is estimated at R10.7 billion. Mines have proposed to cover 56% of the cost (R5.6 billion). Assmang has committed R2 billion over five years to this project in total. The MLF committed capital to address immediate funding requirements. In the first half of F2020, a capital user charge on water of R6/t became effective as the system was upgraded, contributing to above-inflation increases in on-mine unit production costs at Khumani Mine in F2020.

Concerns about governance and technical accountability prompted the MLF to propose a new work programme in F2021. This includes conditions under which the capital raised can be allocated. For example, the funds are ring-fenced for phase 2 and may not be used to address other capital and operating exposures, such as municipal debt. Additionally, the investment is conditional on maintaining technical oversight and implementation of industry-accepted financial and governance control standards.

As such, the MLF has proposed the establishment of a section 21/special purpose vehicle (SPV). This is based on the successful example in Midvaal and is aiming for a similar operating model to the one being explored by the LWUA. The SPV will act as the MLF's funding vehicle and will ensure financial and commercial governance standards are maintained at all times.

While discussions on the new proposal continue, Sedibeng Water infrastructure has continued to deteriorate. Assmang has stepped in to provide some maintenance support to ensure ongoing water supply in the interim.

To further mitigate supply disruptions, mines are maximising stockpiling on-site and at the port. This has been driven by the MLF and allows mines to catch up if there are water-supply disruptions. Khumani Mine, for example, has invested in additional capacity to accommodate the need to catch up because of water-supply interruptions. There are, however, limits to this measure – to secure long-term bulk-water supplies, all parties need to sustain funding and move forward with the development of the project.

Mines continue to participate through the steering committee and are committed to supporting Sedibeng Water to ensure appropriate governance to take this project forward.

Water management continued

Identifying and managing water risks and opportunities at the operational level

ARM's ERM process links strategic intent factors to water risks that may help or hinder operations from achieving their objectives. Water is inherently included in the strategic intent factors. Water availability is considered part of each operation's five-year business plan, which assess the availability and use of appropriate technology to address water requirements or manage impacts.

In 2017 and 2018, ARM completed site-specific risk assessments at Beeshoek, Black Rock, Khumani, Nkomati, Modikwa, and Two Rivers mines as part of a water-performance and reporting gap analysis and compliance project. In F2019, the WWF water risk filter was used to support the identification and assessment of water-related risks at the operations. Water risks were discussed again as part of climate and water workshops in F2021.

At the corporate level, we have embarked on a process to identify risks associated with critical suppliers that may have a business-continuity impact on our operations. Other than the direct supply of water, we have not identified our supply chain as presenting material water-related risks to our organisation, other than the need to secure the supply of water for the operations. This is based on experience and initial investigations into potential risks in future.

We will leverage preliminary results of the climate-scenarios analysis to inform a revised assessment of water and climate-related risks in our supply chain in F2022.

Direct water risks and mitigation measures

Our focus on operational efficiencies emphasises the value of water and the need to use it efficiently. Water balances at operations manage and optimise water use and, where water is material, relevant KPIs are in place to incentivise increased water efficiency.

All operations run closed-circuit water systems to the extent possible to maximise reuse and minimise discharge into the environment. Dirty and clean water are separated, and operations implement a hierarchy of water use to ensure that dirty or process water is recycled for reuse before clean water is abstracted from the natural environment.

Where appropriate, technologies such as reverse osmosis have been implemented to clean process water,

and we continue to investigate natural, sustainable alternatives such as wetland formation, particularly for our mine closure plans. Surface and groundwater quality are monitored to measure compliance with WUL conditions, assess our impact on the receiving environment, and flag the need for mitigation. Biomonitoring of aquatic and riverine environments is performed as appropriate and as stipulated in each operation's WUL conditions.

Various measures are in place to reduce consumption, increase storage and mitigate production downtime, including the use of dust-suppression surfactants to reduce evaporation.

ARM's Ferrous division is investing in new ultra-thickened tailings facilities at Black Rock and Beeshoek mines. The facility at Black Rock Mine, at Nchwaning, involves an integrated process-water recovery, clarification and deposition circuit. It started in early 2019 and was completed and handed over in early 2020. A similar facility will be commissioned at Gloria to be completed in late 2021. The facility at Beeshoek is expected to be completed around mid-2022.

Water harvesting has started partially, with sewerage water being recovered and reused at Khumani and Black Rock mines. The optimal water recovery and clarification of process water at Khumani is the most mature, the process at Black Rock Mine is under way, and it will begin at Beeshoek Mine pending a feasibility study, which is currently under way. The mines are also maximising densities going to tailings and reducing water per unit of tailings deposited. These investments will reduce water consumption.

Beeshoek Mine is applying for an amendment to its WUL to allow for additional dams and new boreholes that include a buffer area to accommodate the need to move boreholes as areas are mined out to provide greater flexibility. These measures would help reduce reliance on water from Kolomela via Sedibeng. The new stormwater dam, commissioned in F2020, has enabled the mine to separate clean and dirty water better during flooding events in F2021. Previously, the mine has also invested in mobile pumps and software to optimise dust suppression using water trucks.

Black Rock Mine has invested in a reverse osmosis plant and filters and reuses process water for gland services. A new lined TSF is being commissioned and, once functional, will improve water performance by reducing the loss of water through seepage. The mine has allocated significant capital expenditure to water metering, with an additional 56 flow meters approved and

expected to be rolled out by May 2022, following a delay in designing their integration into current systems.

Additionally, the mine is investing in a combined sewage treatment plant that, subject to permission, will treat effluent using the reverse osmosis plant to provide potable water for the village and reduce the quantity of potable water withdrawals from Sedibeng. This is currently in design phase and expected to be commissioned in F2022. Investment in a system to divert grey water to the village for irrigation will further reduce the mines' withdrawals from Sedibeng.

Following a discharge after an extreme rainfall event in F2021, the mine developed a new stormwater management plan to encourage better clean and dirty water separation and to reuse captured water in the process. A project, in feasibility and design stage, aims to centralise the mine's wastewater treatment plant and to use treated sewage water for irrigation at the village. This will reduce potable water currently being used for this purpose.

In addition to a design that uses paste technology for tailings disposal (recovering up to 85% of water), Khumani Mine has invested in long-term on-site water storage and built additional stormwater trenches and

dams. These initiatives reduce safety risks during extreme weather and limit production downtime.

The mine has increased paste densities in F2021 and is exploring further opportunities through alternative pumping options. Projects to increase the capacity of return-water lines to reduce evaporation and leakage are in implementation phase, and scheduled to be completed in F2022. A new pipeline and pumping facility is being installed at Parsons stormwater dam to pump water to sites as soon as possible. This will enable the more efficient use of stormwater currently being lost to evaporation.

Khumani is also:

- Checking for leakages in the process-water dam and exploring opportunities to reduce evaporation, with investigation planned for F2022
- Exploring the potential for dry stacking of paste deposited at King
- Re-evaluating the closure of the Gamagara 2 and 3 reservoirs at Parson plant to maintain the quality as potable
- Looking at the long-term option of creating a reservoir that can hold six weeks' water for operational requirements.



Water management continued

Nkomati Mine has desilted existing trenches to minimise exposure of water to mining activities, and introduced drifts to control water flows through the operation. Numerous studies have been commissioned to address water challenges associated with the mine being under care and maintenance and, ultimately, closure.

At Machadodorp Works, a water-management project team has been established. The smelter has constructed cut-off trenches, doubled the sump size and is investigating a reverse osmosis plant to mitigate the risk of discharges to the environment.

Two Rivers Mine has lined the new TSF to reduce water seepage. This will be in operation towards the end of 2021. In F2021, the mine installed new boreholes for monitoring seepage and is installing a pump at the Inyoni dam to reduce current losses as the water flows through a river to the operation. It is awaiting an abstraction licence. In F2020, the mine installed a brominator to improve drinking-water quality and started using gel blocks when reusing dirty water underground. Previously the mine optimised flocculent and increased pump and pipe sizes to reduce spillage.

In F2021, Modikwa Mine started upgrading trenches and building new ones to manage stormwater. A hydrogeological study has been undertaken to identify concentrated nitrates. Subject to amendments to the WUL, the mine will drill scavenger boreholes to intercept potential pollution plumes. It also cleared river crossings, removed silt, and removed vegetation blocking streams flowing through the mine. It is also continually removing alien vegetation. This contributes to ensuring more water is available for other users in the catchment.

We are increasingly looking beyond our operational borders to contribute to collective action at the catchment level. For both our Northern Cape and Platinum division operations, we are engaging in collective actions to ensure long-term bulk-water supplies.

ARM and its joint-venture partners, through its operations, invest in local water infrastructure through their social and labour plans to improve community access to sufficient potable water and increase community resilience. The ARM Rural Upliftment Trusts fund water-provision projects, including sinking and equipping boreholes for schools and communities around South Africa.

Water risk in the value chain

Management embarked on a process to identify risk associated with critical suppliers that may result in a business-continuity impact on the operations. Other than the direct supply of water, we have not identified our supply chain as presenting material water-related risks to our organisation (other than the need to secure the supply of water for the operations). This is based on experience and initial investigations into potential risks in future. Substitutes for critical supplies are available and water costs still represent a relatively small contribution to the cost of purchased goods and services.

In F2019, we undertook an assessment of each operation's top five suppliers by spend. The assessment sought to better understand suppliers' performance on water as part of assessing water-related risks to our operations. We realised that we needed to better assess priority supply-chain risks associated with climate change and its impacts on water.

Accordingly, our F2021 scenario analysis considered projected physical impacts of climate change on water supply. This preliminary investigation has identified critical areas that require additional investigation and collective efforts. These include the projected impacts of climate change on the Vaal River that feeds supply to our Northern Cape mines. We will expand our assessment of water risks in our supply chain in F2022.

Future water focus areas

F2021/F2022 focus areas	Progress
Explore and develop a more appropriate suite of water targets	On track: We started the process in F2020 but faced challenges in setting the baseline (due to recent implementation of the new ICMM water accounting framework and Covid-related impacts in April 2020). We continued the process in F2021 and have set draft targets that include process-orientated targets on increased transparency, commitments to more stakeholder engagement and collective action to address community access to water. In F2022, we will refine and finalise these targets in consultation with relevant stakeholders.
Undertake an assessment of water risks in our supply chain	Delayed: We undertook an initial assessment of physical climate-change impact on our supply chains as part of our climate-scenario analysis. This was preliminary and limited in scope. Further work is needed and will be undertaken in F2022.
Continue to improve water reporting according to the revised ICMM water accounting framework (WAF) guideline	On track: We have continued to make improvements and will report against the revised ICMM WAF guideline in F2022.

F2022



Areas of focus in F2022 and F2023 include:

- Finalising draft context-based water targets
- Reporting our F2022 water data according to the revised ICMM water accounting framework guideline
- Investigating opportunities to enhance community resilience to water-related impacts through our SED and CSI spend programmes
- Expanding our assessment of water-related risks and the role of projected climate changes in our supply chain.



Contact details

African Rainbow Minerals Limited

Registration number: 1933/004580/06
Incorporated in the Republic of South Africa
JSE share code: ARI
A2X share code: ARI
ISIN: ZAE000054045

Registered and corporate office

ARM House
29 Impala Road
Chislehurst
Sandton 2196

PO Box 786136, Sandton 2146
Telephone: +27 11 779 1300
Fax: +27 11 779 1312
E-mail: ir.admin@arm.co.za
Website: www.arm.co.za

Group company secretary and governance officer

Alyson D'Oyley *BCom, LLB, LLM*
Telephone: +27 11 779 1300
Fax: +27 11 779 1312
E-mail: cosec@arm.co.za

Investor relations

Jongisa Magagula
Executive director: Investor relations and new business development
Telephone: +27 11 779 1507
Fax: +27 11 779 1312
E-mail: jongisa.magagula@arm.co.za

Auditors

External auditor: Ernst & Young Inc.
Internal auditors: Deloitte & Touche
and BDO South Africa

External assurance provider

IBIS ESG Consulting Africa Proprietary Limited

Bankers

Absa Bank Limited
FirstRand Bank Limited
The Standard Bank of South Africa Limited
Nedbank Limited

Sponsors

Investec Bank Limited

Transfer secretaries

Computershare Investor Services Proprietary Limited
Rosebank Towers
15 Biermann Avenue
Rosebank 2196

Private Bag X9000, Saxonwold 2132
Telephone: +27 11 370 5000
Fax: +27 11 688 5222
E-mail: web.queries@computershare.co.za
Website: www.computershare.co.za

Directors

Dr PT Motsepe (executive chairman)
MP Schmidt (chief executive officer)
F Abbott*
M Arnold**
TA Boardman*
AD Botha*
JA Chissano (Mozambican)*
WM Gule*
AK Maditsi*
J Magagula
TTA Mhlanga (finance director)
HL Mkatshana
P Mnisi*
DC Noko*
Dr RV Simelane*
JC Steenkamp*

* *Independent non-executive*
** *Non-executive*

Forward-looking statements

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