OUR APPROACH TO CLIMATE CHANGE 2018

CONTENTS

FROM THE CEO, GRAHAM KERR

We are committed to doing our part to create a smooth transition to a world that avoids more than two degrees of warming. Our Climate Change Strategy is built on three focus areas: climate change opportunity, climate resilience and emission reduction. Each year, we commit to reporting on the progress of this strategy, including the targets and goals we have set ourselves to achieve.

As a company, we have a critical role in supplying the resources needed to create a lower carbon economy, in a way that creates and protects value for our stakeholders. This is a significant responsibility and presents opportunities as well as challenges.

We aim to create and protect value through designing our portfolio and our operations to be as climate-resilient as possible. To do this, we review our commodities and operations using the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD). This method tests our business under different climate-related scenarios to help us understand future possibilities and responses.

In FY17, South32 was one of the first companies to use the TCFD recommendations to present a detailed summary of our portfolio resilience to a low carbon, two degree, scenario. In scenarios where there is a far more rapid reduction in global emissions than we see today, our diversified commodity exposure, the position of our assets within their industries, and our strong balance sheet creates financial resilience. Since publishing our first report, stakeholder interest in corporate responses to climate change has continued to grow.

In FY18, we continued to integrate the management of climate change into our business strategy, and began assessing our operations' resilience to the physical impacts of an extreme climate change scenario.

By understanding the potential impacts across a range of climate futures, we are able to design our resilience accordingly, further contributing to our pragmatic and affordable transition to a world experiencing climate change.

In November 2017, we announced that South Africa Energy Coal (SAEC) will be managed as a stand-alone business. While domestically in South Africa there is a long-term market for thermal coal, especially when ownership is broadened, we are choosing to move away from a commodity that is likely to be increasingly substituted in the future.

We continue to reduce our own emissions and seek alternative low carbon energy sources. In FY18, we reduced our Scope 1 emissions by four per cent compared to FY17. Our ambition continues with our short-term emissions reduction supplemented by our long-term decarbonisation efforts, which commence in FY19 and primarily focus on our long-life, emissions intensive operations. We are committed to the review and ratchet of our emission reduction approach every five years from 2021, as we move to our goal of net zero emissions by 2050.

Graham Kerr
Chief Executive Officer

> **We are committed to creating a smooth transition to a world that avoids more than two degrees of warming by strategically managing our response based on scenario analysis.** Graham Kerr

OUR APPROACH TO CLIMATE CHANGE

The impacts of climate change are increasingly being felt around the world through changing weather patterns, regulation, and shifts in technology. As a diversified global resources company, we are working to avoid and manage climate change risks, as well as take advantage of the opportunities we have, in order to create a more prosperous future for our business, society and future generations.

We support the global shift towards a low carbon economy and seek to create value through environmental and social leadership. To demonstrate value to our stakeholders, we need to continually make progress and measure our performance, reporting transparently against our plans.

We support the Paris Agreement objectives and will continue reviewing our climate change response in the context of the United Nations Framework Convention of Climate Change (UNFCCC) actions, credible sources of climate science including the Intergovernmental Panel on Climate Change (IPCC) and national legislation as it emerges.

We participate in CDP Climate Change and CDP Water and engage with investor-led groups such Climate Action 100+[1] to share information and encourage progress.

(1) A five year initiative led by investors to engage greenhouse gas emitters and other companies across the global economy that have significant opportunities to drive the clean energy transition and help achieve the goals of the Paris Agreement.

OUR PURPOSE

Our purpose is to make a difference by developing natural resources, improving people's lives now and for generations to come.

We are trusted by our owners and partners to realise the potential of their resources.

THE VALUES THAT GUIDE US

CARE
We care about people, the communities we're part of and the world we depend on.

TOGETHERNESS
We value difference, listen and share, knowing that together we are better.

TRUST
We deliver on our commitments and rely on each other to do the right thing.

EXCELLENCE
We are courageous and challenge ourselves every day to be the best in what matters.

THE WAY WE WORK

Together we will create an inclusive workplace where we hold ourselves and each other to account to demonstrate our values.

We ensure all work is well designed and reliably delivers safe outcomes, with a focus on continuously improving and learning.

HOW WE MAKE A DIFFERENCE

- We all guarantee everyone goes home safe and well
- We are meaningfully connected and believe in our purpose
- Our operations run to their full potential and maximise return on investment
- Our functions are lean and enable our operations to deliver their full potential
- Technology and innovation is radically lifting our performance
- We create value through our environmental and social leadership
- We have optimised our portfolio and have multiple growth options with a bias to base metals

The Task Force on Climate-related Financial Disclosures (TCFD)

This report has been developed in line with the recommendations of the Task Force on Climate-related Financial Disclosures(2).

Figure 1 Core elements of 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, access, and manage climate-related risks

Metric and Targets

The metrics and targets used to assess and manage relevant climate-related risks and opportunities

(2) *https://www.fsb-tcfd.org/publications/final-recommendations-report/*

Measuring carbon emissions

Throughout this document, we refer to 'carbon' and 'emissions' interchangeably. These terms represent the aggregate carbon dioxide equivalent (CO_2-e) emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). We measure emissions according to the World Resources Institute/World Business Council for Sustainable Development Greenhouse Gas Protocol.

- Scope 1 carbon emissions refers to direct carbon emissions from our own operations, including the electricity we generate at our sites
- Scope 2 carbon emissions refers to indirect carbon emissions from the generation of purchased electricity
- Scope 3 carbon emissions refers to the carbon emissions in our supply chain

SOUTH32 CLIMATE CHANGE STRATEGY

We developed our Climate Change Strategy in 2015 and have been progressively implementing programs to take advantage of opportunities and mitigate or adapt to climate-related risks.

Our Climate Change Strategy is focused on three areas:

1. CLIMATE CHANGE OPPORTUNITY

2. CLIMATE RESILIENCE

3. EMISSION REDUCTION

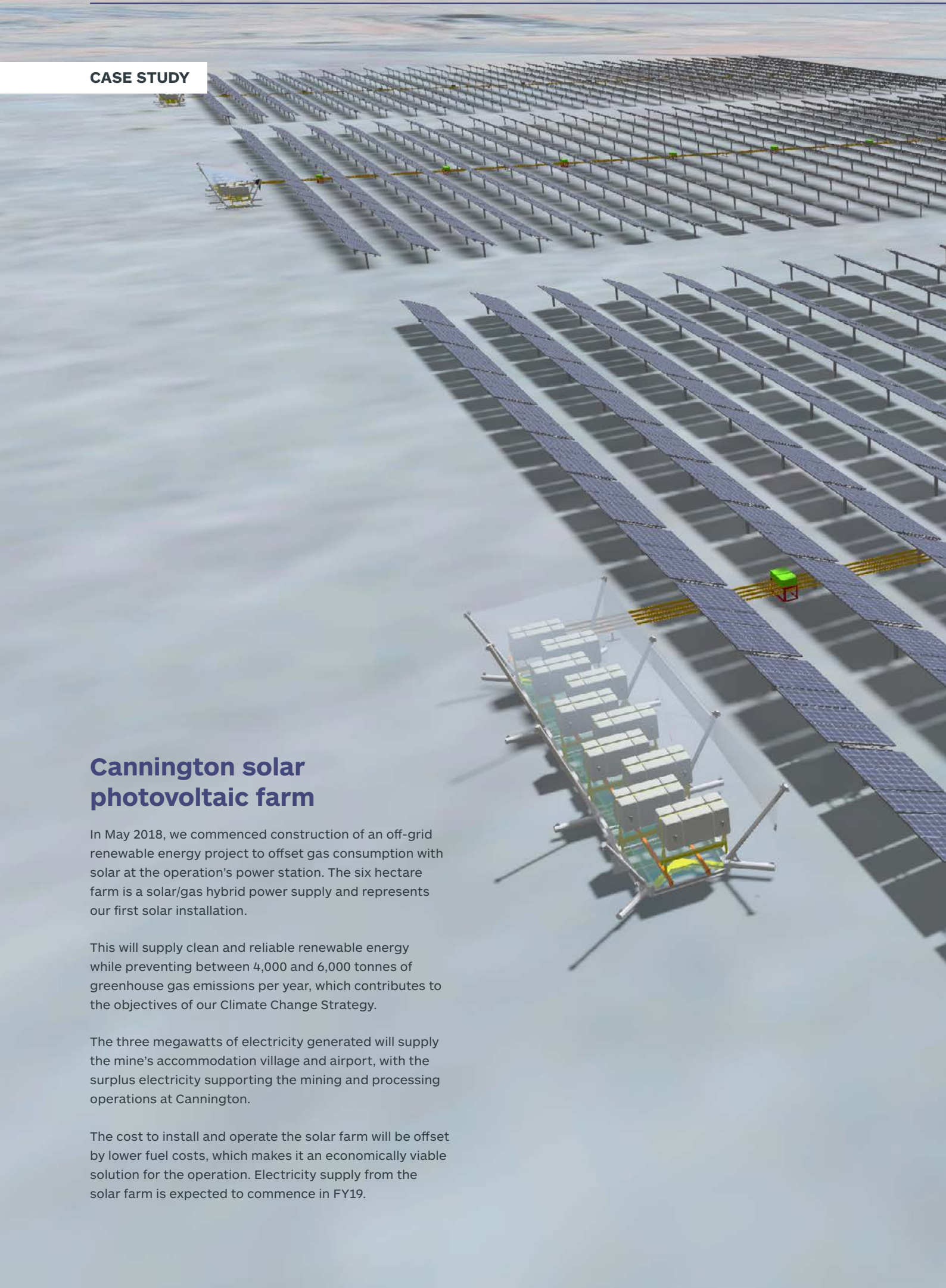
1.

CLIMATE CHANGE OPPORTUNITY

We manage our portfolio to ensure our products remain in demand and resilient in a world impacted by climate change. We commit to:

- Continue to provide the raw materials that support climate action and enable the transition to a lower carbon future
- Work in partnership with energy providers and other stakeholders, including finance providers, to create long-term benefits to society and the environment

CASE STUDY



Cannington solar photovoltaic farm

In May 2018, we commenced construction of an off-grid renewable energy project to offset gas consumption with solar at the operation's power station. The six hectare farm is a solar/gas hybrid power supply and represents our first solar installation.

This will supply clean and reliable renewable energy while preventing between 4,000 and 6,000 tonnes of greenhouse gas emissions per year, which contributes to the objectives of our Climate Change Strategy.

The three megawatts of electricity generated will supply the mine's accommodation village and airport, with the surplus electricity supporting the mining and processing operations at Cannington.

The cost to install and operate the solar farm will be offset by lower fuel costs, which makes it an economically viable solution for the operation. Electricity supply from the solar farm is expected to commence in FY19.

2.

CLIMATE RESILIENCE

To work towards climate resilience for our communities and operations, we need to understand and respond to the physical impacts of climate change. We commit to:

- Implement 'Intelligent Land Management' projects, whereby land holdings are used to create enduring social, economic and environmental value for society and our business through projects such as water protection and biodiversity conservation
- Incorporate climate change modelling in our capital allocation and investment decisions to make our host communities and operations more resilient to the physical impacts of climate change

CASE STUDY

Intelligent Land Management in action

Intelligent Land Management (ILM) is a sustainability framework for land management designed to transform land holdings, which are currently unused or subject to rehabilitation, into areas that increase climate resilience and generate shared financial, social and environmental value. Our ILM framework represents a considerable maturity in the way we perceive and generate value for our stakeholders and is an acknowledgment of the industry's accountability for socio-environmental stewardship and landscape level planning for the life of an operation and beyond.

Historically, value for mining companies has been generated by extracting mineral and energy resources from the land. As a result, mining companies can have considerable landholdings, many of which are often unused for mining activities. For example, unused land which acts as a buffer between mining activities or infrastructure.

In the Illawarra region of New South Wales, Australia, endangered ecological communities exist in areas adjacent to our Appin mine. Our ILM framework has identified these areas as high conservation value land which is critical to the ecological communities that inhabit it. In FY17, we contributed 84 hectares to conservation. In FY18, via the New South Wales government BioBanking scheme, a further 67 hectares were contributed for conservation in perpetuity, ensuring the land will remain undisturbed for future generations.

3.

EMISSION REDUCTION

We are committed to making a pragmatic and affordable transition toward the global goal of achieving net zero carbon emissions by 2050. We will do this by:

- Meeting our short-term carbon emission reduction target to stay below our FY15 Scope 1 carbon emission baseline in FY21[3]
- Reviewing and ratcheting our carbon emission reduction approach every five years from FY21
- Linking our emission reduction targets to all bonus payments and incentives, including at a Lead Team level
- Developing decarbonisation plans (see below)

We continue to review the scope and scale of our targets to ensure they align internal activities with our broader strategic goals.

Scope 1 emissions

Our five-year target is based on Scope 1 as it includes a significant portion of emissions generated from our own energy sources, particularly in Australia. Based on forecast business growth, reaching our FY21 target will require a continuous focus on identifying and implementing near-term emissions reduction projects, while progressing the more strategic medium and longer-term planning required for decarbonisation.

In FY18, our Scope 1 emissions decreased by four per cent compared to FY17, to 10.2 milllion tonnes (Mt) CO_2-e. We continue our progress towards our five-year emission reduction, currently forecast to being three per cent lower than FY15 baseline in FY21.

At Illawarra Metallurgical Coal, flaring activities at our Appin mine between June 2016 and November 2017 generated 238,638 Australian Carbon Credit Units which were issued by the Clean Energy Regulator.

The credits were awarded due to converting methane to carbon dioxide, in the absence of the gas being able to be used for electricity generation. Carbon dioxide has significantly less global warming potential than methane.

Scope 2 emissions

Our Scope 2 emissions were 12.7 Mt CO_2-e in FY18, a five per cent increase compared with FY17. This increase was influenced by higher emissions at our Mozal Aluminium smelter, due to a shortfall in delivery of third-party contracted hydropower, which resulted in greater consumption of coal powered electricity.

Scope 3 emissions

In FY18 our Scope 3 emissions were 117 Mt CO_2-e. Understanding our Scope 3 emissions helps us identify potential carbon emission risk in our value chain.

This is because high carbon products may be exposed to substitution, or the cost of products and services we buy could increase because of pricing carbon.

Approximately 60 per cent of our Scope 3 emissions come from the use of our energy and metallurgical coal downstream. A detailed breakdown of our Scope 3 emissions performance, including the calculation methodology, can be found at *www.south32.net*.

In FY18, SAEC contributed 96 per cent of our total thermal coal production. In November 2017, we announced that SAEC will be managed as a stand-alone business, with the intent of separating from South32. Our actions and progress on our Climate Change Strategy demonstrate that we are taking meaningful action to transition to a low carbon and more climate resilient way of operating.

(3) The carbon emission reduction target is based on absolute, Scope 1 carbon emissions and in the event of any mergers, acquisitions or divestments the FY15 baseline will be recalculated.

Decarbonisation plans

To further our ambition, we are developing decarbonisation plans in FY19 to support our goal of net zero emissions by 2050. We are initially focusing on our long-life, emissions intensive operations at Worsley Alumina and Illawarra Metallurgical Coal (representing around 60 per cent of our current Scope 1 emissions).

The plans will consider current and foreseeable advancements in low carbon technology and alternative energy sources, as identified in our Technology Roadmap.

They will identify the logical investment points for each operation, such as major equipment nearing end-of-life or new infrastructure required to sustain future production.

This information will be used to identify the optimal decarbonisation scenario for each operation, with the outcomes integrated into the business and project planning processes. Any remaining (residual) emissions will form the basis of our carbon offset planning to reach the net zero goal. The plans will be refined and developed over time, with learnings applied across all operations.

As our portfolio evolves, other emissions-intensive assets expected to be in operation in 2050 will be included in this long-term decarbonisation planning approach.

CASE STUDY

Worsley Alumina refinery biomass trials

We are committed to reducing our carbon footprint, and our Climate Change Strategy has the goal of net zero operational emissions by 2050.

Researching alternative fuel sources is one way we can reduce our emissions and during FY18 we completed a biomass trial at our Worsley Alumina refinery in Australia. The pre-feasibility trial tested the use of waste from pine logging, referred to as biomass, as a renewable energy fuel in our Multi-Fuel Co-generation (MFC) facility. The trial was to test our ability to use 30 per cent biomass fuel load in the MFC.

During the trial, the suitability of the current infrastructure, storage locations, material movement and handling and boiler feed systems were analysed to understand whether biomass can become part of the long-term energy mix for Worsley Alumina. The trial was successful, resulting in an abatement of approximately 5.75 kilotonnes CO_2-e.

Accreditation under the Renewable Energy Target Scheme (RET) of the MFC facility was obtained in November 2017, which will allow Worsley Alumina to create and sell Large-scale Generation Certificates (LGCs).

GOVERNANCE AND RISK MANAGEMENT

> **To meet the challenge of climate change, we work to reduce our greenhouse gas emissions. We monitor our impact to avoid compromising the ecosystems which provide resilience against climate change for our host communities.**
>
> **South32 Sustainability Policy**

Governance

Our Sustainability Committee (Committee) represents and assists the Board in managing climate-related opportunities and risks. The Committee's work is supported by the Lead Team.

The Committee discharges its responsibilities in reviewing and approving the South32 Sustainability Policy, which includes the position 'To meet the challenge of climate change, we work to reduce our greenhouse gas emissions. We monitor the impact to avoid compromising the ecosystems which provide resilience against climate change for our host communities'.

Pertaining to climate change, the Committee also:

- Reviews and approves reporting, including disclosures of material climate-related risks.
- Recommends to the Remuneration Committee key performance indicators for the greenhouse gas emission component of the annual incentive plan for the Chief Executive Officer and the Lead Team, and determines the outcome for referral to the Remuneration Committee.
- Reviews and endorses our public climate-related targets and goals.
- Reports to our Risk and Audit Committee on material climate-related risks.

At a management level, climate-related responsibilities are assigned to the Chief Sustainability Officer (CSO), who manages the strategy implementation and provides progress reports on the control of risks and implementation of opportunities to the Committee at least twice a year.

Risk

Climate change-related risks are identified and assessed as part of the Company's risk management framework. We disclose and manage material climate-related risks in the same way we manage financial risks to our operations and long-term strategy.

Our risk management framework details how we identify, monitor and manage material risks associated with our activities.

Our Risk and Audit Committee's work represents and assists the Board to carry out its role in overseeing the risk management and audit practices of South32. This is supported by the Lead Team.

This framework applies to all employees, Directors and contractors of the Company and its subsidiaries.

More information about our governance of risks and assessment of strategic opportunities can be found at *www.south32.net*.

Corporate citizenship

We realise that sector collaboration is necessary to meaningfully address climate change. We contribute to the broader ecosystem by:

- Using our influence and position to create and share knowledge and align approaches
- Providing transparent disclosures
- Providing updates and learnings as we progress

In FY18, we responded to CDP Climate Change, CDP Water, the Dow Jones Sustainability Index, and reported in accordance with the Global Reporting Initiative (GRI) Standards. We also submitted responses to environmental, social and governance (ESG) ratings agencies and proxy advisors.

INDUSTRY ASSOCIATIONS

We regularly review our industry memberships to ensure our positions on issues such as climate change are broadly aligned, and that engagement activities are not undertaken on our behalf which we consider to be contrary to South32's interests.

We believe our current memberships provide valuable access to industry information and enable us to effectively contribute to industry-wide issues in the jurisdictions in which we operate. We retain the right to express an alternative position and do so when appropriate.

We are currently members of:

International Council on Mining and Metals	This is an international organisation promoting collective action on improving sustainable practices within the mining and metals industry.
Carbon Market Institute	This is an independent, membership-based Australian organisation that promotes effective implementation of policy and knowledge exchange for a lower carbon future.
Industry Task Team on Climate Change	This is a South African based group that includes business and government, to ensure sustainable economic growth while moving to a low-carbon economy.
Business Council of Australia	This is a forum for Australian leaders to engage in public policy debates.
Commodity associations	Our memberships include the Manganese International Institute, the Nickel Institute and the International Aluminium Institute. These organisations share and develop knowledge in relation to specific commodities and climate change.
Other National, State and local industry groups	These include the Chamber of Minerals and Energy in Western Australia, Minerals Council of South Africa, Business Leadership South Africa, the Colombian Association of Mining, Queensland Resources Council and New South Wales Minerals Council.

CASE STUDY

Mozal Aluminium

Current climate projections, as well as recent trends in weather patterns, show a declining rainfall trend in the region where our Mozal Aluminium smelter is located, making reliable access to water an emerging risk for our operation.

As there is no alternative climate resilient source of water supply, we built a desalination plant to mitigate the risk. This has the added benefit of reducing our need to use municipal water that is required for community use. The desalination plant was commissioned in February 2018 and ongoing work to integrate the alternative water source will continue into FY19. This is the second desalination plant we have built for our African operations since FY16, having established a fully containerised, modular desalination plant for our Hillside aluminium smelter in FY17.

CLIMATE CHANGE RISKS AND OPPORTUNITIES

The climate change risks outlined in this document are not listed in order of significance and are not intended to be exhaustive. They reflect the most significant risks currently identified for our company. Risks and opportunities will vary depending on how the world responds to climate change.

If the world collectively mitigates climate change and avoids two degrees of warming, there will be opportunities and risks that emerge from how this transition is managed. We consider this under our portfolio resilience assessment.

Globally, if we exceed more than two degrees of warming, the physical risks of climate change become more prevalent and include both acute risks (e.g. from extreme weather events) and chronic risks (e.g. droughts or heatwaves), which could harm the health of society and ecosystems. We consider this under our operational resilience assessment.

South32 climate-related risks, mitigation options and opportunities

Table 1 summarises the most significant climate-related risks, mitigation options and opportunities relevant to our business today, both in a future that exceeds, and in a future that avoids, more than two degrees of warming.

Where internal or external progress has been made since last year's assessment, we have reflected these changes in the table. Our three scenarios have been used to identify likely risks and opportunities relevant to that scenario. Further information on our scenarios is provided from page 22.

Table 1 Climate-related risks and opportunities

Topic	Time horizon[4]	Most relevant scenario	Risks	Mitigation and opportunities
Policy	Short, medium and long term Medium and long term	GC RCC	Carbon pricing policies including carbon taxes, cap and trade systems and any other regulatory carbon pricing mechanisms may increase costs for companies with liable carbon emissions.	We include a short-run regional and long-run global carbon price in our capital allocation and investment evaluations. This contributes to effective and well-informed decisions to manage risks beyond current pricing policies. Further detail is provided on page 19. In addition, our voluntary carbon emission reduction targets drive internal processes to identify, evaluate and implement a range of operational emissions reduction projects on an ongoing basis.
	Short, medium and long term Medium and long term	GC RCC	As our stakeholders, including customers and suppliers, are likely to be subject to similar changes in policy, we may face changing commercial requirements to meet regulatory changes in jurisdictions outside of our own operating environments.	Our scenario analysis incorporates potential policy-based impacts on our supply chain to test resilience of our portfolio to these risks. Insights gained from this process are used as an input into our ongoing strategic plans. We have also calculated and disclosed our annual Scope 3 emissions to ensure that we are aware of the scale and sources of our supply chain emissions. Further detail is provided on page 10.
	Short, medium and long term Medium and long term	GC RCC	Water and biodiversity regulation may become more stringent as pollution concerns or scarcity pressures increase.	Through our focus on innovation and technology, we are working to reduce our land requirements, biodiversity impacts, waste, carbon and water usage over time. As our internal voluntary performance standards drive resource efficient operations, we aim to be ahead of policy change and avoid the risk that more stringent future policies could pose.
Legal	Medium and long term	GC and RCC	Increased litigation against governments and companies, either seeking compensation for damages caused to them because of climate change impacts or to force greater action on climate change.[5]	We consider that our proactive approach to climate-related risk assessment, risk management and disclosure, along with our diversified portfolio, assist in minimising our relative exposure to climate change-related litigation. However, we monitor legal developments in this space and seek advice on major developments when required.

GC: Global Co-operation (two degrees) **PP**: Patchy Progress (three degrees and base case) **RCC**: Runaway Climate Change (four degrees)

(4) In this context, we consider a short-term, medium term and long term as the next 3-5 years, 6-10 years and 11-50 years respectively.

(5) Please see *https://www.law360.com/articles/766214/emerging-trends-in-climate-change-litigation* for a list of recent climate change litigation cases.

Topic	Time horizon[4]	Most relevant scenario	Risks	Mitigation and opportunities
Reputation	Short, medium and long term	PP and RCC	If we fail to implement strategies across our business to address climate-related risks, our reputation with a broad range of stakeholders may be harmed. This may make it harder to obtain and maintain social licence to operate, as well as attract and retain talent.	To manage reputational risks, we provide clear and comprehensive information to stakeholders on our business position, policies, risks and mitigation actions with regards to climate change. We openly support a globally competitive and broad-based price on carbon and have set voluntary short and long-term carbon reduction targets with regard to the Paris Agreement. These targets are linked to all bonus payments and incentives, including our Lead Team. We regularly review our industry group memberships and ensure that positions on climate change and energy policy are aligned with South32's interests (see page 14).
Shareholder action	Short, medium and long term	All	Increasingly, shareholder action has focused on companies' disclosure, responsiveness and lobbying activities related to climate change. If negatively targeted, this could damage our reputation and potentially impact our capacity to secure investment capital and partners.	We regularly and openly engage with our shareholders on climate change and broader ESG issues. We were early adopters of the TCFD voluntary reporting framework in recognition of the increasing value our stakeholders place on transparent climate change disclosures. We intend to maintain this as a core reporting activity to keep our stakeholders informed of our progress on these issues.
Technology changes	Short, medium and long term	PP and GC	Difficulties in integrating new technologies with existing systems, the cost and unproven nature of new technology could reduce productivity and profit margins. There are also risks around the disruptive nature of new technologies that may change demand for our products (see 'market changes').	We have developed a Technology Roadmap that focuses on opportunities to improve productivity and safety through technology and innovation while reducing costs, risks and the environmental and social footprint of our operations. This includes decarbonisation and minimisation of water and other resources' use and impact.
Market Changes	Medium and long term	All	The supply and demand for our commodities may change as technology changes and consumer demands shift. Markets are increasingly directing money towards greener products and solutions creating a risk of lower or more competitive access to finance and investment. As governments and other companies act on climate change, we may be exposed to higher costs for products on which we rely such as electricity, coking coal or water.	We monitor the global environment, conduct detailed assessments of commodity markets and regularly update our supply and demand forecasts so that we can quickly respond to change. For long-term changes, our scenario analysis incorporates potential technology-based impacts on product demand to test portfolio resilience and evaluate new opportunities. We aim to be well positioned to take advantage of customer needs, including providing lower carbon products. Several of our portfolio commodities would benefit from a transition to a low carbon economy and we see opportunities to create value by focusing our business on these commodities.

GC: Global Co-operation (two degrees) **PP**: Patchy Progress (three degrees and base case) **RCC**: Runaway Climate Change (four degrees)

(4) In this context, we consider a short-term, medium term and long term as the next 3-5 years, 6-10 years and 11-50 years respectively.

CASE STUDY

Policy risk mitigation: Carbon pricing

We support policies that help us sustainably transition to a low carbon economy, and consider the potential cost of inaction and resulting policy change to be a risk. Carbon pricing is an effective mechanism to efficiently reduce carbon emissions and we support carbon pricing that is globally competitive and broad-based, covering all industry sectors and all possible carbon emission sources. We would like to see the revenue raised from carbon pricing used to support the transition to a low carbon future.

To enable informed decision making, we maintain a global carbon price forecast and, where relevant, also apply specific, jurisdiction-based carbon prices in our valuations, planning and capital expenditure decisions. These are reviewed and updated based on quantitative and qualitative factors, including recent and predicted developments in carbon policy in economies relevant to South32's operations and markets. We also undertake extensive benchmarking of our carbon price forecasts against a variety of sources, including existing national or regional carbon markets, publicly disclosed carbon prices in companies from comparable sectors, and carbon price forward curves and forecasts by research agencies.

The intent of our global carbon price forecast is not to solely reflect the price when a global carbon market begins operation, but also to provide a proxy for the long-term average cost of carbon in major jurisdictions relevant to South32 in the absence of a domestic price.

On this basis, we form a near-term view reflecting existing or imminent carbon markets in our countries of operation (e.g. the Safeguard Mechanism in Australia, the carbon tax in Colombia and the potential introduction of the South Africa carbon tax). Longer-term, our carbon price is set to a global average of $15/tonne[6] from 2025 onwards. Low and high cases are assessed to provide a range up to $51/tonne through time. We also utilise scenario analysis to stress test our planning and investment decisions, as an example, we apply a carbon price of $100/tonne[6] in the Global Cooperation scenario.

(6) Prices are quoted in US$ real terms (2018).

Topic	Time horizon[4]	Most relevant scenario	Risks	Mitigation and opportunities
Physical risks (acute and chronic)	Short, medium and long term	All, increasing severity in RCC	We mine geologically bound ore bodies, connected by rail, road, ports and sea. These may experience production and logistics delays because of extreme weather events (e.g. bushfires, cyclones and flooding). In addition, droughts, heat extremes or unseasonal weather variability could create water stress or contribute to the spread of disease, also impacting operations.	One of the core objectives of our Climate Change Strategy (see page 5) is to build our operational resilience so we can adapt to a changing climate and quickly return to normal following extreme weather or other acute events. During FY18, we expanded the scope of our scenario analysis to commence testing operational resilience of our Australian operations to physical impacts. Outcomes to date are being incorporated into our understanding of potential future adaptation requirements. Further detail is provided in the scenario analysis section of this report, on page 36.
	Short, medium and long term	All, increasing severity in RCC	The physical impact of climate change may also increase rehabilitation and/or closure liabilities, and may impact on the terms or availability of external insurances.	The two main avenues to build physical resilience identified in our Climate Change Strategy are: 1. Intelligent Land Management (ILM) – an integrated social, environmental and economic approach to achieving climate resilience. 2. Climate modelling – of changes in weather, including rainfall, to better predict the physical risks our operations may be exposed to and to pro-actively mitigate or adapt to these risks. We use the World Resources Institute Aqueduct tool to screen our operations for water scarcity and oversupply risks.
	Short, medium and long term	All, increasing severity in RCC	Physical risks can translate into social risks including potential conflict over access to natural resources. Regions with poorly developed social support systems could be more vulnerable to the physical impacts of climate change. This could result in risks of decreased food and water security creating a challenging operating environment.	We contribute to community development programs which are intended to build resilience that buffers against climate change impacts.

GC: Global Co-operation (two degrees) **PP**: Patchy Progress (three degrees and base case) **RCC**: Runaway Climate Change (four degrees)

(4) In this context, we consider a short-term, medium term and long term as the next 3-5 years, 6-10 years and 11-50 years respectively.

CASE STUDY

Biofuels Trial

At our South Africa Energy Coal operations, we have a large fleet of trucks which use diesel fuel. As part of our efforts to reduce our carbon footprint, we have initiated an ILM concept study to reduce our dependency on diesel. We are investigating the potential to partially power our fleet with biogas, BioCNG, generated by crops grown on rehabilitated land.

A 10 hectare crop trial tested four distinct species planted on both dry and irrigated rehabilitated land.
The water used for irrigation is mine recycled water.
Seedbed preparation, planting and irrigation installation was completed in January 2018 with annual crops harvested in June 2018 and perennial crops to be harvested in 2019.

If successful, this project will result in a carbon emission reduction of approximately 30 kilotonnes (kt) per year. Through unlocking the potential of our rehabilitated land and utilising mine recycled water, the project also has the potential to reduce our overall rehabilitation provision and water liability, as water is remediated through this process. Through the growing of the crops, the project may also represent an opportunity for social enterprise development.

HOW WE USE SCENARIOS

Understanding the impact that climate change could have on our business will create and protect value for our stakeholders and ensure our portfolio remains competitive.

We have undertaken scenario analysis, and to date, have assessed both our portfolio resilience to transition risks, and our Australian operational resilience to physical risks. Details of our scenarios and the outcomes of these assessments are provided in the following sections.

Using the TCFD voluntary guidelines, we have followed a staged process (Figure 2) to stress test our portfolio and our operations against plausible, evidence-based but divergent scenarios.

In collaboration with subject matter experts and stakeholders we developed three scenarios:

(1) Global Cooperation

(2) Patchy Progress (South32 base case)

(3) Runaway Climate Change

These scenarios combine elements from distinct scenarios set out by international agencies including IPCC, IEA and WEO (see Glossary for more detail).

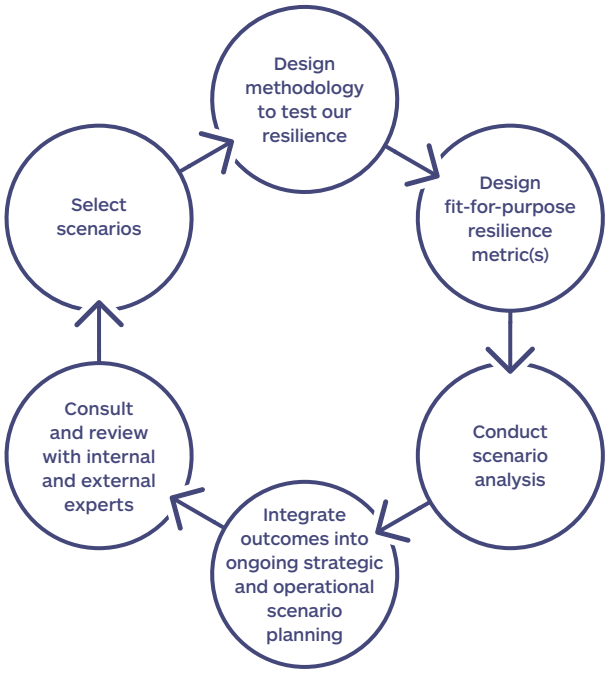
Building these customised scenarios gave us a comprehensive view of the various climate change-driven impacts which may affect our business, including social dynamics, market behaviours and physical impacts.

These scenarios are both qualitative and quantitative in approach and intentionally extreme to provide a sharp contrast between potential futures.

The real future may deliver on a combination of the different scenarios or none, but the scenarios are designed to gain insight, recognise trends, identify possibilities and enable us to act quickly on the opportunities we see. The drivers within the scenarios will be revisited and updated every two years (next in FY19) to incorporate progress against signposts and triggers.

In stress testing against these scenarios, we have focused on indicators that can be used to support internal decision-making while also informing stakeholders of South32's position. We will continue reviewing and refining our resilience measures as our analysis evolves over time, including options to incorporate more quantitative information.

Figure 2 Our approach to stress testing our portfolio and operations



What is a scenario?

A scenario describes a path of development leading to a particular outcome. Scenarios are not intended to represent a full description of the future, but rather to highlight central elements of a possible future and to draw attention to the key factors that will drive future developments. It is important to remember that scenarios are hypothetical constructs; they are not forecasts or predictions nor are they sensitivity analyses. Scenario analysis is a tool to enhance critical strategic thinking.[7]

(7) TCFD Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities (June 2017).

RUNAWAY CLIMATE CHANGE SCENARIO

Scenario snapshot

Little meaningful progress made in reducing global carbon emissions.

Global temperature increase reaches four degrees celsius by the end of the century.

Greatest risks for our business result from physical climate change impacts and large scale social disruption.

Reference scenarios:
International Energy Agency-World Energy Outlook November 2016[8], Current Policies scenario and the Intergovernmental Panel on Climate Change Representative Concentration Pathway 6.0 and 8.5 scenarios.

In this scenario, which will be updated in FY19, the development of new industries is hindered by a slowdown of capital allocation to low carbon products, renewable energy, and research and development (R&D). No global carbon price emerges. Global sentiment largely repeals existing climate policy and there is a stagnation of efforts by political leaders to make meaningful progress in reducing carbon emissions at a local and national level.

Global GDP would experience incremental gains in this scenario until around 2035, supported by incremental productivity improvement. Long-term economic growth would vary across the globe and be dependent on the resilience of countries to the increasing physical impacts of climate change (such as water insecurity and disease).

Between now and 2035, those nations that can rebuild, recover and/or adapt to the physical impacts climate change creates would increase the demand for raw materials, including many of the commodities in our portfolio. For example, the need to build more resilient cities and the rebuilding required following acute weather events, could increase the demand for steel making materials including manganese. However, the ability of many developing nations to recover will be limited, reducing the scope of potential demand growth.

From 2035, the pressure on ecosystems would begin to affect the supply of food and water, harming economic growth and geo-political stability. With many nations struggling to meet their basic needs, consumption of commodities is likely to decline. In this scenario, there are likely to be large numbers of displaced people crossing borders and conflicts over natural resources, as well as a breakdown in the rule of law and global security from 2040.

The greatest risks and opportunities for our portfolio in this scenario result from the physical impacts of climate change. There is some incremental demand growth from the world's investment in adaption and resilience. Relative to the other scenarios, our own operations would also be at greater risk from the physical impacts of climate change, both acute and chronic. This could result in negative impacts to our supply chain and production, thereby reducing profit margins. The physical impacts of climate change in this scenario mean that a world that exceeds more than two degrees of warming is anticipated to be less favourable to long-term global prosperity than a scenario of two degrees or less.

PATCHY PROGRESS SCENARIO (SOUTH32 BASE CASE)

Current trends and technology development continue.

Global temperature increase limited to three degrees celsius.

Large regional divergence and volatile swings in climate change policy result in an unpredictable operating environment.

Transition impacts create both opportunities and risks across our business.

Physical risks are less severe than in the Runaway Climate Change scenario.

Reference scenarios: International Energy Agency – World Energy Outlook November 2016[8], New Policies scenario.

The Patchy Progress scenario, which will be updated in FY19, is our base case and largely reflects current trends and technology development, with limited additional climate change mitigation measures or policy changes beyond 2016. It assumes that concerns over loss of industries due to carbon leakage deter some countries from implementing policy that would help mitigate climate change risks. In this scenario fossil fuel and agricultural groups choose to protect business as usual arrangements.

This scenario is characterised by large regional divergence and volatile swings in climate change policy.

The national commitments[9] in the Paris Agreement on climate change are implemented, though some countries with high emissions fail to meet their current targets, while others continue to adopt more stringent goals consistent with the agreed policy framework.

As a result, the pace and scale of decarbonisation will vary by region and sector.

Existing energy trends continue, with renewable energy gaining an increasing share of the energy mix as costs fall and utilities adopt battery storage as the technology improves. Nonetheless, an uncertain policy environment slows renewable energy penetration and allows high carbon land-use (such as continued clearing of old growth forests and peatlands) to continue, which means the transition is not fast enough to meaningfully reduce global carbon emissions and avoid more than two degrees of warming.

In this scenario, the physical risks of climate change to our portfolio is less severe than those outlined in the Runaway Climate Change scenario. Transition risks including volatile swings in climate change policy create both opportunities and risks for our commodities.

GLOBAL COOPERATION

Collaborative action drives rapid decarbonisation.

Global temperature increase limited to two degrees celsius.

Risks to our business largely related to transition and regulatory impacts.

Reference scenarios:
International Energy Agency – World Energy Outlook November 2016[8] 450 (parts per million (ppm)) scenario, the IEA Energy Technologies Perspectives two degree scenario, and the Bloomberg New Energy Finance, New Energy Outlook 2016[8] modelling.

In the Global Cooperation scenario, which will be updated in FY19, there is a proactive and collaborative approach by major governments, industries and society to reduce carbon emissions, sufficiently enough to stabilise global temperature to two degrees or below by 2100, relative to pre-industrialisation (1950) temperatures. Global carbon emissions peak around 2025 and net-zero carbon emissions is reached by the second half of the century (from 2050) in line with the Paris Agreement.

From FY16, climate change mitigation and adaptation policies are introduced and immediately begin to have a meaningful impact on business. Significant nations and sub-regions introduce incentives to avoid further deforestation and phase out fossil fuel subsidies. A global carbon market emerges from FY30. The global carbon price rises to more than US$100 a tonne after cheaper, first round carbon emission reduction projects are implemented. The global carbon price stays high enough to ensure emissions continue to fall, though market forces and significant incentives (such as low-cost lending for green products) play a greater role in changing behaviour than carbon penalties in this scenario. Governments and private business fund extensive R&D and green investments.

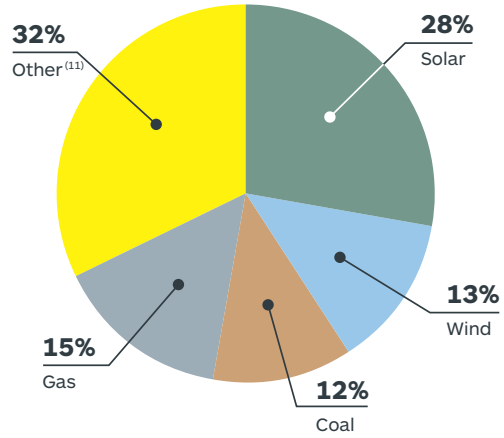
The global economy grows more strongly than in the Runaway Climate Change or Patchy Progress scenario, as the rapid development of new green industries more than offsets the loss of businesses that cannot survive when potable water, biodiversity and carbon emissions are priced appropriately. This scenario demonstrates how global collaboration to protect natural resources can result in the development of emerging economies, where there is an increase in the consumption of low carbon services and sustainable products.

A transformation of the global energy system occurs.

In this scenario, solar (mostly photovoltaics) accounts for 28 per cent of the total energy mix, wind accounts for 13 per cent and energy coal and natural gas account for 12 per cent and 15 per cent respectively. Hydro, nuclear, oil and renewables other than solar or wind combined, account for the remainder in 2040[10].

The commercialisation of battery storage provides cheap, reliable, green energy on demand allowing renewables to displace fossil fuel generation. This scenario assumes limited uptake of Carbon Capture and Storage (CCS) given the relative immaturity of the technology in 2016. CCS would only be used where there are limited options to transition energy or industrial capacity to lower carbon alternatives.

Figure 3 Energy mix by 2040 in the Global Cooperation scenario



Source: Adapted from Bloomberg New Energy Finance, New Energy Outlook 2016(8)

Although the transformation of the energy sector is critical, it will not be enough by itself to limit the temperature increase to less than two degrees. In this scenario, various societal and political drivers all contribute to achieve avoidance of two degrees of warming, such as:

- Changes to consumer and industrial behaviour that promote commodity recycling to its technical limits
- The deployment of technologies which increase productivity through efficiency
- A reduction in deforestation and an increase in reforestation and afforestation brought about by better designed and planned urbanisation
- Smarter agricultural practices and much lower consumption of meat products which reduces the need for land clearing

(8) References were the latest available at the time of scenario development in FY17. These will be updated in FY19 as a component of the review process every two years. FY19 reviews will include IEA's SDS scenario and Bloomberg New Energy Finance New Energy Outlook 2018.

(9) Commitments are the intended Nationally Determined Contributions made by each nation.

(10) *https://about.bnef.com/new-energy-outlook/*. Other efforts such as land-use change, reforestation, some carbon capture and storage are necessary to avoid two degrees of warming.

(11) Hydro, nuclear, oil and renewables other than solar or wind combined.

ASSESSING OUR RESILIENCE

The response of our business is dependent on how the world collectively chooses to deal with climate change over the long-term.

Our scenarios have been selected to represent the most extreme potential for impact within a plausible range.

In FY17, we completed a detailed assessment of our portfolio resilience to transition risks that may arise from climate change. Transition risks are defined as non-physical risks arising from the structural shift toward a low-carbon energy system, most significantly policy, technology, legal and market change. This analysis used the Global Cooperation scenario to compare commodity performance against our base case (Patchy Progress scenario).

In FY18, we commenced the assessment of our operations' resilience to the physical impacts of climate change. We chose to use the extreme Climate Change scenario as this presents the most chronic and acute physical impact scenario. Due to the in-depth work required, and in the interests of transparency and information sharing, we chose to undertake and disclose the results of our Australian operations' assessment first. In FY19, we will extend this assessment to our Southern African and Colombian operations, as well as our greenfield or acquired sites.

Our portfolio resilience to transition risks

Our portfolio composition will depend on future prices and the opportunities that emerge over time. This scenario analysis and modelling provides us, and our stakeholders, with a view on the outlook for each commodity in our current portfolio under the Global Cooperation scenario.

SCENARIOS USED: GLOBAL COOPERATION SCENARIO[12]

Our methodology is built around the existing valuation models and scenario-based analysis used in our strategic planning process. This considers major variables such as the outlook for commodities, the development of technology, the needs of societies, consumer behaviour and the ability of the environment to continue providing the natural resources and ecosystem services that we and the world need to continue to thrive.

As a first step in evaluating comparative portfolio resilience, we applied the main supply and demand drivers to our existing global commodity models to determine whether the commodity would be advantaged or disadvantaged by the rapid transition involved, relative to the base case. This was a qualitative step to frame the subsequent company-specific assessment. We then undertook a quantitative analysis to assess the scale of this directional impact on South32's specific products and operations. This included factoring in relative demand for our products compared to competitors (e.g. based on chemical composition and supply location) and our position on the cost curve for each of our unique value chains.

When comparing outcomes between the base case and the Global Cooperation scenario drivers, we found that comparisons of net present value or earnings forecasts did not provide us with meaningful insights on broader portfolio resilience. This was largely due to the variability of other underlying factors (particularly commodity price forecasts) overshadowing the impacts of the climate-scenario related inputs. We instead took the decision to use a fit-for-purpose resilience metric (Figure 4), which focused on the demand for each commodity from each operation in our portfolio. Resilience was determined by a quantitative assessment of whether the supply and demand balance increased or decreased (ten per cent either way) or materially increased or decreased (20 per cent either way), relative to our base case forecasts out to 2040.

(12) This section refers to South32's resilience under the Global Cooperation scenario. As such, the descriptions of resilience here are not South32 forecasts, but describe what we have assessed could happen if the world's development progressed in line with the Global Cooperation scenario.

Our analysis shows us that the commodity diversification of our portfolio provides strategic resilience in a Global Cooperation scenario. To ensure we maintain a robust understanding of our resilience under this scenario, we will review our assumptions and assessment every two years. Table 2 below provides a summary of resilience, with further detail provided in the following section.

Figure 4 Resilience scale (percentage change compared with base case between 2015-2040)

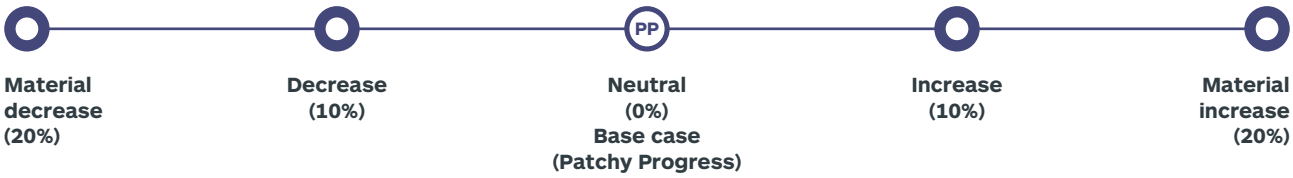


Table 2 Summary of portfolio resilience

Operation and commodity	Resilience in Global Cooperation Scenario compared with our base case (Patchy Progress)
Cannington	
Lead	
Silver	
Zinc	
Cerro Matoso Nickel	
Illawarra Metallurgical Coal	
South Africa and Australia Manganese	
South Africa Energy Coal	
South Africa Aluminium, Mozal Aluminium and Worsley Alumina	

PP Patchy progress (South32 base case)

The following sections describe the resilience of our commodity portfolio under the Global Cooperation scenario compared with our Patchy Progress (PP) Base Case, as well as provide insight into the unique risks and opportunities presented by this scenario for our current operations.

CANNINGTON

Lead

Decrease (10%)

Lead is primarily used in the starter batteries in conventional vehicles. In the Global Cooperation scenario, we assume 33 per cent of global car stock is electric by 2040, with approximately one billion electric vehicles in use.

The conventional vehicle ownership model would come under pressure as less resource intensive transport options emerge alongside increasingly urban populations. These include public transport, car or ride-sharing options propelled by a rise in autonomous vehicle technologies.

Greater recycling of batteries and the emergence of non-lead batteries in cars would mean that primary demand growth from the automotive sector would peak in the short to medium-term (2020 to 2025) and decline thereafter. The level of sustained demand for lead acid batteries from conventional vehicles could be met through closed loop recycling. As such, lead demand in new batteries decreases and lead is not resilient in the global cooperation scenario.

While the Global Cooperation scenario is not favourable for lead demand, the positive outlook for zinc and silver are likely to see lead produced globally as a by-product, creating a resilient lead supply.

Silver

Increase (10%)

In the Global Cooperation scenario, around two-thirds of the energy generated in 2040 would come from renewables, with almost a third of this from solar panels. Silver is used in solar panels for its reflective qualities as it helps generate electricity by reflecting sunlight into collectors.

There is also likely to be additional demand from the construction industry. Insulated silver coated glass reduces the need for heating and cooling and will play an important role in reducing the energy use in buildings.

This scenario also results in more rapid innovation. The growing use of robotics, monitoring and hand-held devices are also expected to boost silver demand relative to the base case.

Zinc

Increase (10%)

Zinc galvanised steel materials are used extensively in transport, construction and appliance manufacturing due to their insulation and anti-corrosive properties. Zinc weatherproofs steel against corrosion via galvanisation but this protection is lost over time due to environmental degradation and therefore needs to be constantly replaced.

There will also be a positive impact on zinc demand from the increased use of light weight steel alloys in the automotive sector, as designs are changed to meet the stringent carbon emission targets and avoid the carbon prices. As a result, zinc demand will benefit from the steel demand growth to occur in the global cooperation scenario.

Our Cannington operation in Australia produces lead and zinc concentrates, both of which contain silver. All concentrates are sold to smelters who smelt, extract the silver and other by-products such as copper and then refine the product into a London Metals Exchange deliverable.

The likely increase in demand relative to our base case for zinc and silver in the Global Cooperation scenario has been considered as part of our business development strategy.

CERRO MATOSO

Increase (10%)

Nickel is primarily used in stainless steel, alloys and plating. Many of its properties will be more valuable in the Global Cooperation scenario. It is anti-bacterial, possesses high corrosion resistance, and is used in batteries that support both renewables and electric vehicles.

The use of nickel intensive stainless steel relative to other stainless steel grades have been more closely linked to technical standards and Gross Domestic Product (GDP) growth than energy use. We do not see these factors changing and therefore nickel demand is unlikely to be hampered in this scenario.

Our Cerro Matoso operation in Colombia produces ferronickel (an alloy of nickel and iron), which is sold almost exclusively to stainless steel producers. It has traditionally been recognised for its low impurities and stable nickel content. The nickel we produce is likely to benefit from increased global demand and is resilient in the Global Cooperation scenario.

ILLAWARRA METALLURGICAL COAL

Neutral (0%)

Metallurgical coal, also known as coking coal, forms high strength coke that is primarily used in the integrated steel making process. There are three main types of metallurgical coal of which hard coking coal is the most sought after by steel producers.

In the Global Cooperation scenario, steel (and, therefore, metallurgical coal) benefits from the substitution for cement, which has a more energy and carbon emissions intensive production process. There is significantly more steel scrap collected and reused in this scenario and this scrap steel will be made available to meet the growing global steel demand as the world continues to urbanise and industrialise.

However, as an outcome of the increase in available steel scrap, an increasing proportion of steel demand will be met through Electric Arc Furnace (EAF) production, which does not require metallurgical coal. In this scenario we expect that steel produced by blast furnaces (the alternative to EAF production and that uses metallurgical coal) will fall from approximately 75 per cent in 2016 to approximately 50 per cent in 2040.

This scenario also assumes that, due to changes in consumer behaviour, there will be significantly more steel scrap in the future than currently available, most notably in China as the economy matures.

Around 80 per cent of Illawarra Metallurgical Coal's production is premium mid volatility hard coking coal, which is recognised as a valuable component in steel making blends and sold globally. As steel scrap alone will not meet market demand in the Global Cooperation scenario, demand for high quality metallurgical coal exports will remain resilient on the back of demand from major steel producing countries (such as India and Brazil).

Illawarra Metallurgical Coal is well positioned to benefit from a high globally consistent and equally applied carbon price. Carbon pricing policy incentives are likely to support an expansion of the operation's gas capture and energy conversion operations, which would enhance its position on the cost curve relative to other producers and support margins.

SOUTH AFRICA AND AUSTRALIA MANGANESE

Neutral (0%)

Manganese ore is inextricably linked to the global steel industry. Over 90 per cent of manganese ore is converted to a manganese alloy which is used to remove sulphur, de-oxidise and strengthen steel. These unique characteristics make the commodity robust in the global cooperation scenario.

Although other alloys can strengthen and harden steel, only manganese can remove sulphur and deoxidise in a cost-efficient manner. As these steps are important to reduce pollution and the public health risk of steel production, manganese is unlikely to be substituted for another product in the Global Cooperation scenario.

The increase of steel scrap recycling has less of an impact on manganese than other steel raw material inputs because manganese is largely lost in the recycling process and needs to be continually replaced. In the Global Cooperation scenario, energy efficient urbanisation including high-rise buildings, public transport, water, power, and all other infrastructure requiring steel are significant drivers of demand. Growth in manganese demand is also expected as low carbon products, such as electric vehicle battery technologies, achieve deeper penetration.

Although manganese is relatively abundant, the resources in major steel producing countries, like China and India, are relatively low grade. Higher grade imports are necessary to achieve the right blend.

Our operations produce mostly high-quality grade manganese. We also supplied approximately 25 per cent of the manganese ore traded in the seaborne market in 2016. Therefore, we are well positioned to take advantage of continued demand for high quality manganese in this scenario.

SOUTH AFRICA ENERGY COAL

Decrease (10%)

Energy coal is primarily used in electricity generation, with the remainder used in areas such as cement production and heating. Its future in the global energy mix is tied to public opinion and the technical and economic feasibility of CCS technology.

Public acceptance of energy coal continues to diminish, with climate change and concerns around the impact of air pollution on public health making it politically risky to support new energy coal power stations or mines. Although CCS is used in the Global Cooperation scenario, with some plants fitted with the technology by 2025, it is deployed much more slowly than renewables, reducing energy coal's ability to take part in the transition to a low carbon future. As a result, the seaborne trade for energy coal would continue to decline to 2040.

Energy coal demand is more resilient in South Africa, Russia and South East Asian nations with centralised energy coal operations built between 2000 and 2025. In these areas, coal use is likely to largely focus on integrated operations with low cost deposits near power plants. In this scenario, there is no scope for the development of greenfield energy coal mines. Any investment would be focused on small incremental projects in well-established mining regions.

Although the supply-demand balance for energy coal drops around 20 per cent in the Global Cooperation scenario, demand is likely to be resilient in the domestic markets we supply.

SAEC produces energy coal for both the South African domestic market and export markets. They supply the domestic South African market under long-term contracts to Eskom, the national power provider (which delivers 90 per cent energy coal powered generation) and seaborne export markets.

The domestic market in South Africa for our energy coal is likely to be relatively resilient in this scenario. As the seaborne export market for energy coal would decline, it is likely that we can divert this product to opportunities in the domestic market. Compared to our global portfolio, the value ascribed to South Africa Energy Coal on South32's balance sheet is very low.

In November 2017, we announced that SAEC will be managed as a stand-alone business.

Illawarra Metallurgical Coal produces a by-product energy coal stream (approximately 20 per cent of product mix) which is exported to countries with electricity supplied by large centralised energy coal operations built between 2000 and 2025.

SOUTH AFRICA ALUMINIUM AND WORSLEY ALUMINA

Increase (10%)

Aluminium is often referred to as the metal of the future as it can be recycled with no loss of mass or quality and is highly corrosion resistant. Construction, packaging and transport sectors will continue to create demand for aluminium, making it relatively resilient against substitution risks in the key end- use sectors. Building light-weight transport options, offering durability and design flexibility in building construction, and substituting fossil-fuel based plastics in packaging, are some examples of how aluminium is used in the below two degrees of warming carbon constrained, Global Cooperation scenario.

In this scenario, the demand for aluminium increases relative to the base case. Aluminium recycling is advanced to technical limits. Alumina inputs (and consequent bauxite demand) will still be required to meet primary aluminium demand expectations.

Aluminium smelters are energy intensive and can produce significant carbon emissions, especially when using coal-fired energy. In the Global Cooperation scenario, renewable energy becomes an increasingly important fuel source for smelters. Nonetheless, it is anticipated that a large portion of the world's energy coal powered aluminium smelters remain in use for their technical life to meet the forecast increase in demand.

In this scenario, these smelters are all subject to the global carbon price of US$100 dollars per tonne from 2030. Since a large portion of the supply base (energy coal powered) will be impacted by the carbon cost, it is expected this will be transferred to end users and the global aluminium price will increase accordingly.

We own Hillside aluminium smelter in South Africa and Mozal Aluminium smelter in Mozambique. Hillside aluminium smelter, is dependent on power generated from energy coal, while Mozal Aluminium purchases green power from hydro sources. In the Global Cooperation scenario, South Africa Aluminium is expected to maintain positive margins and Mozal Aluminium is likely to benefit from its lower carbon position.

In Australia, we operate the Worsley Alumina refinery which sources bauxite from its Boddington mine. Worsley Alumina benefits from a lower energy intensive bauxite (Gibbsite) compared to higher energy intensity bauxite used in most Chinese refineries (Boehmite/Diaspore). As such, the additional carbon cost impost per tonne of alumina produced at our Worsley Alumina refinery would be relatively lower than the global supply. This means that of the bauxite/alumina required to meet primary demand, Worsley Alumina is likely to benefit preferentially in the Global Cooperation scenario.

Our resilience to the physical impact of climate change[13]

SCENARIO USED: RUNAWAY CLIMATE CHANGE SCENARIO[14]

Nearly every sector of the economy faces risks from the short and long-term physical effects of climate change. Physical impacts are classified as chronic or acute. Chronic are those that incrementally develop over time, such as air temperature, or decreasing rainfall trend. Acute are the sudden shock events such as flooding, bushfire and cyclones.

The resilience of our business to the physical impacts of climate change will depend on the scale and pace of global temperature rise and associated climatic trends including (for example) precipitation, sea level rise, humidity, temperature and frequency and intensity of extreme weather events.

We used the Runaway Climate Change scenario to test our strategic risks and opportunities for physical impact, as this presents the most chronic and acute modelled physical impacts.

This analysis provides us, and our stakeholders, with insights on where our operations may experience material impacts due to physical climate change beyond those incorporated into our base case. Importantly, it also provides drivers, or signposts, for timely adaptation.

We commenced with the Australian operations in FY18 and plan to complete similar assessments for the Southern African and Colombian operations, as well as our greenfield or acquired sites, over the course of FY19 and FY20.

Our methodology is built around Australian climate data projections that are aligned with the Runaway Climate Change scenario, and were largely sourced from the Mining Climate Assessment (MiCA) tool available through the International Council on Mining and Metals (ICMM) database (using 2035 as a proxy for 2040) and CSIRO (using 2030 and 2050 projections to cross-check MiCA data).

Based on these resources, projections were developed for several key measures (for example temperature increase, precipitation etc.) at the locations of each operation, which will plausibly be operated/ managed by South32 through to 2040, based on their reserve lives and post-closure rehabilitation activities. We used a variety of technical resources and methodologies to develop a fit-for-purpose approach to this analysis. A worked example is provided on page 37.

Each operation was considered separately, and resilience was assessed across three key impact categories: asset integrity and production continuity, maintaining supply chain and logistics, and worker health. A total of 14 drivers were considered to give a range of possible outcomes to 2040, considering:

Exposure: A rating of exposure to acute and chronic physical climate change projected for an operation's location

Sensitivity: A rating to reflect financial or other critical impacts that consider existing operational design, infrastructure and supply chain factors

Adaptive Capacity: A rating to reflect an operation's capacity to adapt to avoid the critical impacts, based on an understanding of availability, current technology or other adaptation options

The results indicate where we may need to reprioritise our attention on designing and planning for resilience, and will form an input into our ongoing planning process as we assess signposts for realising this or other scenarios. This includes timely and pragmatic decisions on future infrastructure investments required to preserve the value of our operations, as well as to assist in avoiding maladaptive investments.

(13) This section refers to South32 operational resilience under the Climate Change scenario. As such, the descriptions of resilience here are not South32 forecasts, but describe what we have assessed could happen if the world's climate progressed in line with the Runaway Climate Change scenario, as described on page 24.

(14) Projected change in global mean surface temperature for the late 21st century, relative to the 1986–2005 period – IPCC 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

ASSESSMENT EXAMPLE: WORSLEY ALUMINA RUNAWAY CLIMATE CHANGE SCENARIO AT 2040

Climate stressor	Examples of impacts considered for all South32 operations	Relative assessment of resilience in 2040 Runaway Climate Change scenario – Worsley Alumina
Changes in extreme weather patterns	Containment failure in dams following intense rainfall	Moderate resilience
	Containment failure in facilities following intense rainfall	High resilience
	River flooding affects mine and processing operations	High resilience
	Cyclones or storms affect port and rail operations	Moderate resilience
Warmer temperatures and lower rainfall	Bushfires affect operations	Moderate resilience
	More dust created by our mining and processing activities	Low resilience
	Droughts affect water supply to operations	Low resilience
	Droughts affect hydroelectric power supply to operations	Not applicable
Warmer temperatures and more frequent heatwaves	Hotter weather affects how we manage gas levels in underground mines and in processing facilities	Very high resilience
	Heat interrupts flight operations	Not applicable
	Heat interrupts rail operations	High resilience
	Power supply to operations interrupted	Moderate resilience
	Heat affects worker health and safety	High resilience
Warmer temperatures and more rainfall	Conditions affect where and when our locations are receptive to malaria	Very high resilience

Impact category key

- **Asset integrity and production continuity:** Impacts which could directly affect the operation's capacity to operate safely and maintain planned production levels (e.g. direct damage from severe storms, flooding from intense rainfall events, productivity decline from increasing dust creation).
- **Maintaining supply chain and logistics:** Impacts which could materially affect access to critical inputs and delivery of products to key locations (e.g. storms affecting port and rail integrity, drought affecting hydroelectric power supply, heat interrupting flight operations).
- **Worker health:** Impacts on the health and safety of our employees (e.g. heat-related illness, increased malaria risk due to regional climate changes).

Resilience key

- **Very high resilience** has been attributed where, under this scenario, our operations have been assessed as highly unlikely to be impacted in 2040 for this driver.
- **High resilience** has been attributed where, under this scenario, our operations have been assessed as unlikely to be impacted in 2040 for this driver.
- **Moderate resilience** has been attributed where, under this scenario, our operations have been assessed as may be impacted in 2040 for this driver.
- **Low resilience** has been attributed where, under this scenario, our operations have been assessed as likely to be impacted in 2040 for this driver.
- **Very low resilience** has been attributed where, under this scenario, our operations have been assessed as highly likely to be impacted in 2040 for this driver.

POTENTIAL PHYSICAL IMPACTS FOR AUSTRALIAN OPERATIONS USING THE RUNAWAY CLIMATE CHANGE SCENARIO

GEMCO (manganese)

Adaptation focus indicated under the Runaway Climate Change scenario

- More cyclone events may severely damage port infrastructure. *Adaptation options include designing for greater tolerances, or infrastructure that can be installed and reinstated quickly*

Worsley Alumina

Adaptation focus indicated under the Runaway Climate Change scenario

- Drier conditions may lead to increased dust. *Adaptation options include additional dust suppression methods not involving water*
- Drought affects water supply to operations. *Adaptation options include water efficiency, climate independent water sources and/or developing processes that do not require water*

Cannington (silver, zinc and lead)

Adaptation focus indicated under the Runaway Climate Change scenario

- Extreme weather at Townsville may affect access to the airport, port and rail. *Adaptation options involve considering third party adaptation efforts, as well as alternative railing and shipping to allow for disruption*
- Drier conditions may lead to increased dust. *Adaptation options include enhanced dust suppression methods not involving water*
- Drought may affect water supply to operations. *Adaptation options include water efficiency, climate independent water sources and/or developing processes that do not require water*

Illawarra Metallurgical Coal

Adaptation focus indicated under the Runaway Climate Change scenario

- *The scenario analysis showed that Illawarra Metallurgical Coal has no points of adaptation focus in the current assessment*

TEMCO (manganese)

Adaptation focus indicated under the Runaway Climate Change scenario

- *The scenario analysis showed that TEMCO has no points of adaptation focus in the current assessment*

GLOSSARY OF TERMS

Alumina
Alumina is produced from bauxite in the Bayer refining process. Alumina is then converted (reduced) in an electrolysis cell to produce aluminium metal.

Bauxite
Principal commercial ore of aluminium.

Biodiversity Banking and Offsets Scheme
The New South Wales Government in Australia introduced the Biodiversity Banking and Offsets Scheme (BioBanking scheme) to help address the loss of biodiversity values, including threatened species, due to habitat degradation and loss.

BioBanking enables 'biodiversity credits' to be generated by landowners and developers who commit to enhance and protect biodiversity values on their land through a Bio- Banking agreement. These credits can then be sold, generating funds for the management of the site. Credits can be used to counterbalance (or offset) the impacts on biodiversity values that are likely to occur because of development. The credits can also be sold to those seeking to invest in conservation outcomes, including philanthropic organisations and the government.

Carbon Capture and Storage (CCS)
Carbon capture and storage refers to mitigating global warming by capturing carbon dioxide from large point sources such as fossil fuel power plants and storing it instead of releasing it into the atmosphere.

Carbon emissions
For South32 reporting purposes, these are the aggregate carbon dioxide equivalent (CO_2-e) emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). We measure emissions according to the World Resources Institute/World Business Council for Sustainable Development Greenhouse Gas Protocol.

- Scope 1 carbon emissions –refers to direct carbon emissions from operations
- Scope 2 carbon emissions – refers to indirect carbon emissions from the generation of purchased electricity
- Scope 3 carbon emissions – refers to the carbon emissions in our supply chain

CDP
CDP is a non-government organisation that runs a global disclosure system for climate change and water. It rates companies based on their performance and disclosure. CDP was previously the 'Carbon Disclosure Project'.

Coking coal
Used in the manufacture of coke, which is used in the steelmaking process by virtue of its carbonisation properties. Coking coal can also be referred to as metallurgical coal.

Electric vehicles
Vehicles that use one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off- vehicle sources, or may be self-contained with a battery, solar panels or a generator to convert fuel to electricity. Electric vehicles include road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft.

Electric Arc Furnace (EAF)
A furnace that heats charged material by means of an electric arc (an electrical breakdown of a gas that produces an ongoing electrical discharge).

Energy coal
Used as a fuel source in electrical power generation, cement manufacture and various industrial applications. Energy coal is also referred to as steaming or thermal coal.

ESG
Environmental, social and governance.

GC
Global Co-operation climate change scenario (two degrees).

Gross Domestic Product (GDP)
The total value of goods produced and services provided in a country for one year.

Greenfield
Greenfield development refers to a new venture or operation, without any association or proximity to a current operation.

Intergovernmental Panel on Climate Change (IPCC)
The IPCC is the international body for assessing the science related to climate change. The IPCC was set up in 1988 by the World Meteorological Organization (WMO) and United Nations Environment Program (UNEP) to provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation.

International Energy Agency (IEA)
The IEA is a collaborative organisation including 30 member countries, with aims including energy security and economic development. It develops and publishes a range of reference materials including the WEO and IEA Market Reports.

Metallurgical coal
This refers to all coal used in the process of steelmaking. It can also be referred to as coking coal.

Paris Agreement
A global climate agreement that was agreed under the United Nations Framework Convention on Climate Change (UNFCCC) at the 21st Conference of the Parties (COP21) in Paris (30 November to 12 December 2015). The Paris Agreement sets in place a durable and dynamic framework for all countries to take climate action from 2020, building on existing international efforts in the period up to 2020.

Portfolio resilience
Financial resilience of South32's commodity portfolio to the range of climate-related transition risks which may arise.

PP
Patchy Progress climate change scenario (three degrees and base case).

RCC
Runaway Climate Change scenario (four degrees).

Renewable energy
Renewable energy is produced using natural resources that are constantly replaced and never run out.

Risk Management Framework
A framework, which sets out the overall approach to risk management of South32 Limited and its subsidiaries (the Company). It applies to all employees, Directors and contractors of the Company.

SAEC
South Africa Energy Coal.

Task Force on Climate-related Financial Disclosures (TCFD)
The Task Force on Climate-related Financial Disclosures (TCFD) produced guidance for voluntary climate-related financial disclosures that are consistent, comparable, reliable, clear, and efficient, and provide decision-useful information to lenders, insurers, and investors.

Transition Risks
TCFD defines these as non-physical risks arising from the structural shift toward a low-carbon energy system, most significantly policy, legal, technology, and market changes.

Depending on the scope and pace of these changes, varying levels of financial and reputational risk may arise for organisations.

World Energy Outlook (WEO)
Energy analysis and long-term projections published by the International Energy Agency based on current policy, markets and technologies.

World Resources Institute Aqueduct Tool
A global water risk mapping tool that helps companies, investors, governments and other users understand where and how water risks and opportunities are emerging worldwide. The tool uses a peer reviewed methodology and the best-available data to create maps of water risk.

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