

RioTinto

Our approach to climate change

2018



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At Rio Tinto, we want to be part of the solution to help address the climate change challenge.

Cautionary statement about forward-looking statements

This document contains certain forward-looking statements, including statements relating to the operations and business of the Rio Tinto Group. These statements are forward-looking statements within the meaning of Section 27A of the US Securities Act of 1933, and Section 21E of the US Securities Exchange Act of 1934. The words “intend”, “aim”, “project”, “anticipate”, “estimate”, “plan”, “believes”, “expects”, “may”, “should”, “will”, “target”, “set to” or similar expressions, commonly identify such forward-looking statements. Examples of forward-looking statements in this report include those regarding demand for commodities, plans and objectives of the Group, potential future opportunities for the Group and projections for reduced energy use in certain activities of the Group. Forward-looking statements involve known and unknown risks, uncertainties, assumptions and other factors set forth in this document that are beyond the Group’s control. In light of these risks, uncertainties and assumptions, actual results could be materially different from projected future results expressed or implied by these forward-looking statements which speak only as to the date of this report. Except as required by applicable regulations or by law, the Group does not undertake any obligation to publicly update or revise any forward-looking statements.

Image: The Kimberley region of Western Australia

Tackling climate change



At Rio Tinto, our purpose is to produce materials essential to human progress. As such, we want to be part of the solution to help address the climate change challenge. Our aim is to make sure our business, and those in our supply chain, continue to deliver economic and social benefits in the short, medium and long term, as we assist in the transition to a low-carbon future.

Indeed, we have publicly acknowledged the reality of climate change, and its potential to affect our business, our communities and our world. Climate risks and opportunities have formed part of our strategic thinking for over two decades and with the sale of our coal assets last year, we now have a fossil-fuel free portfolio – the only major company in the mining industry to do so.

In terms of performance, we have reduced our emissions intensity footprint by almost 30% since 2008; today, 71% of the electricity used across the business is from low-carbon, renewable energy. The materials we produce will also play a key part in the transition to a low-carbon economy, from the recyclable properties of hydro-powered aluminium to the copper that will be used in electric cars.

We also continue to innovate. In 2018, we announced a pioneering new technology partnership with Alcoa, with support from Apple and the governments of Canada and Quebec, to further develop carbon-free aluminium smelting technology – an industry first. We are working on other partnerships in this space because we know we can’t make a meaningful contribution, just on our own.

Tackling climate change effectively will require a level playing field, not only across our industry, but across all industries and jurisdictions: a challenge as serious as climate change mandates transparency, collaboration and a shared contribution to the solution.

It will also require transformational changes to the broader systems in which we operate. For this we need strong government policy that creates the right environment for change, coupled with business action and societal shifts. We believe the best solutions will come from government, business and consumers working together.

This is why we signed the Paris Pledge, which supported and endorsed the commitments and ambition outlined in the Paris Agreement. It is also why we worked on our climate change strategy last year, to consider what more we can do. We continue to take steps to manage risks and build resilience to climate change, as well as to position ourselves for new opportunities. We are aiming for a substantial decarbonisation of our business by 2050 and we are working to define new emissions reduction targets from 2020. And we are looking at a variety of scenarios and abatement options to help us achieve our goals.

We welcome and support efforts, like those of the Task Force on Climate-related Financial Disclosures (TCFD), to increase transparency. We believe that companies, including ours, should be clear about how they plan to tackle climate change. So take a look at our climate change report and tell us what you think at sustainability@riotinto.com. We do not have all the answers to the complex questions that moving to a low-carbon economy entails, but we are ready to play our role in tackling the climate change challenge and believe that we are well positioned to be part of the solution.

As we look to the future, Rio Tinto will take action in four key ways:

- 1. Supply essential metals and minerals for the transition to a low-carbon economy**
- 2. Reduce our own carbon footprint**
- 3. Identify and assess physical risk exposures**
- 4. Partner and advocate for policies that advance climate goals**

J-S Jacques
Chief executive

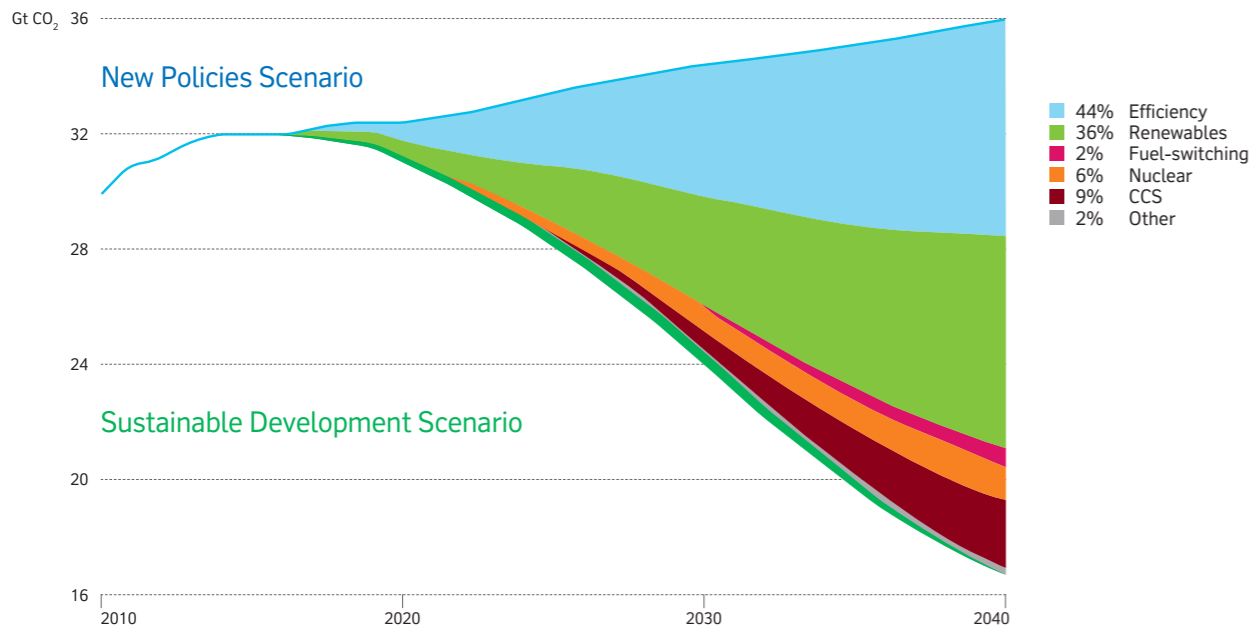
The imperative of our time

In 2015, we supported the outcomes of the Paris Agreement and the long-term goal to limit the global average temperature rise to well below 2°C. We also note the 2018 special report by the Intergovernmental Panel on Climate Change (IPCC) on the impacts of a 1.5°C warming scenario, which reinforces the need for action to address the threat of climate change and meet sustainable development goals.

We believe the best outcomes will be achieved through collective action by governments, by business and by consumers, working together to address climate change. In signing the Paris Pledge, we have shown our willingness to play our role to support climate action and we believe we can and should be part of the solution.

We also appreciate that the necessary reductions in global greenhouse gas (GHG) emissions must be achieved without compromising the availability of secure, affordable energy.

Global energy-related CO₂ emissions under IEA New Policies and Sustainable Development scenarios



Energy efficiency and renewables account for 80% of the cumulative CO₂ emissions savings in the Sustainable Development Scenario – IEA World Energy Outlook 2017

Rio Tinto has publicly acknowledged the reality of climate change for over a decade. We recognise that it is largely caused by human activities and has the potential for a lasting, negative impact on our business, our communities and the world. Indeed, from forest fires to hurricanes to loss of biodiversity, we are already experiencing some of these negative impacts.

It is clear that first, we need to decouple economic growth from emissions. In 2017, global GDP grew by 3%, mostly driven by growth in India and China. This resulted in a growth in energy demand of more than 2% – double the previous year. Relying largely on fossil fuels to power this growth has led to a rise in global emissions, which had been flat for the previous few years.

The IEA forecasts that with policies and targets announced by governments to date, global energy-related CO₂ emissions will continue to grow over the next decades.

In this report, we assess the impact of climate change and the effects this could have on our business. We have focused on an assessment against a transition to a 2°C scenario, consistent with the Paris Agreement.

The report uses the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) as a framework and we note that in line with TCFD recommendations, climate-related implementation efforts will evolve over time.

“We believe the best outcomes will be achieved through collective action by governments, by business and by consumers, working together to address climate change”

Core elements of recommended climate-related financial disclosures



- Governance**
The organisation’s governance around climate-related risks and opportunities.
- Strategy**
The actual and potential impacts of climate-related risks and opportunities on the organisation’s businesses, strategy and financial planning.
- Risk management**
The processes used by the organisation to identify, assess and manage climate-related risks.
- Metrics and targets**
The metrics and targets used to assess and manage relevant climate-related risks and opportunities.

Our role in a low-carbon future – becoming part of the solution

Climate change is a strategic imperative for the world and for Rio Tinto. It presents a long-term challenge if governments, society and business do not take action. And it requires a long-term perspective to address both the risks and uncertainties, and opportunities.

We believe that Rio Tinto can and should be part of the solution, as we provide materials that are essential to building a low-carbon economy. We have integrated climate change into our strategic planning process for nearly two decades. As we develop our business strategy we consider environmental, social and governance (ESG) risks and opportunities, including climate change. The climate change actions we take are consistent with our objectives of delivering superior performance and creating long-term shareholder value, fully aligned with our purpose and values.

After executing our strategy over the past decade, we are now the only large diversified mining company which no longer has coal in its portfolio. Our decision to divest from fossil fuels was informed by the market outlook for thermal coal and our ability to realise full value for the assets. We now have the opportunity to invest in commodities and sectors that have more attractive growth prospects in a carbon-constrained world.

We are focussed on:

Supplying the materials essential to building a low-carbon economy

Managing our own footprint

Resilience to physical impacts

Partnering and advocating for policies that advance climate goals

Supplying the materials essential to building a low-carbon economy

Rio Tinto supplies the metals and minerals used to help the world grow, and these materials have a key role to play in supporting the transition to a low-carbon economy.

Each of the commodities we produce has a role to play:

Cu

Copper is the primary conductor in the world's electrical infrastructure contributing to electrification of transportation and smart technologies. For example, electric vehicles use 4 to 6 times more copper than traditional internal combustion engine cars.

Al

Aluminium is light, strong, flexible, corrosion-resistant and infinitely recyclable. Our clean, renewable hydro-powered aluminium business in Canada, supplies our customers, like those in the car industry, with sustainable materials to reduce emissions.

Fe

Iron ore is used in steel, the fundamental building block of industry and infrastructure. Our higher-grade ores also contribute to reducing GHG and other air emissions in China and elsewhere.

B

Borates are a vital ingredient of energy-efficient building materials and are in fertilisers, which help to feed the world's growing population.

TiO₂

Our titanium dioxide business is working on the development of low-cost metal powders for 3D printing which is used by the aerospace industry, removing the need to cast metal, reducing energy and waste.

We believe there are three key elements to consider in the transition:

1. A shift away from fossil fuels and towards higher energy efficiencies;
2. Increased electrification of transportation and industrial processes; and
3. A stronger focus on material re-use and recycling, ie the circular economy.

Managing our own footprint

Many of our operations are energy-intensive and we are taking action to improve both productivity and efficiency, as we reduce emissions. This starts with making sure we have a strong understanding of how energy in our business is used, constantly assessing low-emission technology opportunities, and building our own capability to innovate. We have had emissions intensity targets since 2008 with a focus on abatement opportunities.

We have reduced our emissions footprint by almost 30% since 2008 and 71% of the electricity used across the business is from low-carbon renewable energy.

We have committed to substantial long-term decarbonisation by 2050, and work is underway to define new emissions reduction targets to take effect when current targets expire in 2020.

Resilience to physical impacts

We consider climate risks over the life of our operations, from the way we design and develop new projects through to closure and beyond. We have already seen the impacts of climate change at many of our sites and are using scenarios to assess further medium to long-term risks.

Historical decisions and actions





Managing climate risks and opportunities

We manage our climate risks through our risk management framework. The framework reflects our exposure to a variety of uncertainties (both threats and opportunities) that can have financial, operational and compliance impacts on our business performance, reputation and ability to operate successfully. It includes clearly defined oversight responsibilities for the board, Sustainability Committee and the Executive Committee, who are supported by the Risk Management Committee and support functions, to enable effective risk identification, evaluation and management across Rio Tinto.

Image: Forest rehabilitation at Richards Bay Minerals, South Africa

Responsibility for the Group's climate change strategy and implementation framework sits with the head of Corporate Development, with direct oversight by the chief executive and the Executive Committee. Corporate Development is responsible for Rio Tinto's corporate strategy process.

Under Rio Tinto's risk management framework, emerging risks are identified, assessed and appropriately managed. Rio Tinto has used the major risk categories identified in the TCFD recommendations as the basis for its risk assessment:

1. Risks related to the transition to a lower-carbon economy
2. Risks related to the physical impacts of climate change

Partnering and advocating for policies that advance climate goals

Governance

Climate change is discussed at the most senior levels of management and by the board. The board Sustainability Committee, chaired by Megan Clark AC, has oversight of the key sustainability risks, including climate change, the quality of the controls and performance against our targets. It meets five times per year.

This report, and the assessment of the resilience of our business to transition risks and to climate scenarios described in this report, have been discussed with both the Executive Committee and the board as a key part of the business strategy discussion.

Our strategy considers four critical global megatrends: global interconnections; industrialisation and urbanisation; demographic shifts; and disruptive technologies. These are supported by six specific strategic realities defining the "so what" for Rio Tinto. In 2018, climate change was added as one of the strategic realities. This reflects our view that climate change has the scope to profoundly shape our sector and business over the medium and long term.

Our investment decisions have been tested against an internal carbon price since 1998. Climate change is also one of the seven key performance indicators for the Group. We are committed to reducing the energy intensity of our operations and the carbon intensity of our energy, including through the development and implementation of innovative technologies. Our GHG performance is an important indicator of this commitment and our ability to manage exposure to future climate policy and legislative costs.

Climate Action 100+



Rio Tinto is one of the companies covered by the Climate Action 100+ (CA100+). This global initiative is backed by over 300 investors with >\$300tn in assets under management. We are collectively asking systematically important greenhouse gas emitters to work with us to improve their governance, disclosure, and alignment with the goals of the Paris Agreement.

Last year Rio Tinto supported the recommendations of the TCFD and we welcome this first report under that structure. Significantly 2018 saw the completion of the company's strategic exit from coal. In addition, there were technological breakthroughs in materials that have a key role in the low carbon transition. We are also encouraged that Rio Tinto has joined the Energy Transitions Commission, which takes a multi-sector approach to hard-to-abate sectors like steel.

Over time Rio Tinto faces complex portfolio and operational choices. It is useful to see initial quantification of the impact of the transition on different commodities. We look forward to reviewing the company's new targets and metrics: a critical part of the TCFD recommendations and the CA100+ request for Paris alignment. Once targets for the 2020s are determined we expect relevant ones to be integrated into remuneration policies. We would also welcome a step change in Paris-aligned policy advocacy in contexts where Rio Tinto and its peers have considerable direct and indirect influence.

We believe that the first year of engagement under the CA100+ umbrella has been mutually beneficial, and we look forward to further discussions in 2019. ”

Andrew Gray
Director – ESG & Stewardship,
Australian Super and Member,
Climate Action 100+ Global
Steering Committee

Helen Wildsmith
Stewardship Director – Climate
Change, CCLA and Founder,
'Aiming for A' Initiative

Climate policy advocacy

We are actively involved in climate change policy engagement across the jurisdictions in which we operate and which are important to us. We are guided by our policy position that supports market mechanisms. We believe this is the best way of achieving emissions reductions, and we support a market-based price on carbon. Underpinning this we encourage the establishment of stable regulatory frameworks that support investment, competitiveness across jurisdictions, and the use of revenues raised from carbon pricing to facilitate the transition to a low-carbon economy. We also believe effective action requires a level playing field, not only across our industry, but across all industries and jurisdictions: a challenge as serious as climate change mandates transparency, collaboration and a shared contribution to the solution.

We engage on policy issues directly, through formal submissions, which are publicly available, and indirectly through industry associations. Membership of industry associations provides us with an important platform to encourage broader industry understanding of climate risks and the implications of climate change issues and policy proposals. On the complex issue of climate change, we believe governments, investors, civil society organisations and consumers must come together in collective action.

Each industry association is different – they represent a range of companies and organisations and often cover multiple issues, not just climate change. We review the value of individual industry association memberships both prior to joining and when membership is due for renewal, and have published guidelines which govern our approach to participation in industry associations.

We advocate for policy that is consistent with our public climate change position and we recognise that an industry association's view will not always be exactly the same as ours. We disclose the industry associations we belong to and state climate policy differences and alignment on our website. This disclosure is updated annually, and at the time of this report, we have not identified any associations where we believe their position is so inconsistent as to lead us to leave.

Transition risks

Policy and regulation Current and emerging regulation has the potential to impact business costs associated with meeting regulatory requirements and the impact on markets for our products. This includes the potential for increases in carbon pricing and emissions reporting obligations. The Paris Agreement encourages increasing regulation, but the pace and form of action by governments will differ.

The 2018 stocktake assessment of progress under the Paris Agreement as part of the United Nations Framework Convention on Climate Change (UNFCCC) process is expected to highlight the inadequacy of current commitments and increase pressure on government to take greater action. The evolution of China’s national emissions trading scheme will be important as China is a carbon-intensive producer of key commodities such as aluminium and a key influencer of other jurisdictions.

See page 13 on climate policy advocacy

Market The minerals and metals produced by Rio Tinto have an important role in a low-carbon economy. Climate change will have implications for our markets and the demand for our products. Copper demand is expected to increase as electrification expands. The associated development of battery technologies will also have a material impact on demand for products such as lithium. The success of our aluminium business in reducing its carbon footprint and creating a low-carbon branded aluminium product has been instrumental in positioning Rio Tinto to capitalise on customer demand for “green metals”.

The use of our products also contributes to GHG emissions. For example the steel making process, which uses iron ore as a raw material, is very energy and GHG intensive. The transition to low emissions could impact on the competitiveness of our iron ore product.

See page 22 to 23 on Portfolio impacts and resilience

Technology The development and deployment of low-emissions technology presents cost beneficial opportunities for the business to reduce emissions and improve energy efficiency and productivity. Technology deployment in the electricity sector, and the sector’s transition to low carbon, has the potential to impact the future price of purchased electricity. Development and increased demand for downstream technologies, such as electric vehicles, will have implications for the demand for and pricing of our products.

We are seeking to identify the technologies that are most relevant and valuable to us and, where appropriate, to partner and collaborate with others.

See pages 24 to 29 on Reducing our footprint

Legal Climate change has the potential to result in legal compliance problems and litigation. There is increasing emphasis on the duty of directors to consider and disclose climate change risks. Some communities and activists are using legal routes as a lever to drive greater action and to reduce emissions across a product’s value chain. By seeking to make companies liable for the impacts of climate change, they aim to encourage a move away from fossil fuel production and use.

Rio Tinto has been named in two class action cases. In California, plaintiffs claim a number of oil and coal companies knowingly contributed to GHG emissions and in so doing adversely impacted the environment through physical climate impacts. And in the Philippines there is a case linking the impacts of climate change to human rights violations.

Legal action continues to evolve, and it is important for companies to monitor and understand the development of the science behind climate change and transparently disclose their actions.

Reputation Stakeholder expectations on climate change are evolving and will impact the sector and Rio Tinto’s reputation and ability to operate. In recognising the valuable products the sector produces, we also know that metal and minerals production can be energy intensive and the use of some products can result in significant emissions. This has driven engagement with a number of stakeholders, particularly our customers and our investors.

We have worked increasingly closely with our investors on climate change related issues. We recognise that expectations for, and scrutiny of, disclosures will increase. Rio Tinto’s intent is to demonstrate that we are following through on our public commitments on climate change, aligning our disclosure with good practice and internationally accepted frameworks. We welcome the structured and coordinated engagement through the Climate Action 100+ network. In parallel with our work on climate change, we have also increased our engagement on ESG issues more broadly, led by the board and Executive Committee.

See the case study on the ASI and testimony from Climate Action 100+ on pages 12 and 15.

Aluminium Stewardship Initiative (ASI)

Rio Tinto embraced and pioneered the concept of multi-stakeholder engagement along the aluminium value chain. Working with the International Union for Conservation of Nature (IUCN), other producers, users and stakeholders along the value chain, the ASI was launched in 2012 with a commitment to maximise the contribution of aluminium to the development of a sustainable society. It has established an independent, third party verification of the sustainability of the value chain, including the carbon content. In 2018, Rio Tinto became the first company to be verified under the ASI.



Nespresso coffee pods will soon be made with the world’s first certified responsible aluminium, produced by Rio Tinto

Physical risks

Acute physical risks Changes to the intensity and frequency of extreme events, such as tropical cyclones, have the potential to damage infrastructure and interrupt business operations. This could result in increased operational costs and loss of revenue from reduced production. The changing nature of extreme weather events also has the potential to impact on the design criteria for new projects and for closure. For many years, we have undertaken annual seasonal planning for extreme weather events.

Many of the forecast future risks represent an extension and intensification of current exposures that we are already experiencing. Our controls are expected to be robust in regions where extreme events already occur, but less developed where extreme events are currently uncommon. Incremental, experience-driven improvement in controls may be sufficient to build resilience to increasing intensity and frequency of events. Rio Tinto’s business resilience and recovery planning processes are an important part of the process by which we respond to and learn from events, and develop improved systems and processes.

Climate change and energy considerations are built into the study definition guidelines that support our project development and closure processes. However, infrastructure design criteria can be slower to be updated than climate science understanding, so there is a risk that compliance with existing engineering codes and standards provides insufficient resilience for future extreme weather events.

See pages 30 to 35 on Resilience to physical risks

Chronic physical risks Longer-term trends can be more difficult to identify and respond to. For example: warming temperatures could significantly reduce the usability of ice roads in sub-arctic locations, resulting in supply chain disruptions and increased operational costs; rainfall patterns may vary both in terms of average rainfall, and seasonal variability, impacting water availability and requiring stronger discipline in water balance management; and temperature increases will result in more extreme-heat days. This could have knock-on, indirect impacts, including employee and community health. We anticipate that energy use profiles at facilities may change, particularly where energy is used for heating or cooling.

See pages 30 to 35 on Resilience to physical risks

Climate scenarios

Because our operations currently result in significant GHG emissions, the transition to a low-carbon economy will have a material impact on Rio Tinto's long-term strategy and operations.

A comprehensive assessment of the full range of impacts is challenging, since it must consider the interplay of technical, social and political factors over long periods of time. We therefore incorporate climate change considerations into our strategic planning and commercial frameworks, to make sure that risks and opportunities can be addressed comprehensively. Climate change is a strategic business issue which requires a whole-of-business approach. As such, we will review our approach to climate change every year, as part of our ongoing corporate strategy process.



Image: A ship loaded with aluminium leaving Kitimat, Canada

CLIMATE SCENARIOS

Our analysis indicates that Rio Tinto's business is relatively robust to scenarios mapping the policy and technology pathways necessary to limit global temperature rises:

- **Financial impact at a manageable level:** Rio Tinto has the financial and institutional capacity to manage the long-term impacts of a scenario limiting a rise in global temperature to below 2°C, while continuing to be profitable;
- **Portfolio naturally hedged:** diversification of our portfolio across multiple commodities provides a natural hedge against climate change policy; our aluminium and copper assets will be needed in the transition to a low-carbon future and could provide an offset in an environment where our iron ore assets are less attractive from a climate change perspective;
- **Many abatement options available to us to reduce direct emissions:** the significant number of internal abatement options available, coupled with a more gradual evolution of downstream industries, will give us time to anticipate and adapt to changes in policy.

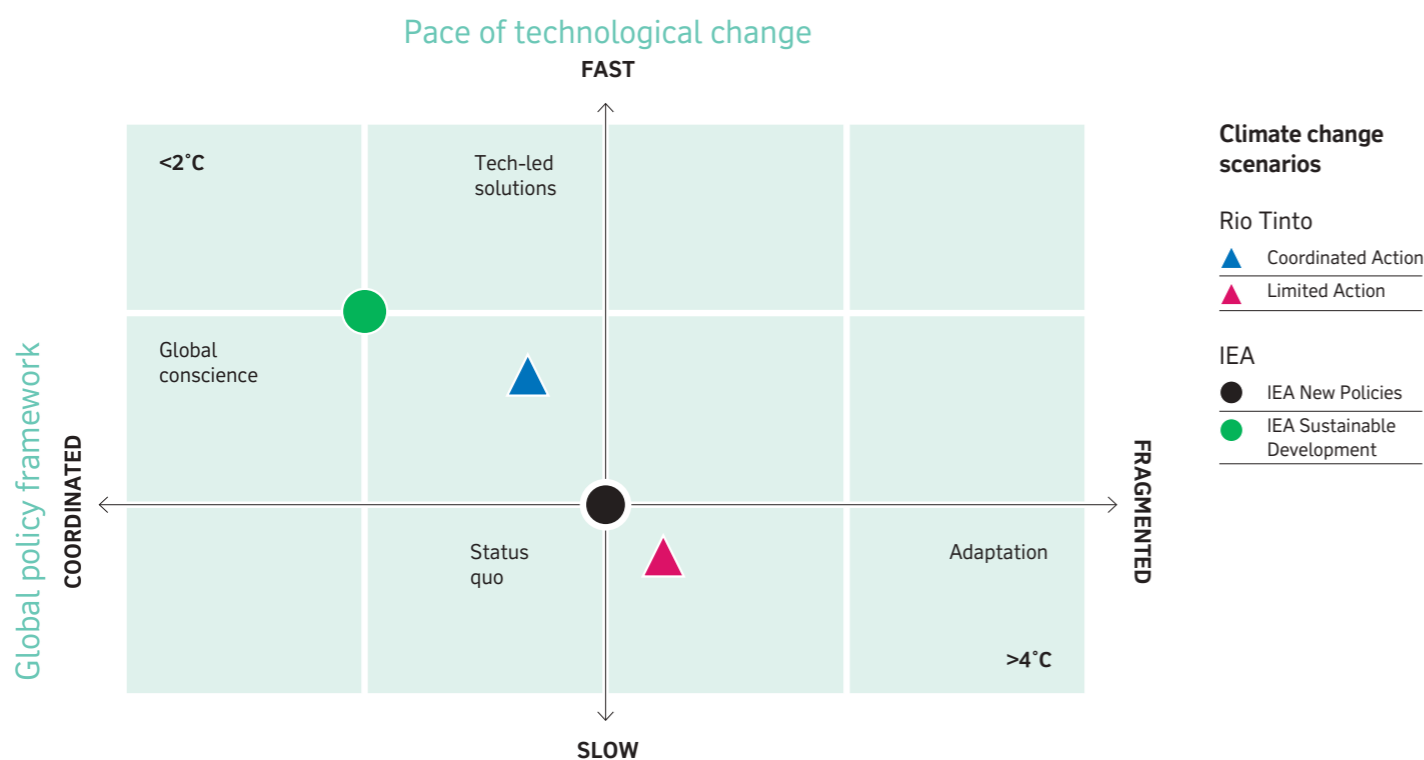
Rio Tinto considers the impact of climate change over two time horizons given the long-term nature of our business and the potential for unpredictability in regulatory response.

1. **Short to medium term (0-20 years):** while there is limited scope to react immediately to regulatory changes, we do have the ability to mitigate (or potentially take advantage of) shifts in technology and the policy environment. In this timeframe, physical changes are largely pre-determined since they are largely the result of carbon levels already accumulated in the atmosphere over past decades.
2. **Long term (20-50 years):** the physical impact of climate change to the world could potentially become more severe, depending on the success or failure of policy. Technology development is highly uncertain.

Across these time horizons, the Group assesses three climate change scenarios, which consider:

- **The policy environment** – for example, the level and coordination of carbon pricing internationally; and
- **The rate of technological development** – for example, the costs of low-carbon electricity generation and batteries.

Our approach recognises that there is an interplay between these two factors: technology that leapfrogs what is available today, for example, could succeed in dramatically reducing climate change and its impacts even in an environment where government mandates do not exist.



We have identified three scenarios that attempt to assess plausible combinations of these factors to better understand the resilience of the business across all time periods.

1. **Limited Action:** currently forms the baseline for our financial assessments and assumes that carbon prices (or other financial incentives to reduce carbon emissions) remain similar to today's levels throughout the planning period. It describes a conservative assumption against which to measure more proactive scenarios.
2. **Coordinated Action:** describes a central case view of policy pathways to 2050, taking into account both climate change objectives and a view on the feasibility of policies being adopted. We believe it is likely that climate change ambition will gradually increase over time, resulting in an increase of nationally determined contributions. However, we anticipate that the pace and degree of ambition will be insufficient to meet the Paris Agreement. This scenario lies in-between the International Energy Agency's (IEA) New Policies and Sustainable Development scenarios, resulting in a climate change outcome in the 2.5 -3.5°C warming range by 2100.
3. **IEA Sustainable Development Scenario:** developed by the IEA to describe a plausible path to meet the key global goals of the Paris Agreement and hold the rise in the global average temperature to well below 2°C above pre-industrial levels. This scenario assumes relatively high-carbon prices (up to US\$140/tCO₂e by 2040 in developed countries) as well as a widespread deployment of low-carbon technologies such as carbon capture and storage. Where possible we use IEA's assumptions directly, but it is also necessary to make additional reasonable assumptions regarding how these will pass through to the mining and processing industries.


The IEA Sustainable Development Scenario (SDS)

In the SDS, global CO₂ emissions peak before 2020 and decline swiftly. By 2040, emissions are at the lower end of a range of publicly available decarbonisation scenarios, all of which estimate a temperature increase of around 1.7-1.8°C in 2100.

Developed world carbon prices reach US\$140/tCO₂e in 2040 (US\$100/tCO₂e in the developing world). This increases the cost of carbon-intensive power used for mining, processing, and transporting ores to customers. The total economic cost of implementing low-carbon technology is not expected to be a significant drag on economic growth, given the multiple co-benefits, including higher productivity from lower levels of air pollution. Thus, the main impact on commodity prices is from the cost side, and the dominant factor influencing our margins is our carbon intensity (or that of using Rio Tinto's products) relative to that of our peers.

We have made commodity-specific assumptions to flesh out the Scenario in a plausible fashion:

- **Iron ore and steel:** we assume full pass-through of carbon costs to mines and smelters even though a degree of transitional assistance is possible. High carbon prices provide an incentive to increase the use of high-grade ores, lump, and pellets. High carbon prices are assumed to cause significant substitution towards scrap, reducing demand for ore.
- **Copper and aluminium:** we consider the impact on the cost of acquiring raw materials, such as alumina, and assume that transitional assistance for aluminium is phased out quickly. In the short to medium term, carbon-related cost inflation is likely to be lower for copper than aluminium, leading to limited substitution towards copper.
- **Battery materials (incl. lithium):** we use a high-case electric vehicle penetration forecast, consistent with the IEA SDS, but with additional detail on the types of vehicles, size of batteries and implications of these for commodity demand.



New frontiers: the metals and minerals essential to delivering a low-carbon society

As noted earlier in this report, the materials that Rio Tinto produces have a significant role to play in supporting the transition to a low-carbon economy. Beyond the implications for the future demand of our products, we also need to consider potential shifts in industry structure and the competitive position of our assets to develop a deeper understanding of our portfolio's resilience in a carbon-constrained world.

The pre-feasibility studies of our Jadar project in Serbia have continued to progress this year. Jadar has the potential to become a significant source of lithium, a key raw material for battery technologies used in renewable energy storage and electric vehicles. The Rio Tinto Ventures team is exploring partnerships and other opportunities that will allow us to expand into metals critical to a low-carbon economy, with a strong focus on battery minerals.

Energy Transitions Commission: hard-to-abate sectors

Rio Tinto has joined the Energy Transitions Commission (ETC), a group of leaders from public, private and social sectors with the goal of accelerating change towards low-carbon energy systems. The ETC is tackling the challenge of how we reduce emissions from the “hard-to-abate” industrial and transport sectors of the economy, including steel – the customer for our iron ore and the source of most of our scope 3 emissions.

These sectors will account for an increasing percentage of the total global emissions and without action will make it impossible for the world to meet the goals of the Paris Agreement and net zero emissions by 2050 to 2070.

The recent ETC report, *Mission possible: Reaching zero carbon emissions from hard to abate sectors by mid-century*, concludes that it is technically possible to decarbonise these hard-to-abate sectors at an affordable cost to consumers and to the overall economy, but there are important issues relating to the feasible pace of change and the optimal process of transition, including the pace of innovation and the importance of strong policy actions. As an important part of the value chain, we believe we can contribute and benefit from this cross-business and multi-stakeholder collaboration.

Commodity impacts

The table gives a high-level summary of the potential risks and opportunities for Rio Tinto’s portfolio across different time horizons within the IEA SDS relative to the Limited Action case. Coordinated Action, which lies between Limited Action and the IEA SDS, would have directionally similar, albeit smaller, implications.

The methodology used to consider implications of the IEA SDS on the outlook of our key commodities accounts for impacts of regulations and technologies on demand, the cost structure of supply and the knock-on effect on price.

Commodity impacts of a 2°C scenario

Commodity	Outlook	Short to medium term	Long term
Pilbara iron ore	↓	Pilbara iron ore becomes less attractive due to the effect of increased use of scrap, however, the business continues to be highly profitable. Demand for lump and pellet is robust. There is scope to significantly decarbonise our iron ore mining operations in order to maintain cost-competitiveness (see Reducing our footprint).	There is large uncertainty around how the steel production sector will decarbonise in the long run, which could materially affect the value of Rio Tinto’s iron ore business. In addition to an escalation of the severity of the medium-term impacts, there is a need to plan for greater frequency and intensity of cyclones on the Pilbara coast.
Copper (and battery materials such as lithium)	↑	Increased demand for copper as well as other battery materials due to greater focus on electrification. Supply investment expected to lag demand due to long mine development lead times, resulting in extended periods of high prices.	Structural increase in demand due to faster electric vehicle take-up and investment in power and the grid, requiring significant new supply, partially offset by an increase in scrap collection rates.
Aluminium (including bauxite mining and alumina refining)	↑	Emission-reduction policies likely to increase aluminium prices, benefiting low-cost, low-carbon producers but putting greater pressure on coal-based smelters as well as the refineries supporting them.	Structurally steeper global aluminium cost curve and potential for decarbonising aluminium smelting direct emissions using inert anode technology.

Portfolio resilience

The factors described above could have a material impact on our business, but on balance we believe that Rio Tinto is likely to be resilient to these issues, given:

- Factors will affect different commodities in different ways and as a diversified miner we will benefit from this. For example, climate change policies placing a carbon price on emissions will result in downside impacts on lower-grade iron ore. However, these same policies will benefit tier one copper and aluminium assets;
- The relative cost position of most of our assets is expected to remain robust within their respective industry cost curves. Our hydro-based aluminium assets in Canada will consolidate their position at the bottom of a steeper aluminium cost curve. The overall cost position of our iron ore and copper businesses will be relatively unchanged, with suppliers of low-grade iron ore expected to face much stronger margin compression;
- Impacts are likely to materialise over the long term and we have a range of options, and the financial and operational capacity to execute these, to (i) mitigate risks; (ii) reduce direct emissions through a range of abatement projects and (iii) to offset remaining emissions where commercially justified.

Rio Tinto’s internal use of a carbon price

One of the ways we mitigate the potential impact of climate change policies on our business is through the use of an internal price on carbon. Rio Tinto has tested the resilience of its investments against a carbon price since 1998. We have developed separate price forecasts for the regions and main markets in which we operate and sell our products, and modelled how these might change over time.

Our process to develop and update carbon prices includes short-term market data, price forecasts and scenarios, and input from experts within and outside our business. The forecasts will be impacted by variables such as the progress of international climate agreements and commitments on national energy and climate policy, and the evolution of low-emission technology costs and deployment.

The climate scenarios described contribute to the maintenance and update of our carbon cost forecasts. They also impact the forecasts we use for the price of our commodities.

Reducing our footprint

Rio Tinto has participated in the CDP (formerly Carbon Disclosure Project) voluntary disclosure initiative since its inception in 2002. We have always believed that measurement and disclosure of appropriate climate data should help drive our business activities and provide stakeholders with an opportunity to assess our performance against stated commitments. We have placed a summary and analysis of key climate-related metrics on our website to allow stakeholders to access and use this information. All of our data is reported in accordance with the GHG protocols developed jointly by the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD).

Image: Our aluminium business in Canada uses clean, renewable hydro-power

REDUCING OUR FOOTPRINT

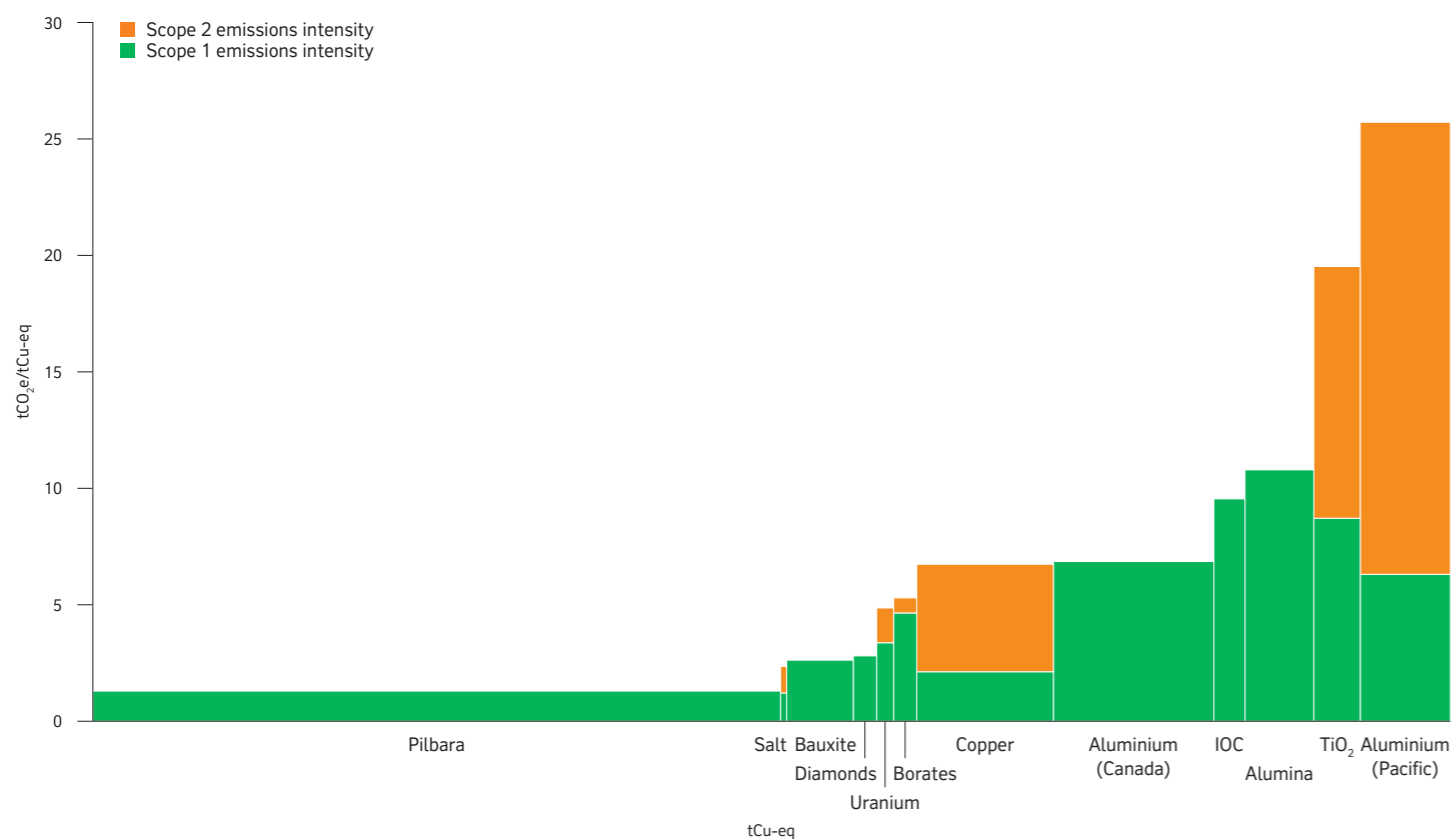
The table below shows the Group's 2018 emissions for our managed operations.

2018 greenhouse gas emissions

	Million tCO ₂ e
Scope 1	17.8
Scope 2	10.8
Scope 3	536.0

We have a clear understanding of the scope 1, 2 and 3 emissions from each managed operation. 71% of our electricity consumption already comes from renewable sources, which has a positive effect on our scope 1 and 2 emissions and represents a significant and growing competitive advantage. Our scope 3 emissions are mostly related to iron ore, and therefore represent scope 1 emissions from the steel industry. As we manage our carbon footprint, it is important to recognise that the scope 1 and 2 emissions intensity of our operations also vary greatly across our portfolio.

2018 emissions intensity for managed operations (tCO₂e/tCu-eq)*



2018 absolute emissions for managed operations (million tCO₂e)*

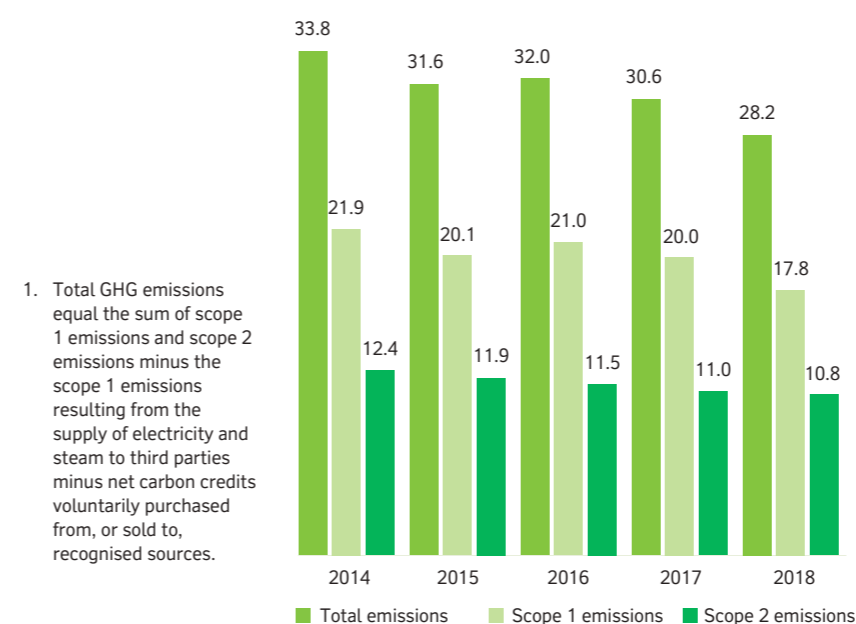
	Aluminium (Pacific)	Aluminium (Canada)	Alumina	Bauxite	TiO ₂	Copper	Pilbara	IOC	Other
Scope 1	2.0	3.9	2.6	0.6	1.4	1.0	3.2	1.0	1.1
Scope 2	6.2	0.0	0.0	0.0	1.8	2.2	0.0	0.0	0.2
Scope 1 & 2	8.2	3.9	2.6	0.6	3.2	3.2	3.2	1.0	1.3

* Excludes operations divested in 2018

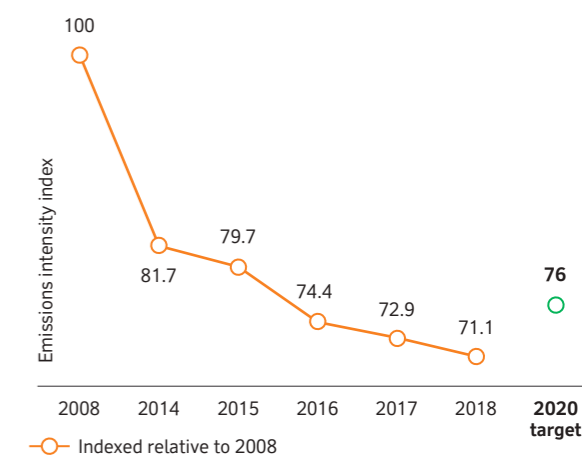
In 2008, Rio Tinto set its first climate change target, to reduce the GHG emissions intensity of our operations by 10% over five years. Our current target ends in 2020 by which date we plan to have reduced the emissions intensity by at least 24% against a 2008 baseline. Since 2008 we have consistently

beaten our targets and are on track to do the same by the end of 2020. The absolute emissions from our operations have also reduced over the same period, since 2008, by 43%. The sale or closure of assets have contributed to reductions in both emissions intensity and absolute emissions.

Total greenhouse gas emissions¹ (million tCO₂e)



Greenhouse gas emissions intensity



Elysis

In 2018, Rio Tinto, in partnership with Alcoa, Apple and the Canadian and Quebec governments, announced the world's first carbon-free aluminium smelting process. The Elysis joint venture will develop and commercialise inert anode technology, the most significant innovation in the aluminium industry for more than a century. The revolutionary process enables the elimination of all GHG emissions from smelting, producing an oxygen by-product. It also reduces operating costs and increases productivity. It is planned that the technology will be able to be installed at new facilities or retrofitted to existing smelters.



Abatement opportunities

Consistent with our position statement and our support for the Paris Agreement, we have a goal to substantially decarbonise our business by 2050. We maintain a strong focus on energy efficiency and productivity to deliver incremental improvements, but this is not enough. We know we need to look at larger transformative opportunities for emissions reduction.

We have undertaken a Group-wide review of our abatement opportunities and using internal workshops, supported by external experts, we have captured a wide range of knowledge and expertise to review technology opportunities now and into the future. We have created marginal abatement cost curves for most of our operations and sites. This has helped us understand which technologies may be applicable and has supported engagement with the Executive Committee, Sustainability Committee and the board.

This is helping us to assess potential decarbonisation pathways and develop a deeper understanding of the commercial options and applicable technology developments. We can now look to identify where we can reduce emissions and where we have challenges, and prioritise resources and research and development to best effect. Partnerships with other companies facing similar issues, and with those who can help us develop solutions, are important so that we can learn and meet our goals.

The cost of low-emission technologies is falling rapidly, and expected to do so well into the next decade, meaning that the economics of transformation improves. Solar photovoltaic (PV) and battery technology is expected to be cost competitive against other reliable energy sources by mid to late next decade. Some of these low-emissions technologies are starting to become economic for some of our sites, even without a carbon price on our emissions. Early adoption of small-scale solar demonstration projects across more than 20 of our sites, the investment in a 1.7MW solar PV plant at Weipa, and a 9.2MW wind farm at the Diavik mine have helped us to understand and plan for operational risks, such as integration into our existing power systems and intermittency.

One of the factors we consider is the long-term energy supply arrangements we have in place for many of our long-life assets. When these supply arrangements become due for replacement or renewal this creates opportunities to identify and implement lower-cost and low-emission alternatives. We recognise that the transition to lower-emission energy sources has the potential to reduce operating costs, to make our assets less dependent on fossil fuels and international markets, and to reduce our exposure to changes in government carbon policy.

We also recognise that some of our emissions will be very challenging to abate with no commercially viable alternatives today. Large energy-consuming sites like Boyne Smelters in Queensland, the Oyu Tolgoi mine in Mongolia, and Richards Bay Minerals in South Africa, currently source electricity from coal-fired power generation. To remove these emissions we will need low-cost and low-emission alternatives that also generate a reliable power supply. Our alumina refineries would need a low-emission alternative to replace the gas used in high temperature calcination. And transitioning the mobile mining fleet from diesel to low-emission energy requires renewable energy, development of electric mining vehicles and energy transfer systems. Under an initiative led by the International Council on Mining and Metals, we are participating with our peers in the sector and with original equipment manufacturers to pursue this.

The challenge to decarbonise will require sustained effort over a number of decades. Capital costs are material, but so too are the potential reductions in operating costs. Over the next year, Rio Tinto will prioritise and define the phasing of our abatement projects to reduce risk, minimise cost and build our experience.

Indicative abatement opportunities for Rio Tinto businesses

Abatement considerations	Related Group's scope 1 & 2 emissions	Target operations
Energy efficiencies	Up to 5%	– All
Renewables: solar + wind + battery storage	Up to 10%	– Pilbara iron ore – Oyu Tolgoi – Bauxite
Truck and rail fuel switching (incl. electrification)	Up to 10%	– Iron ore – Copper – Bauxite
Inert anode	Up to 20%	– Aluminium smelting
Harder to abate, requiring more complex technologies or power solutions	Over 40%	– Boyne smelter – Alumina – TiO ₂ + Iron smelting – Marine

Increasing abatement cost (\$/tCO₂e)

The role of the carbon markets and offsets

Rio Tinto's policy position supports the development and use of market mechanisms as an effective and efficient way to reduce emissions. Article 6 of the Paris Agreement introduces the foundations to support the eventual development of a robust global carbon emissions market. Putting a price on carbon emissions has been shown to deliver emissions reductions cost-effectively, generate revenue for countries and foster innovation when global competitiveness is safeguarded. Article 6 encourages the development of a carbon price by:

- Establishing a way to generate and transfer verified emission units from one country to another
- Enabling the private sector to play a role in the generation and transfers of emission units
- Ensuring that double counting of emissions reductions does not occur, which requires clear, quantitative, transparent accounting of country emissions and the transfer of emissions between countries
- Ensuring environmental integrity
- Quantifying a broad range of mitigation activities

Consistent with our policy position, Rio Tinto supports Article 6 as a critical step towards ensuring a cost-efficient pathway for the delivery of the Paris goals, allowing governments and businesses to unlock opportunities by creating incentives for innovation. Membership and support of industry associations like IETA is important in ensuring business can play a role in supporting the development of the policy landscape.

Future target

Rio Tinto will set new targets to replace the current emissions intensity target before it expires in 2020. The new targets will aim to achieve the dual goals of (i) driving improved internal performance on business issues relevant to climate change, such as energy use and emissions reduction, and risks that have the potential to impact business outcomes; and (ii) providing a public indicator and external measure of ambition and performance.

The new targets will be developed over the course of 2019, based on and informed by the internal assessment of marginal abatement opportunities and identification of pathways to decarbonise our business.



Emissions markets are all about creating real incentives: by producing a price on carbon, they enable companies to gain financial rewards for reducing emissions. These incentives can bring businesses on side as a partner in the fight against climate change. The market approach also lowers the overall cost of the transition, enabling business and government to reach for more ambitious goals. The World Bank estimates that market solutions can lower the cost of meeting 2050 goals by 50%.

IETA accepts the science of climate change, the global response under the UNFCCC and its Paris Agreement. We are confident that market approaches can support action at the scale envisioned in Paris. To get there, a portfolio of strategies will be essential – from those that improve efficiency, cut emissions or deploy renewables, to those that capture and store carbon in forests and underground. However, since mitigation opportunities are not spread evenly around the world, we need a market approach that reaches across international borders.

This is why we and many business organisations believed it was essential for the Paris Climate Agreement to encourage market-based solutions. IETA led the business community's advocacy that helped to deliver Article 6 of the Agreement. It provides a firm policy foundation for cooperation through carbon markets far into the future.

IETA envisions that a global network of linked markets using Article 6 can deliver investment at scale to the places that deliver the “biggest bang for the buck” – making the Paris emissions goals economically feasible.

Dirk Forrester, President and CEO, International Emissions Trading Association (IETA)

IETA supports market-based solutions to climate change. It provides a platform for members to become visible not only for the policies they support, but also for excellence in making the markets that actually drive change. Its 140 corporate members span the globe, enabling IETA to participate in most policy arenas.





Resilience to physical risks

We have seen the impacts of climate change at our sites for many years. Since 2003, we have established controls to manage climate-related risks to the business. Our study guidelines for all new project developments require an assessment of potential climatic impacts in the medium to long term. We have an annual tropical storm forecasting process to ensure operational leaders are well prepared for seasonal impacts and disruption.

Identifying and assessing physical risk exposure

Over the last year we have undertaken a desktop assessment of our physical risks that focuses on the potential exposure of the regions in which we operate through to the end of the century, both for our existing assets and future project developments. The science-based assessment used the “Business as usual” scenario (Representative Concentration Pathways 8.5) in the IPCC 5th assessment report (IPCC AR5). This is a deliberately conservative approach that combines assumptions about high population and relatively slow income growth with modest rates of technological change and energy intensity improvements, leading in the long term to high energy demand and GHG emissions in the absence of climate change policies.

Within this scenario we focused on four climate variables that are expected to have material impacts on the business over the period to 2035:

Climate variable	Indicators
 Temperature	Temperature averages and extremes; heat stress (health)
 Rainfall / water cycle	Rainfall averages and extremes; water stress
 Sea-level rise	Sea-level rise and storm surge
 Extreme climatic events	Cyclones (intensity and frequency); flood frequency

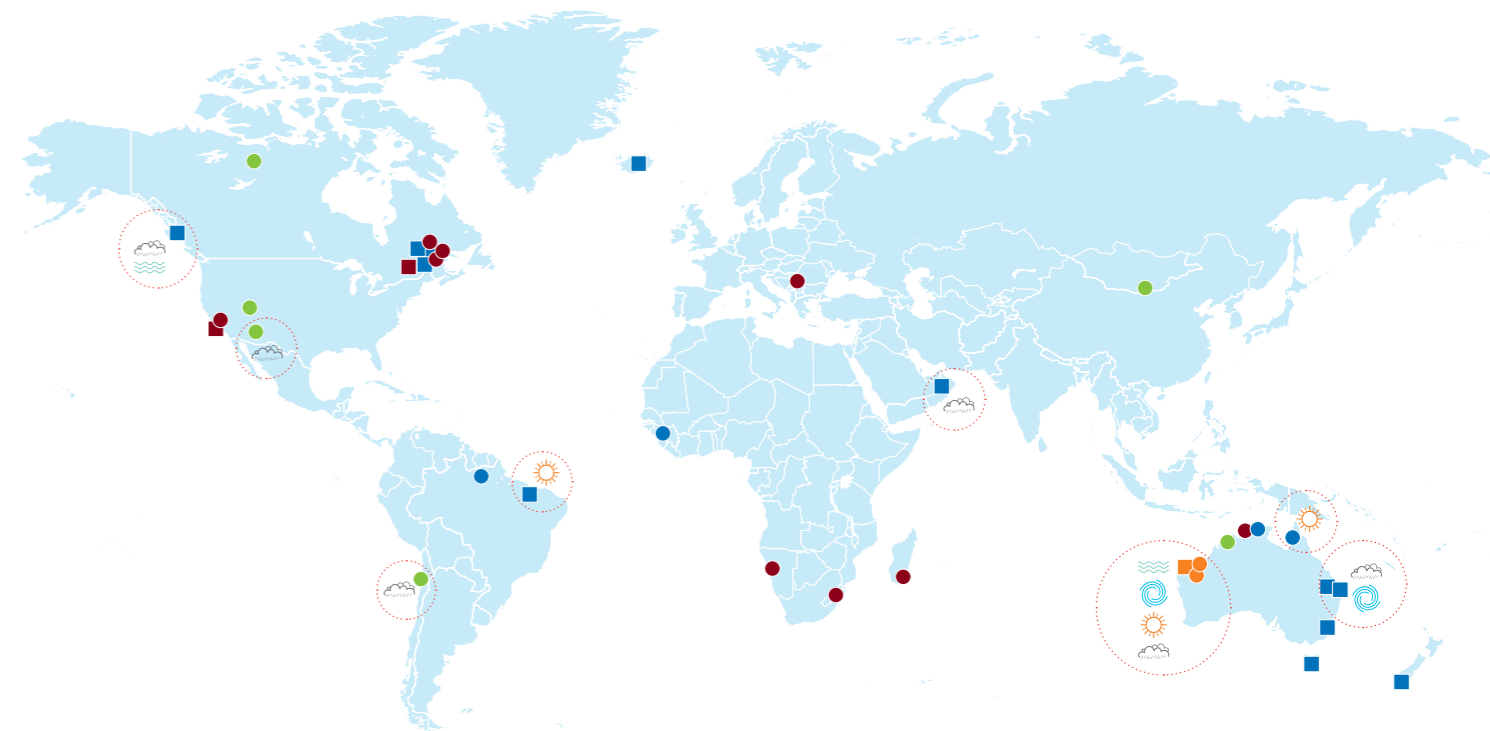
Using credible external data sources², exposure scores were set for each variable and ranked from low to very high exposure, resulting in an aggregate score for each of our operations. These exposure scores were informed by a rubric with a clearly defined methodology.

We made assessments for mid-century and end-of-century periods, including taking into account the impacts on assets that might have closed and been rehabilitated in those timeframes. We grouped assets by regions, making the assumption that regions would share similar climatic changes. Our assessment of a number of climate models used in global research was that there was not always consensus on the outcomes, so we based most of the longer-term trend analysis and modelling off IPCC AR5, for which there is a high degree of confidence.

Rio Tinto will experience a variety of climate conditions encompassing nearly all identifiable climate impacts across our sites. The exposure assessment highlighted particular regions where we might expect to have high exposure to physical climate change risk.

Within each region, and based on the site assessments, there are sites with high exposure to one or more of the physical climate risk variables. These include:

- **Pilbara iron ore assets** – have a high exposure to all physical climate risk variables, and are material to Group revenue;
- **Gladstone aluminium assets** – have a high exposure to sea-level rise (storm surge) and extreme weather events;
- **Weipa and Amrun bauxite mines** – have a high exposure to temperature and “deadly heat”, which can impact the health and safety of our people; and
- **British Columbia aluminium assets** – with exposure to sea-level rise (storm surge) at Kitimat, and increased rainfall and warming impacts on inflow management practices at Kemano power station.



2. IPCC AR5; WRI Aqueduct water tool; NASA sea-level rise data; Climate Impact Lab Mapping; Conservation International mapping; University of Hawaii/ESRI; Australian Bureau of Meteorology/CSIRO State of the Climate Report 2018














Future activities




Our next step is to validate the desktop exercise with operational leaders and assess our existing controls. We have prioritised those operations with the highest risks.

Exposure impacts on an operation, such as production, business interruption, indirect costs, or safety, will depend on the level of risk from the climate variables and whether future climate extremes are assessed as being significant. Where high exposure scores represent an extension of current climate conditions, it is expected that the capacity to mitigate risk already exists, but may need to evolve over time to ensure appropriate resilience to increasing frequency and/or intensity of events. Where climate variables do not currently impact on operations, capacity to mitigate risk is likely to be lower. There will be opportunities to transfer learnings between sites to build capacity where it does not already exist.

Disclosure standards and good practice are evolving. In 2018, the European Bank for Reconstruction and Development (EBRD) and the Global Centre of Excellence on Climate Adaptation (GCECA) published guidance to support the TCFD recommendations. To date, our focus has been on understanding primary impacts. Future work will identify significant risks to our supply chains and the potential consequences of secondary order impacts.

A summary of the guidance against our exposure assessment highlights areas of alignment and gaps:

EBRD/GCECA guidance	Rio Tinto 2018 exposure assessment					
Assess value chain	 Supply chain	 Operations	 Markets			
Assess first order impacts	 Heat stress	 Drought	 Extreme rainfall	 Cyclones	 Sea level rise	 Wildfire
Assess second order impacts	 Assess impacts of climate change on economics, humans and ecosystems beyond the boundaries of the organisation. Includes changes in availability of natural resources such as water, disruption to transport, changes to global trade routes and migration.					
Assess physical climate risk over asset life	 Projections for 5-20 year timeframe	 Scenario analysis for 20+ year timeframe	 Assessment of historical impact of extreme weather events			

-  Completed
-  Work in progress or partial achievement
-  Not part of our current scope

Part of the solution

Learn more about our commitments and progress online at riotinto.com

Climate change presents a significant global challenge for the world and for Rio Tinto; as producers of the materials that drive human progress, we believe it also presents opportunities for our business.

We have understood this for decades and integrated climate change into our strategic planning process. Our portfolio is differentiated in the industry and well positioned for a low-carbon future. Our products are an essential part of the transition to a low-carbon economy. We have reduced our emissions footprint by 43% since 2008 and are actively pursuing new technological solutions that will further reduce our emissions, such as our partnership with Alcoa and Apple to produce carbon-free aluminium.

We continue to take steps to manage risks and increase the resilience of our business to climate change, as well as position ourselves for new opportunities. We have a strong governance process in place and regularly review and refresh our approach to climate change within our corporate strategy framework. We consider the exposure of each of our sites to physical risks related to climate change.

We also test our portfolio against a range of scenarios mapping the policy and technology pathways necessary to limit global temperature rises. Our analysis indicates that Rio Tinto's business is relatively robust, including against a 2°C scenario consistent with the goals of the Paris Agreement.

We are aiming for a substantial decarbonisation of our business by 2050 and are working to define new emissions reduction targets from 2020. To inform this, we are developing a deep understanding of the carbon footprint and abatement opportunities for each of our assets. By bringing this together into a Group-wide abatement cost curve, we can assess potential decarbonisation pathways and prioritise our commercial and technology options.

We are ready to play our role in tackling the climate change challenge and believe that we are well positioned to be part of the solution, working in partnership with other businesses, investors, consumers and civil society. But we also recognise the essential role of governments around the world, to create the legal and regulatory certainty and incentives necessary for investment and innovation.

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Image: The award-winning wind farm at the Diavik Diamond Mine, Canada

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