It all hinges on Renewables

National Business Initiative

THE MASSIVE AND URGENT ENERGY TRANSFORMATION SOUTH AFRICA NEEDS

IN PARTNERSHIP WITH

BOSTON CONSULTING GROUP

BUSINESS UNITY SOUTH AFRICA

Acknowledgements

RESEARCH SUPPORTED BY

UK PACT South Africa: UK PACT has partnered with South Africa to support action on Just Transition pathways and a low-carbon economic recovery. As the third largest economy in Africa, South Africa plays a critical role in economic and policy priority setting at a continental level and across the Southern Africa region. South Africa's longstanding participation in the United Nations Framework Convention on Climate Change (UNFCCC) processes creates a solid platform for an impactful and transformational UK PACT partnership. Moreover, UK PACT seeks to support climate action that will contribute to the realisation of other development imperatives in South Africa, such as job creation and poverty alleviation. Priority areas of focus for UK PACT in South Africa are aligned with key national priorities in the just energy transition, renewable energy, energy efficiency, sustainable transport, and sustainable finance. UK PACT projects can contribute to addressing industry-wide constraints, common metropolitan challenges, and bringing city, provincial and national level public and private partners together to address climate priorities.

We Mean Business: This is a global coalition of nonprofit organisations working with the world's most influential businesses to take action on climate change. The coalition brings together seven organisations: BSR, CDP, Ceres, The B Team, The Climate Group, The Prince of Wales's Corporate Leaders Group and the World Business Council for Sustainable Development. Together we catalyze business action to drive policy ambition and accelerate the transition to a zero-carbon economy. NBI has been a regional network partner to WMB since the beginning of 2015.

Strategic Partnerships for the Implementation of the Paris Agreement (SPIPA): Climate change is a global threat that requires a decisive and confident response from all communities, particularly from major economies that represent roughly 80 % of global greenhouse gas emissions. The 2015 Paris Agreement complemented by the 2018 Katowice climate package, provides the essential framework governing global action to deal with climate change and steering the worldwide transition towards climate-neutrality and climate-resilience. In this context, policy practitioners are keen to use various platforms to learn from one another and accelerate the dissemination of good practices. To improve a geopolitical landscape that has become more turbulent, the EU set out in 2017 to redouble its climate diplomacy efforts and policy collaborations with major emitters outside Europe in order to promote the implementation of the Paris Agreement. This resulted in the establishment of the SPIPA programme in order to mobilise European know-how to support peer-to-peer learning. The programme builds upon and complements climate policy dialogues and cooperation with major EU economies.

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The African Climate Foundation: The ACF is the first African-led strategic climate change grant-making foundation on the continent. Building on the success of partner organisations like the European Climate Foundation and ClimateWorks Foundation, the ACF was established to provide a mechanism through which philanthropies can contribute to Africa's efforts to address climate change. As an African-led and African based foundation, we are committed to supporting African solutions to the climate change challenges facing the continent.

The Confederation of Danish Industry: The DI is Denmark's largest most representative, and most influential business and employers' organisation, covering manufacturing as well as service industries across sectors such as transport, energy, IT, health, trade, and professional services. DI believes that a strong society needs strong companies – just as strong companies benefit from a strong society. Thus, DI is committed to creating a society in growth and balance, helping Danish companies to win both at home and abroad. DI believes that the private sector plays a crucial role in the just, green transition and in achieving the UN's 17 Sustainable Development Goals. A strong private sector creates jobs and develops the innovative solutions that are essential to create decent living conditions and sustainable development in developing economies. DI believes that societies need a strong private sector voice and thus partners with other employer and business membership organisations like the NBI, as well as Danish and local unions all around the world in order to create local jobs, improve business conditions, contribute to a green transition and sustainable development as well as improve labour market stability and conditions.The Confederation of Danish Industry has partnered with the NBI on a range of projects, and most recently on the Just Transition Pathways project, to support the development of decarbonisation pathways for the Cement and Transport sectors.

The Banking Association South Africa: The BASA advances the interests of the industry with its regulators, legislators, and stakeholders, to make banking sustainable, profitable and better able to contribute to the social and economic development and transformation of the country. As the national association of domestic and international banks operating in South Africa, BASA advocates the views of the banks on legislation, regulation, social, and economic issues that affect the industry. It engages with its members through committees and work groups and facilitates the sustainable transformation of the banking industry. It promotes inclusive economic growth by working with legislators, regulators, as well as other business associations and stakeholders, to establish a stable, conducive policy and business environment. It seeks to find sustainable solutions to the challenges of poverty, unemployment, and inequality by mobilising the skills and resources of the industry. BASA has partnered with the NBI on the Just Transition Pathways project to support research into understanding the funding requirements for a Just Transition in South Africa.

PARTNERS

National Business Initiative

At the National Business Initiative (NBI), we believe in collective action and collaboration to effect change; building a South African society and economy that is inclusive, resilient, sustainable and based on trust. We are an independent, business movement of around 80 of South Africa's largest companies and institutions committed to the vision of a thriving country and society. The NBI works with our members to enhance their capacity for change, leverage the power of our collective, build trust in the role of business in society, enable action by business to transform society and create investment opportunities.common metropolitan challenges, and bringing city, provincial and national level public and private partners together to address climate priorities.

Business Unity South Africa

BUSA, formed in October 2003, is the first representative and unified organisation for business in South Africa. Through its extensive membership base, BUSA represents the private sector, being the largest federation of business organisations in terms of GDP and employment contribution. BUSA's work is largely focused around influencing policy and legislative development for an enabling environment for inclusive growth and employment.

Boston Consulting Group

BCG partners with leaders in business and society to tackle their most important challenges and capture their greatest opportunities. BCG, the pioneer in business strategy when it was founded in 1963, today works closely with clients to embrace a transformational approach aimed at benefitting all stakeholders — empowering organisations to grow, build sustainable competitive advantage, and drive positive societal impact. Their diverse global teams are passionate about unlocking potential and making change happen, and delivering integrated solutions.

Summary Of Findings

The world is embarking on an ambitious decarbonisation journey to avoid catastrophic climate change. An increasing number of governments and companies have committed to transition to Net-Zero economies by 2050. For South Africa, responding to climate change is fundamentally about economic competitiveness and lifting its people out of poverty, inequality, and unemployment while contributing to the global goal of reducing carbon emissions.

The NBI-BUSA-BCG Climate Pathways and Just Transition study assesses what it would take for South Africa to reach Net-Zero by 2050 and to ensure a Just Transition. It is one of the most robust, transparent, and inclusive climate studies in South Africa. The work was undertaken over two years and led by a group of 30+ CEO Champions from multiple sectors. It has involved more than 400 stakeholders from business, government, civil society, and labour in nearly 200 hours of technical workshops and a large number of 1:1 engagements. Throughout this process, evidence-based inputs were developed that informed – and continue to inform – the critical national discussion on South Africa's climate response. The work is ongoing, and a number of detailed analytical and model-based sector-level reports have been released. This report lays out the core findings on the transformation South Africa needs to pursue in its energy sector and adds to the body of work already released by considering the interactions between other sectors.

It finds that South Africa's Just Transition pathway to a competitive, Net-Zero economy hinges on its ability to unlock its globally advantaged, high-potential wind and solar energy resources at scale and at an unprecedented pace. By developing an energy system anchored on renewables, South Africa can contribute to solving its current energy crisis - which reached new heights in 2022, with the worst power outages since 2019 - and improve the affordability, availability, and reliability of power supply – all while enabling new green industries to build the foundation of a globally competitive economy that is resilient to trade risk arising from the transition to Net-Zero.

The cost of inaction is high. South Africa has the second most carbon-intense economy, compared to other economies with more than $500 billion GDP in the world, more than twice the G20 average (per $ of GDP)[1]. This puts almost 50% of exports at risk as key trade partners prioritise imports from low-carbon economies via carbon border tax adjustments and other mechanisms. Amid stalled GDP growth, unemployment at ~35% and rising inequality, 'more of the same' will not be enough. The status quo must change and transitioning to renewables can be a catalyst for that change. The large-scale deployment of renewable energy can enable a ~60% reduction of South Africa's national emissions. Large-scale renewable energy deployment is also the backbone of a Just Transition. It can result in net-positive job creation. Furthermore, unlocking South Africa's renewable energy resources – in combination with South Africa's access to key mining commodities, expertise in key industries such as synthetic fuels production, existing trade relationships, and a young, growing population – positions South Africa well to compete in new, green markets and to drive further job creation.

Decarbonising South Africa's energy supply requires an unprecedented rollout of renewables. By 2050, at least 190 gigawatts (GW) of renewables need to be deployed to fully decarbonise the power sector. Capturing the opportunity presented by the Green H_2 economy requires potentially up to 170-200 GW of additional dedicated renewables capacity. That means South Africa will need to build ~6-7 GW of renewables every year for the next three decades for the power system alone. The annual renewables build rate would further increase if the Green H_2 opportunity is pursued. To put that in

1. Oxford Economics; Global Carbon Atlas


The Overberg Valley

perspective: South Africa has an installed capacity of ~5 GW[2] of renewables today – which took over ten years to build. At the same time, China installed 120 GW of wind and solar in 2020 alone[3]– showing that a large scale renewables roll out is possible when all enablers are in pace.

A critical enabler for the large-scale and rapid pace of renewables deployment is the modernisation, expansion and strengthening of the national power grid. This is a challenge the rest of the world also faces, so fast-tracking grid strengthening and modernisation efforts can be considered as a globally competitive advantage for South Africa as it enables the fast scale-up of new green industries.

South Africa's transition to Net-Zero will require massive investments. Overall, ~ZAR 6 trillion is required over the next three decades to decarbonise the whole economy – more than half of which is needed in the power sector. However, much of this funding replaces existing expenditure, e.g. on fossil fuels. For example, the annualised investment rate required in the power sector is ~ZAR 100 billion p.a. compared to Eskom's current primary energy spend, which today sits at ZAR 120 billion[4]. Nonetheless, ensuring the right market structure, terms of finance – particularly the catalytic role development finance can play in stimulating new green industries – and covering the social cost of the Net-Zero transition will be critical and indeed a challenge that requires collaboration across all spheres of society.

South Africa needs to immediately drive the decarbonisation and transformation of its energy sector

This means South Africa now urgently needs to:

01

Make the ramp-up of renewables a national priority

02

Coordinate a national green industries incubation and an economic diversification approach

2. CSIR: Statistics of utility-scale power generation in South Africa, July 2021; note that the ~5 GW only includes wind, solar PV and CSP (Concentrated Solar Power), it represents only utility or wholesale capacity and does not account for embedded or distributed generation
3. IEA, Renewables 2021 Data Explorer
4. ESKOM, Annual Financial Statements, 31 March 2021

Introduction

The foundation of this study is a broad and inclusive stakeholder engagement process through which the methodological approach, key assumptions, underlying analysis and broader framing of recommendations were discussed and jointly refined (Figure 1).

The project was funded by development finance institutions and non-governmental organisations. The donors include the UK Pact, the EU's Strategic Partnerships for the Implementation of the Paris Agreement (SPIPA) programme, We Mean Business Coalition, The Confederation of Danish Industry, Banking Association South Africa (BASA), and the African Climate Foundation. While all stakeholder opinions and inputs were considered, and fact-based suggestions were systematically incorporated, any non-fact-based pressure to change conclusions against the outcomes of the rigorous analytical approach, motivated by individual interest or ideology, has been dismissed.

The conclusions of this work were accepted by the diverse advisory board, steering committee, and the study's 30 CEO Champions (Figure 2). The transparent, inclusive, and independent[5] project governance and multi-stakeholder processes ensured that the NBI-BUSA-BCG Climate Pathways and Just Transition study is to date one of the most robust, transparent, and inclusive climate studies in South Africa.

This report consolidates the critical findings of this multi-year study. It should be read alongside the sector technical reports, which provide details that underpin the conclusions presented.[6]
This includes the following publications:[7]

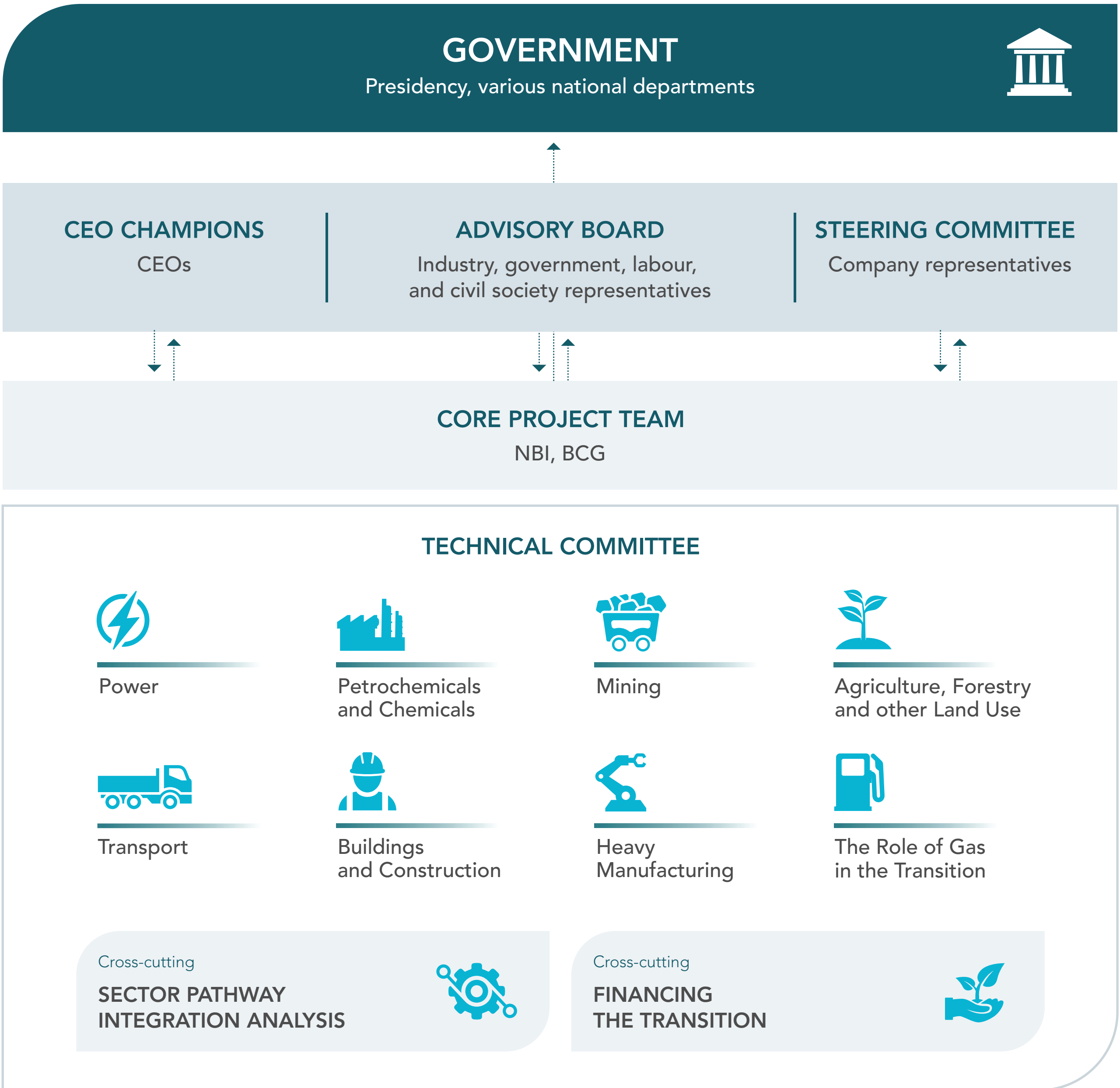
1. Decarbonising South Africa's Power Sector (Aug 2021)
2. Decarbonising the South African Mining Sector (Oct 2021)
3. Decarbonising South Africa's Petrochemicals and Chemicals Sector (Nov 2021)
4. Decarbonising the Agriculture, Forestry and other Land Use Sector in South Africa (Nov 2021)
5. The Role of Gas in South Africa's Path to Net-Zero (complementary to the Power publication) (Feb 2022)

Publications still to be released in 2022

6. Decarbonising South Africa's Transport Sector
7. Decarbonising South Africa's Heavy Manufacturing Sector
8. Decarbonising South Africa's Buildings and Construction Sector
9. Financing South Africa's Transition to Net-Zero
10. Consolidated analysis of South Africa's Net-Zero transition

5. Independent of private sector financing, and thus undue influence to include non-fact-based results
6. Reports available from: https://www.nbi.org.za/climate-pathways-and-a-just-transition-for-south-africa/
7. Reports 6, 7, 8, 9 and 10 still to be released as of the date of the publication of this report

Figure 1 | Overview of governance structure and stakeholder engagements of this study



Source: NBI-BCG Project Team

Figure 2 | Overview of CEO champions

ONBOARDING OF ADDITIONAL CEOS ONGOING

Joanne Yawitch
NBI CEO

Cas Coovadia
BUSA CEO

Portia Derby
Transnet CEO

Shirley Machaba
PwC CEO

Mark Dytor
AECI CEO

Nolitha Fakude
Anglo American SA Chairperson

Taelo Mojapelo
BP Southern Africa CEO

Deidré Penfold
CAIA Exec Director

Theo Boshoff
AgBiz CEO

Seelan Naidoo
Engen CEO

André de Ruyter
Eskom CEO

Stuart MacKenzie
Ethos CEO

Mxolisi Mgojo
Exxaro CEO

Alan Pullinger
First Rand CEO

Nyimpini Mabunda
GE SA CEO

Tshokolo Nchocho
IDC CEO

Mohammed Akoojee
CEO Imperial Logistics

Leila Fourie
JSE Group CEO

Vivien McMenamin
Mondi SA CEO

Andrew Robinson
Norton Rose Fulbright CEO

Roland van Wijnen
PPC Africa CEO

Njombo Lekula
MD SA Cement and Materials, PPC

Alex Thiel
SAPPI CEO

Fleetwood Grobler
Sasol CEO

Hloniphizwe Mtolo
Shell SA CEO

Lungisa Fuzile
Standard Bank CEO

Gavin Hudson
Tongaat Hulett CE

Paul Hanratty
Sanlam CEO

Bertina Engelbrecht
Clicks CEO

Stuart Kent
Aurex CEO

01

South Africa cannot afford to sit idle – the cost of inaction is massive

Climate change is an existential threat to humanity. To avoid reaching catastrophic and irreversible tipping points, global warming needs to be limited to 1.5˚C by 2100. This requires global net-CO_2 emissions to reduce by ~45% by 2030 and to reach Net-Zero emissions by 2050. South Africa should contribute to this global effort and aim to reach Net-Zero emissions by 2050 while staying within its fair share of the global carbon budget, estimated to be between 7 and 9 Gt CO_2e[8].

However, South Africa's unique socio-economic context of inequality and poverty, record high unemployment, a weak economy and dependence on a carbon-intense, inadequate energy system, which does not meet South Africa's power needs (Side Box 1), make its Net-Zero transition one of the most challenging decarbonisation undertakings globally (Figure 3).

Yet, the economic and social cost of inaction for South Africa is massive. With six out of ten key export markets moving to Net-Zero, ~50% of South Africa's export value, more than 1 million direct jobs, and ~15 % of GDP[9] could be at risk if decarbonisation is not pursued. This is because a carbon-intense South African economy will face mounting trade risks and decreasing competitiveness should trade partners act on their Net-Zero commitments (Figure 4). For example, the EU plans to implement a carbon border tax, which would make carbon intense goods less competitive[10].

On top of this, South Africa will urgently need to adapt to climate change. South Africa is among the countries at greatest physical climate change risk, threatening South Africa's people and economy (Figure 5).

The imperative is clear: South Africa must decarbonise its economy in the next three decades and transition toward a low-carbon, climate-resilient, and competitive economy that is powered by reliable, affordable and clean energy sources. This endeavour needs to be just: it will need to address South Africa's triple challenge of inequality, poverty, and unemployment and lead to a future economy that is socially resilient and inclusive. To achieve this, the communities and workers most affected by both the physical impacts of climate change and the decarbonisation of the economy must be at the centre of the transition with the aim that no one is left behind.

SIDE BOX 1

SOUTH AFRICA'S ENERGY CRISIS

As a result of reliance on a lower-grade, aged coal plant fleet, lack of investments in new supply capacity and a growing power supply shortage, South Africa's national power system has consistently not been able to adequately meet the country's power demand. As a result, South Africa has suffered from sustained power cuts (loadshedding) in the past two decades, which have significantly hampered economic growth. In 2019 alone, it is estimated that loadshedding cost the South African economy ZAR 60-120 billion[11].
The situation has further worsened. In 2022, the energy crisis reached new heights, with the worst power outages since 2019.

8. Extrapolation of the medians of various methodologies described by Climate Action Tracker. The full range is 4–11 Gt CO_2e.
9. Estimated as the loss of the coal and petrochemicals industries due to the shift to greener commodities, and the loss of the current export potential in heavy manufacturing and AFOLU due to climate regulations in key export markets
10. Carbon border tax is an import duty based on the carbon emissions from the production of a good. Importers will have to pay the same carbon price as if the good was produced within the EU. The objective of the carbon border tax is to protect local industries from regions with less stringent carbon policies and taxes. The tax is planned to be enforced from 2026.
11. CSIR, Setting up for the 2020s. Adressing South Africa's electricity crisis and setting up for the next decade. Available at: http://researchspace.csir.co.za/dspace/bitstream/handle/10204/11282/RS_Setting%20up%20for%202020.pdf%20version%201.1.pdf?sequence=3&isAllowed=y

Figure 3 | South Africa's challenging starting point

01

South Africa is one of the most carbon intense major economies

South Africa's economy is heavily reliant on coal, with

86% of power being coal-based[1]

With a carbon intensity of 0.6kgCO2e/$ PPP GDP South Africa is the

2nd most carbon intense major economy[2] in the world

South Africa is the largest emitter in Africa, driving

40% of the continent's emissions[3]

02

South Africa is the most unequal country in the world

South Africa has with 0.63 the

largest GINI

coefficient globally

The top **10%** of South Africa's population

owns **86%** of aggregate wealth[4]

Over **34%** of South Africans are unemployed, with youth unemployment

reaching a record of **65.5%** in 2021[5, 6]

55% of South Africans live in poverty

with more than **10%** living in extreme poverty[5]

03

South Africa's economy is weak

Economic growth has stalled over recent years, with

~1% GDP growth

for the last 5 years, and an overall decline of

~-0.2% in 2010-2020[7]

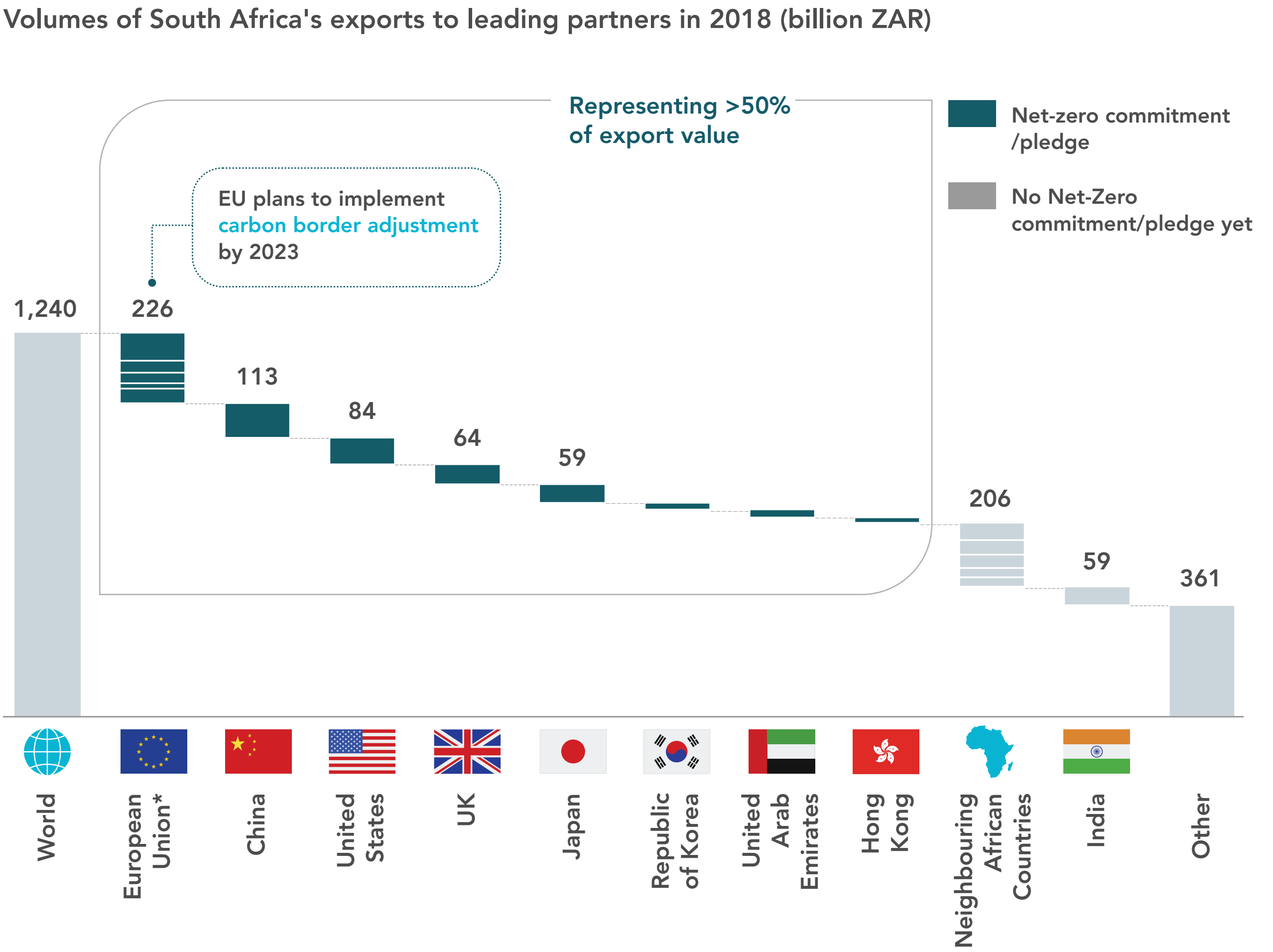
DEBT

The debt to GDP ratio is increasingly growing, at

8% p.a. between 2016 (47.13%) and 2021 (68.83%), constraining South Africa financially[8]

1. South Africa overview; The Mail & Guardian: South Africa tops G20 coal-reliance list in 2020; 2. Major economy = GDP in excess of USD 500 billion per annum. Only Iran precedes South Africa; 3. Oxford Economics, Global Carbon Atlas, 4. The World Bank. 2021. 'South Africa Overview'; 5. StatsSA. 2017. 'Poverty Trends in South Africa. An examination of absolute poverty between 2006 and 2015'; 6. Chatterjee, A., et al. 2020. 'Estimating the Distribution of Household Wealth in South Africa'; 7. Oxford Economics, Carbon Atlas, GDP by Country. 2022; 8. Statista: South Africa: National debt in relation to gross domestic product (GDP) from 2016 to 2026

Figure 4 | South Africa is facing a significant trade risk, with key export markets committing to Net-Zero



* Top 4 trade partners within EU are Germany, Netherlands & Belgium, and among those with most aggressive targets. Note: Exchange rate based in 2018 average = R 13:24/US$ | Source: World Integrated Trade Solution 2018; Press research

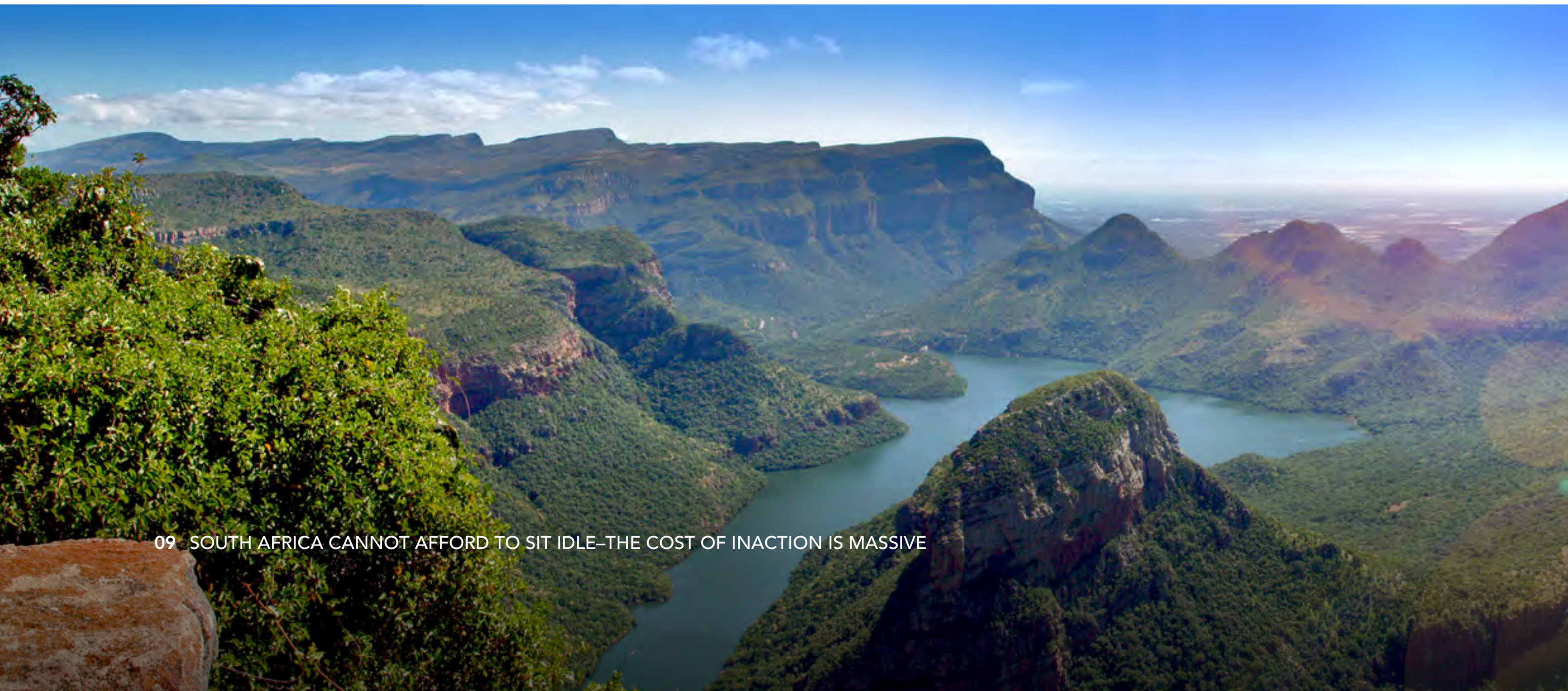
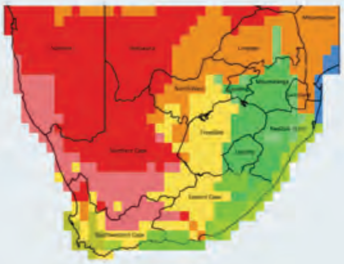
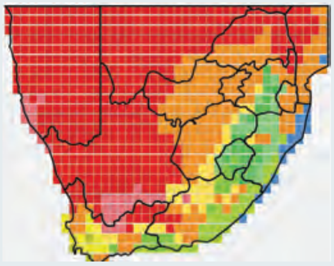
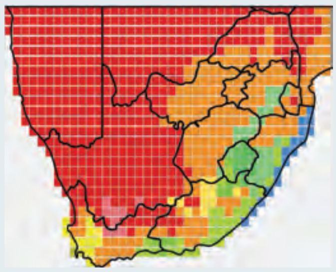
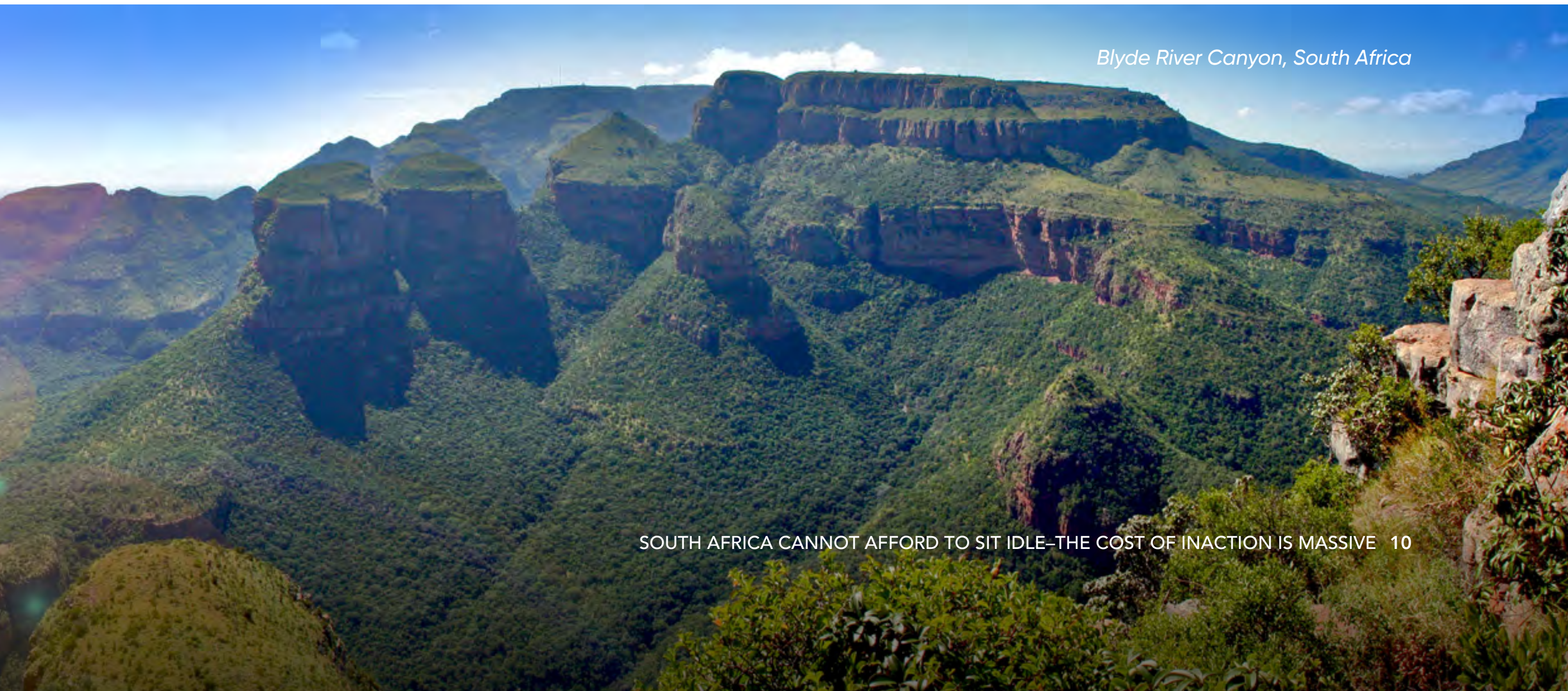


Figure 5 | South Africa is at increasing climate risk. A significant increase in hot desert zone and shift from warm to hot temperature zones is projected in South Africa across climate scenarios

KOPPEN GEIGER CLIMATE ZONES IN SA (1961- 1990)	RCP4.5 (EQ.[1]) (2040-2060; 2°C MIROC3.2-MEDRES MODEL)	2050 RCP8.5 (EQ.[2]) (2040-2060; 3°C MIROC3.2-MEDRES MODEL)
		
Cold and hot desert in the West	~25% increase in size of hot desert	~48% increase[3] in size of hot desert
Cold steppe in the center & south-west	~18% increase in size of hot, arid steppe	~34% increase[3] in size of hot, arid steppe
Warm temperature regions in the east & south-east	Warm temperate partially replaced by hot temperate	Warm temperate replaced by hot temperate except in Lesotho. ~124% increase[3] in size of tropical savannah (east coast)

Arid, Desert, Hot · *Arid, Desert, Cold* · *Arid, Steppe, Hot* · *Arid, Steppe, Cold* · *Temperate, Dry & Hot Sum.* · *Temperate, Dry & Warm Sum.* · *Temperate, Dry Win., Hot Sum.* · *Temperate, Dry Win., Warm Sum.* · *Temperate, no dry season, Hot Sum.* · *Temperate, no dry season, Warm Sum.* · *Tropical, Savannah*

1. 2°C global temperature increase 2. 3°C global temperature increase 3. Relative to base period
Source: Theoretical and Applied Climatology (2015); Agricultural Research Council & DAFF; NBI-BCG team



Blyde River Canyon, South Africa

02

Renewable energy is the key to a competitive and Net-Zero economy in South Africa

South Africa is endowed with abundant, high-quality renewable energy resources – among the best in the world – with complementary wind and solar energy potential across the country. Leveraging South Africa's renewable energy resources strategically is key to enabling a Just Transition to a competitive, Net-Zero economy.

First, by developing an energy system anchored in renewables, South Africa can contribute to solving its current energy crisis, and improve the affordability, availability and reliability of its power supply. A renewables-dominated power system is the most cost-competitive power system for South Africa. In addition, renewable energy combined with flexible power supply allows for fast deployment of new generation capacity to close the existing 4-6 GW[12] supply capacity shortfalls and reduce the risk of loadshedding.

Second, renewable energy is key to decarbonise and diversify South Africa's economy, and to address the increasing trade risks South Africa faces. The large-scale deployment of renewable energy enables a nearly 60% reduction of South Africa's national emissions (Figure 6). Around 40% of this reduction is linked to the decarbonisation of South Africa's coal-intensive power generation, and around 20% is linked to a further reduction across industries through electrification - meaning that renewable electricity becomes the main energy source across all sectors, substituting fossil fuels. One key example is the electrification of road transport, where internal combustion engines are replaced by electric vehicles. Renewable energy is also required for the production of Green H_2, which enables decarbonisation across industries. Securing a clean energy supply for South Africa's economy is also critical for realising new economic opportunities around Green H_2, including green steel and net-zero synthetic fuels (Side Box 2).

Transitioning South Africa's power system to renewable energy will allow the country to reduce electricity costs, enable fast deployment of urgently needed power generation capacity, and enable the decarbonisation and diversification of South Africa's economy.

12. Creamer Media's Engineering News: Eskom compiling 'consolidated proposal' for ending load-shedding crisis, May 2022

Drakensberg Amphitheatre, South Africa

SIDE BOX 2

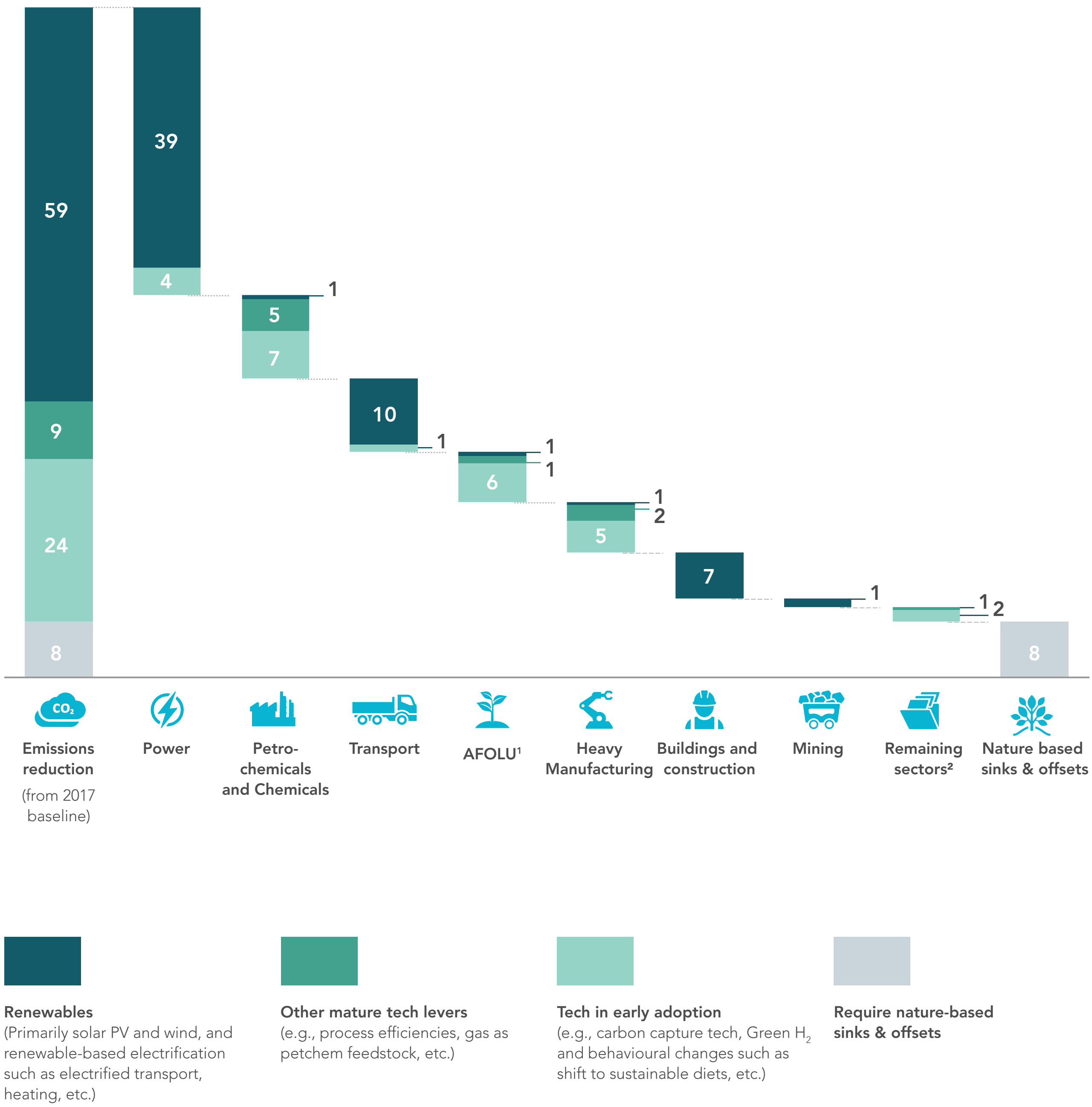
THE ROLE OF GREEN H_2 IN SOUTH AFRICA'S NET-ZERO TRANSITION

Green H_2 is produced via water electrolysis (splitting water into H_2 and oxygen), powered by renewable energy. No emissions are produced during the production process. Without Green H_2, South Africa cannot reach Net-Zero by 2050: Green H_2 serves as a Net-Zero energy carrier in industrial processes such as steel, cement, glass, and chemicals production. It also serves as an alternative transport fuel, primarily in heavy-duty fuel cell electric vehicles, and as a feedstock for synthetic fuel production such as sustainable aviation fuel. It also enables last-mile decarbonisation in power, where it can replace gas in peaking plants. South Africa's world-class renewables enable it to produce Green H_2 at a globally competitive cost of ~USD 2.0/kg by 2030. This, coupled with expertise in synthetic fuel production and manufacturing, could enable South Africa to become a leading supplier in the production of Green H_2-based products (e.g., sustainable aviation fuel, green ammonia, and green steel).


Vredenburg, South Africa

Figure 6 | Renewable energy is critical to drive 60% of emissions reduction in South Africa

National direct annual emissions abatement potential by decarbonisation lever category (%)



1. AFOLU: Agriculture, Forestry and Other Land Use; 2. Remaining sectors includes: consumer and commercial waste, and other sub-categories from mineral & metal production not part of Heavy Manufacturing; Source: GHGI (2017), IEA (2015), WEO (2019), CDP (2015), GHGI (2015), CAT, NBI-BCG Project team

03

Most of the required technology to decarbonise is available. However, an unprecedented infrastructure rollout is needed

The Net-Zero transition drives a fundamental shift in South Africa's energy mix away from fossil fuels, with renewable power becoming the economy's primary energy carrier (Figure 7 and Side Box 3).

The technologies to enable this transformation are largely available – mainly renewables, which are already today the most cost-competitive energy source in South Africa, and battery and gas-based peaking technology[13], which are needed to address the intermittency of wind and solar energy. Last-mile decarbonisation requires more disruptive technologies such as Green H_2 and carbon removals closer to 2050 – and those technologies are still in early development stages.

Decarbonising South Africa's power system requires an unprecedented renewable energy rollout. By 2050, at least 190 GW of renewables needs to be installed. While this is massive, South Africa has sufficient domestic renewable energy sources; its Renewable Energy Development Zones[14] can hold ~920 GW of solar and wind capacity.[15] However, the required renewables deployment speed is unprecedented: ~6-7 GW of renewables need to be deployed every year for the next three decades for the power system alone. To capture the significant opportunity presented by the Green H_2 economy, the average annual build rate could potentially increase up to the double to an average of up to ~13 GW p.a. (note that this average is skewed, as most of the Green H_2 renewable need occurs post-2040). South Africa's installed capacity of ~5 GW of renewables today took over 10 years to build, marking a challenge the country will need to overcome.

Gas is only required in limited volumes and for a limited period of time, with a flexible and short payback liquified natural gas infrastructure such as floating storage. Gas enables a larger and faster scale-up of renewables, and can drive the competitive decarbonisation of other sectors - to replace more carbon-intense industrial feedstock such as coal, for example, with the need to replace gas with batteries (for short-term power balancing; pumped hydro storage can also provide this short-term power balancing, but batteries are preferred due to its lower cost) and Green H_2 (for long-term seasonal balancing), sustainable sources of carbon (for feedstock substitution) and direct electrification (for industrial process heat) as soon as cost parity can be achieved with these green alternatives. There is no need for exploiting untapped gas reserves in Southern Africa, given the long lead times for first production and long payback period yielding a high risk of stranded assets which outweighs the socio-economic benefit of gas reserve development.

13. Intermittent renewable supply, which varies from within a day to between seasons, requires peaking capacity.

14. REDZ are dedicated geographical regions where solar PV and wind can be concentrated. These regions have shortened environmental authorisations, as a result of proactive site sensitivity work, to allow for faster renewables rollout.

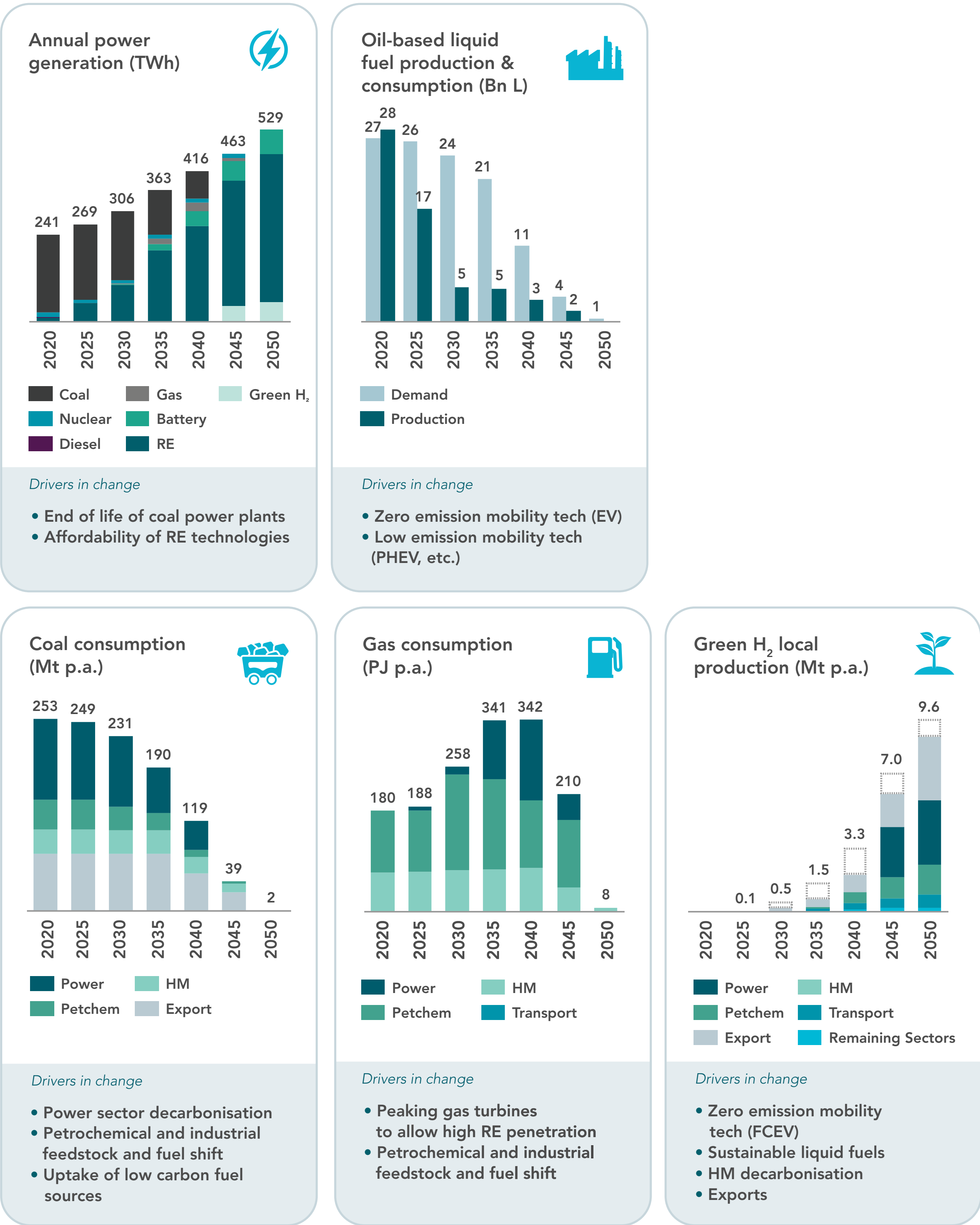
15. Assuming 60% (~550 GW) solar PV and 40% (~370 GW) wind, at an average load factor of 22% and 38% for solar PV and wind respectively.

SIDE BOX 3

THE TRANSFORMATION OF SOUTH AFRICA'S ENERGY LANDSCAPE TOWARDS NET-ZERO

Coal is phased out by the mid-2040s. From only ~3% of power generation today, renewables are deployed rapidly to reach 80% of power generation by 2050. Conventional liquid fuel demand is effectively eliminated by 2050, primarily due to declining demand from transport. By 2050, annual Green H_2 demand could reach 9 Mt. Local Green H_2 demand is driven by the power, transport, heavy manufacturing and petrochemicals sectors. Exports of Green H_2 products could make up 3-4 mt of the total 2050 Green H_2 demand. Dedicated renewable energy is required to produce Green H_2, with up to ~5-10 GW by 2030 and up to 170-200 GW by 2050 of additional renewables required – hence, potentially nearly doubling the renewables requirement by 2050, and potentially causing the renewables build rate to increase significantly from ~6-7 GW p.a. to up to ~12 GW p.a. in the mid-2030s, before rising to up to nearly 18 GW p.a. in the 2040s due to the significantly growing Green H_2 demand (Figure 8).

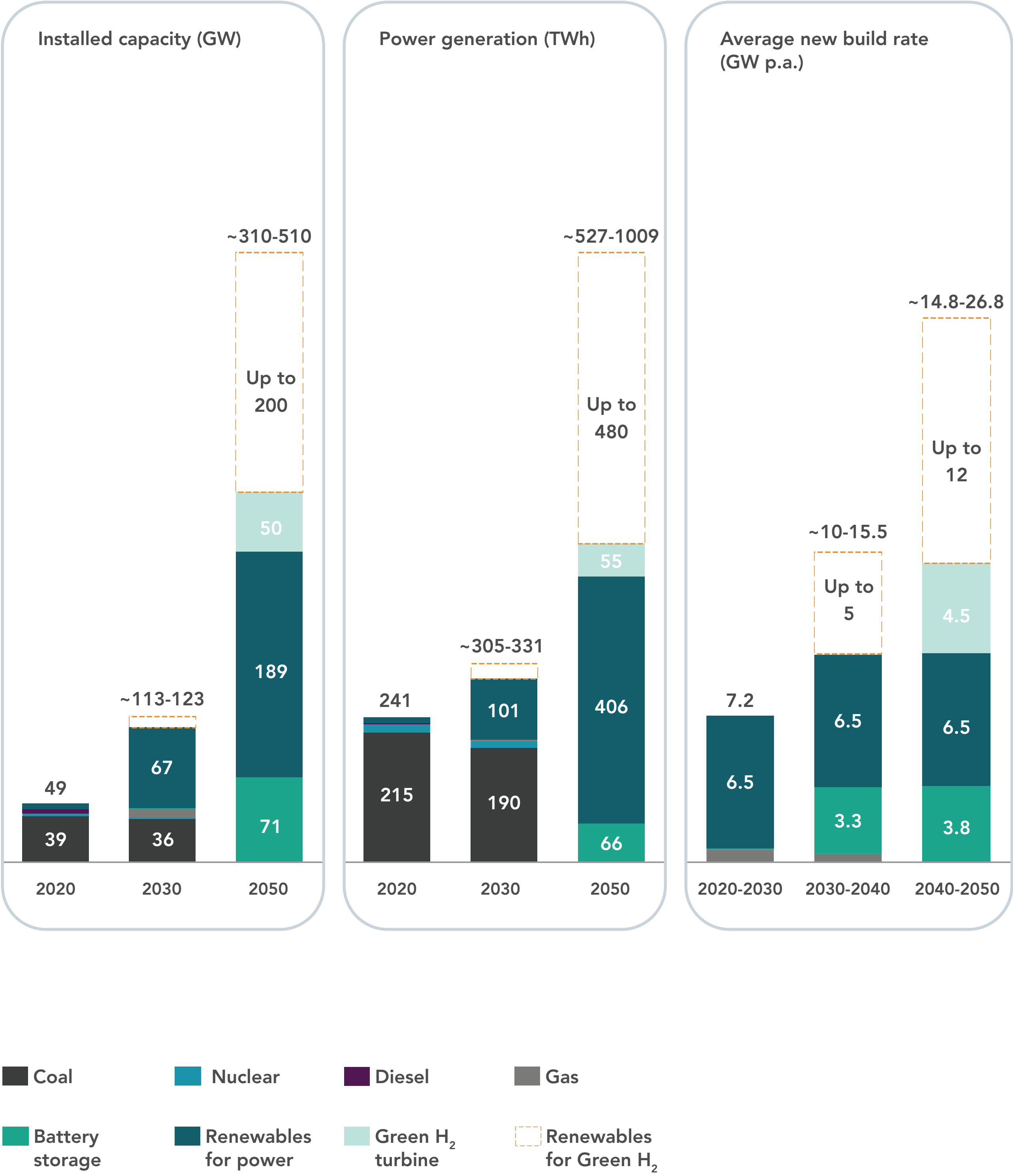
Figure 7 | South Africa's energy mix shifts from coal-based power & oil-based fuels to renewables & Green H_2



Source: Eskom annual report (2021), Sasol annual report (2021), Mineral council of South Africa: Coal, SAPIA refining capacity, NBI-BCG Project team

Cape Town, South Africa

Figure 8 | South Africa's shift to a renewable-based power system, and renewables required for Green H_2 production



Note: Electricity generation does not include curtailed power. However, it does include 'auxiliary demand' for example the charging of batteries, pumped storage
Source: NBI-BCG Project Team

04

Expanding and modernising South Africa's power grid is critical to enabling the energy transition

South Africa's power grid infrastructure is inadequate, and – if not modernised, strengthened and expanded – could pose a significant barrier to the rollout of renewables at scale.

Today, the South African power grid is largely "at capacity" – only an additional ~30 GW of generation capacity can be added to it by 2024 (for reference, in a Net-Zero scenario, South Africa requires ~190 GW of renewables for the power system alone). The grid also has limited capacity for new power generation in regions with the highest renewable energy potential, such as the Northern Cape (Figure 9). This already causes problems: in the latest Renewable Energy Independent Power Producer Programme, some commercially viable renewables projects could not be undertaken, as the grid was already at capacity in the respective region, and no further generation capacity could be added[16].

South Africa's power grid urgently needs to be expanded and strengthened to accommodate large-scale renewable energy capacity from across the country, but also to deal with increasing power demand from growing and ever-more electrified economy. This requires the construction of new power lines and additional transformer capacity.

Beyond expanding and strengthening the grid, it also needs to be modernised, and made "smarter" through increased digitisation. A smarter grid is more efficient and resilient. It allows for improved management and the matching of power supply and demand – which is critical to ensure system stability – particularly in a renewables-dominated power system.

16. Department of Mineral Resources and Energy, 28 October 2021 media briefing on REIPPP Bid Window 5

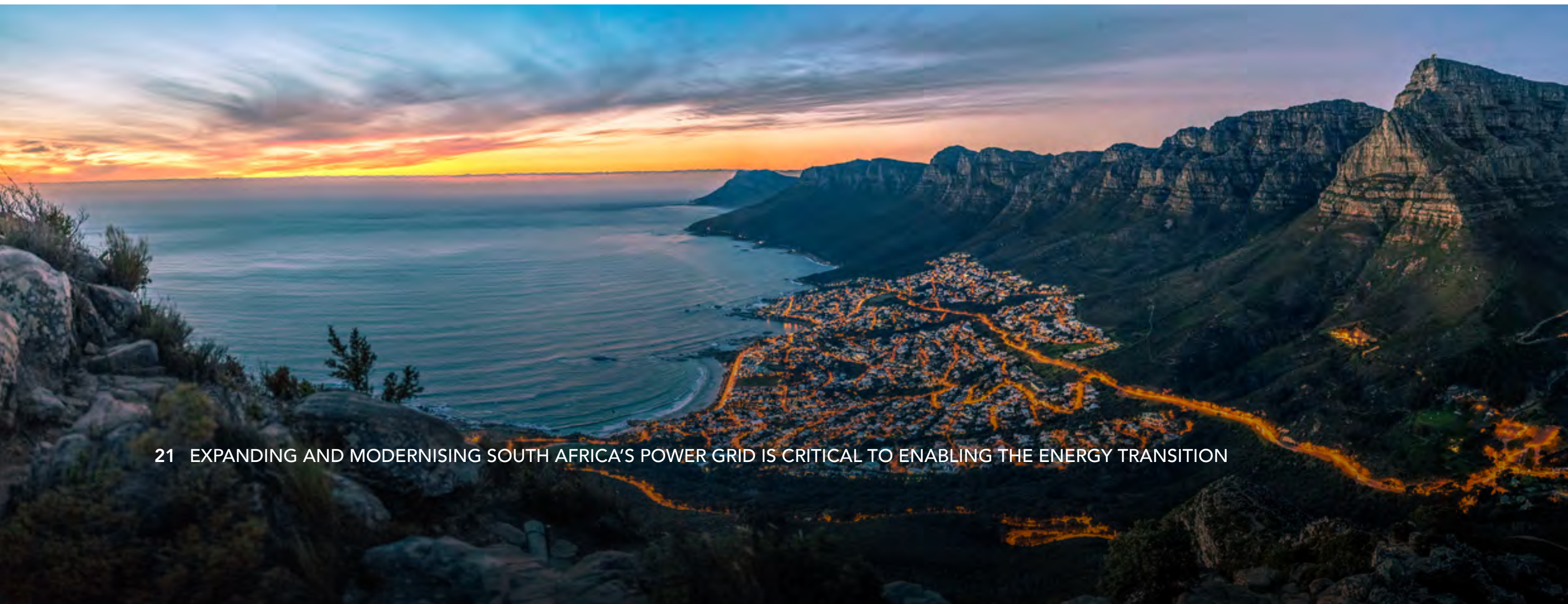


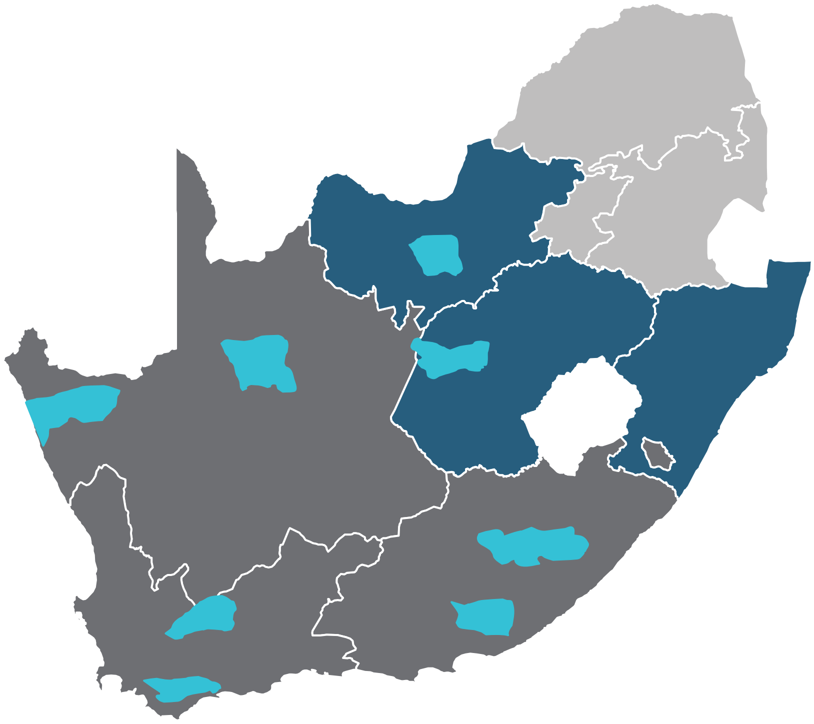
Figure 9 | A much larger grid capacity is needed

Grid connection capacity

~30 GW of existing connection capacity could be used for renewables – most of this in Mpumalanga - if the grid is strengthened and upgraded

Additional ~30 GW of connection capacity needs to be built to achieve the overall 60 GW required by 2030

Optimal renewables sources are in coastal areas with today only limited grid connection



~5.1 GW Connection capacity available

~13.7 GW Connection capacity available

~13.5 GW Connection capacity available

Renewable Energy Development Zones

Source: Eskom Grid Connection Capacity Assessment 2024

Cape Town, South Africa

05

The main challenge will be financing. By 2030, around ZAR 310 billion of investments are needed in renewables alone[17]

South Africa's transition to Net-Zero will require massive investments. Overall, ~ZAR 6 trillion is required over the next three decades to decarbonise the economy (Figure 10 and Side Box 4).[18] This is equivalent to ~4.6% of South Africa's current GDP being spent on the transition every year until 2050. The decarbonisation of South Africa's power sector alone makes up half of the required amount, at ~ZAR 3 trillion.

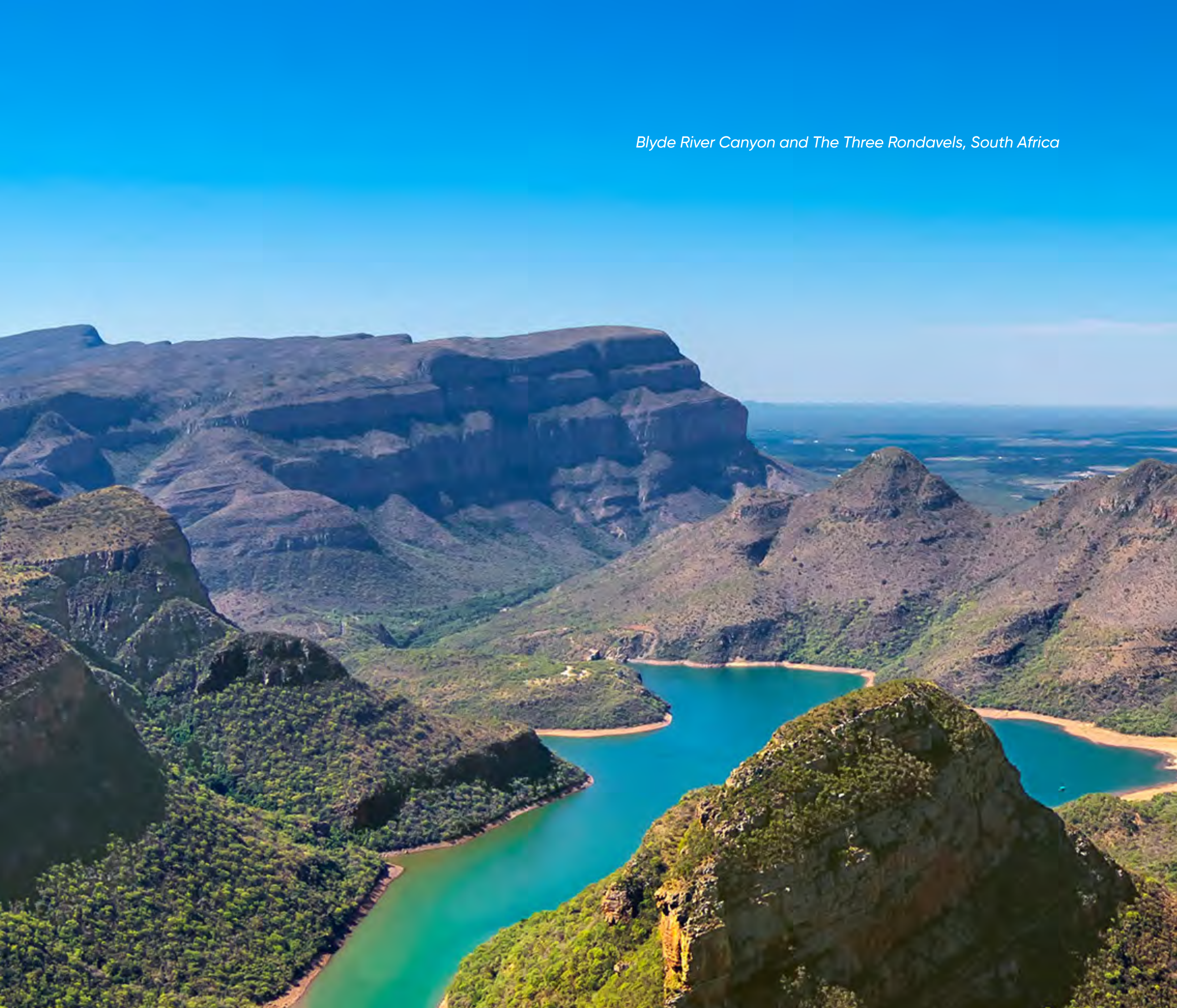
However, not all of this funding is additional funding. For example, the annualised investment rate required in the power sector is ~ZAR 100 billion p.a. compared to Eskom's current primary energy spend, which sits at ~ZAR 120 billion p.a.[19]. This means that the transition to Net-Zero for the power sector will actually cost the country less in the long term. What is important however is speed. The 2020s are a crucial decade in making South Africa's transition successful, and early investments in power systems are critical, driving 70% of investments by 2030 (Figure 11).

In addition, ensuring the right market structure, terms of finance – particularly the catalytic role development finance can play in stimulating new green industries – and covering the social cost of the Net-Zero transition will be critical and indeed a challenge that requires collaboration across all spheres of society.

Given South Africa's constraints around public financing[20], large-scale private sector investment and international support will be needed. Around 60% of investment required in the 2020s- such as in renewables generation- are sufficiently bankable and mature to be funded from private sector-dominant sources. International development finance will also be critical to fund 'non-bankable' investments (e.g. social costs, re-skilling costs) and cover the 'economic gap' in new green industries to crowd-in private sector investment (e.g., to subsidise Green H_2 costs and stimulate supply-side investments).

None of this can be achieved without increased collaboration between government, private sector financiers, donor institutions and other key stakeholders. The value of an integrated and coordinated effort at national level cannot be emphasised enough.

17. This includes embedded generation and is part of a broader ~ZAR 690 billion investment needed in power systems
18. ~ZAR 5.9 trillion capital expenditure includes high assumption of H_2 exports at ~4 Mt p.a., requiring ~ZAR 0.7 tn in capex
19. Eskom, Annual Financial Statements, 31 March 2021
20. South Africa's fiscal deficit was 5.7% of GDP in 2021, and government debt stands at ~ZAR 3.7 trillion (~74% of GDP)
21. 17% and 18% (~ZAR 840 billion and ~ZAR 900 billion) for renewable energy capacity and batteries respectively



Blyde River Canyon and The Three Rondavels, South Africa

SIDE BOX 4

THE TOP PRIORITY INVESTMENTS WHICH ARE CRITICAL TO ENABLE THE DECARBONISATION OF SOUTH AFRICA'S POWER SUPPLY

The deployment of renewable energy capacity– such as wind and solar – and battery storage capacity at scale, which require approximately ~ZAR 1.7 trillion of investments until 2050[21]

The modernisation, strengthening and expansion of the power grid, with around ZAR 560 billion needed until 2050 for grid expansion alone

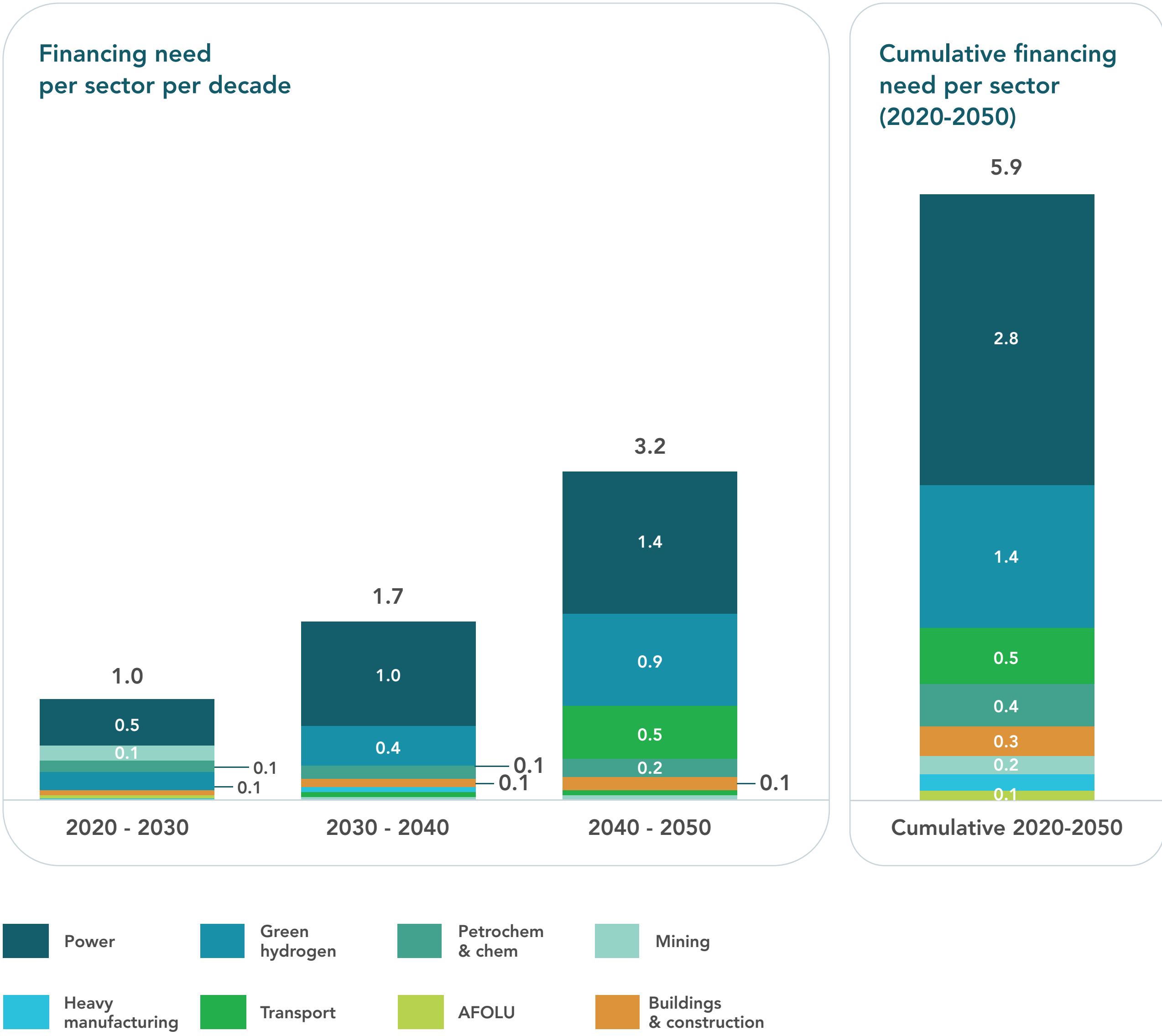
Addressing the social cost of transitioning the power sector – including job loss along the coal value chain and in South Africa's coal mining regions

Figure 10 | ~ZAR 6 trillion is required over the next 30 years to decarbonise the economy

Net-zero transition to 2050 could cost ~ZAR 6 trillion, mostly in the power sector and in Green H_2 production

CapEx to 2050 by sector (cumulative per decade in ZAR trillion)

Note: Focus on mitigation investments across sectors. Social and adaptation financing has not been quantitatively assessed.

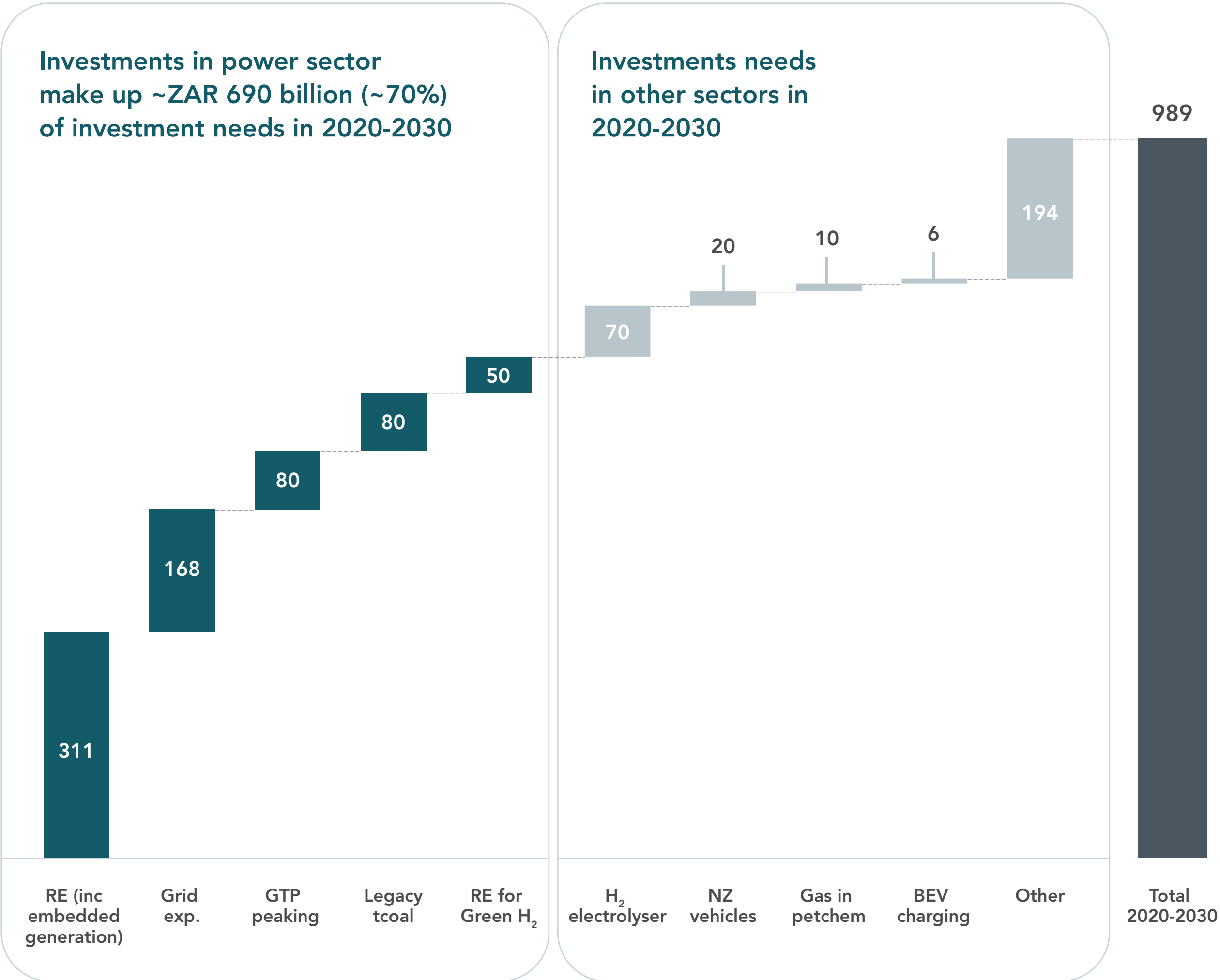


Note: Data expresses total CapEx requirements based on NBI Climate Pathways work on mitigation spend per sector which is required to align SA to a 1.5°C pathway | 1. Power includes both generation and grid expansion costs 2.Green Hydrogen here assumes ~3.7 Mt p.a. local demand and includes ~4 Mt p.a. H2 for export but does not include Green H_2 to convert existing synfuels assets to green assets, which is incorporated the in petrochemicals figure (assumed as an additional ~1.5 Mt p.a. of hydrogen by 2050) 3. Petrochem includes additional costs for gas infrastructure
Source: NBI-BCG project team

Figure 11 | Investment needs in 2020-2030 are driven by investments in power systems

CapEx 2020-2030 by investment area (cumulative in ZAR billion)

Note: Focus on mitigation investments across sectors. Social and adaptation financing has not been quantitatively assessed.



Source: BCG-NBI Project Team

06

Renewables anchor economic diversification and job creation in South Africa – but more is needed to ensure a Just Transition

Unlocking South Africa's renewable energy resources will drive job creation and enable economic diversification.

Developing a Net-Zero, renewable energy dominant power system can result in net-positive job creation of 2.4 million cumulative job years over the next three decades if South Africa can successfully localise elements of the renewable energy value chain. Unlocking South Africa's renewable energy sources - in combination with South Africa's access to key mining commodities, expertise in key industries such as synthetic fuels production, existing trade relationships, and a young, growing population - positions South Africa well to capture new, green markets and to drive further job creation. For example, a localised Green H_2 economy could create up to 2.5 million cumulative job years by 2050. More jobs can be created across South Africa's economy if investments are made in green industrialisation - by establishing renewable-powered, energy-intensive manufacturing production hubs, for instance.

However, jobs are not created equally across South Africa's geographies and across time frames, and can also not necessarily "absorb" workers who have lost their jobs in the context of the Net-Zero transition, due to lack of required skills.

More than just job creation is needed to reduce inequality, strengthen social cohesion, eradicate poverty, and ensure participation in a new economy for all. Other vital enablers need to be put in place, and socio-economic risks managed, including the closure of coal plants and reinventing the local economies of today's key coal mining regions in the country (Figure 12), addressing job losses via initiatives like early retirement and reskilling, workforce planning and reskilling, management of geographical and cultural dislocation of communities, and physical and digital infrastructure improvements. This should be accompanied by tangible industrial development activities, which prioritise Small and Medium Enterprises, black entrepreneurs, black women, youth, and marginalised communities. A national, coordinated effort involving the private sector, public sector, and civil society will be crucial to drive those responses successfully (Figure 13).

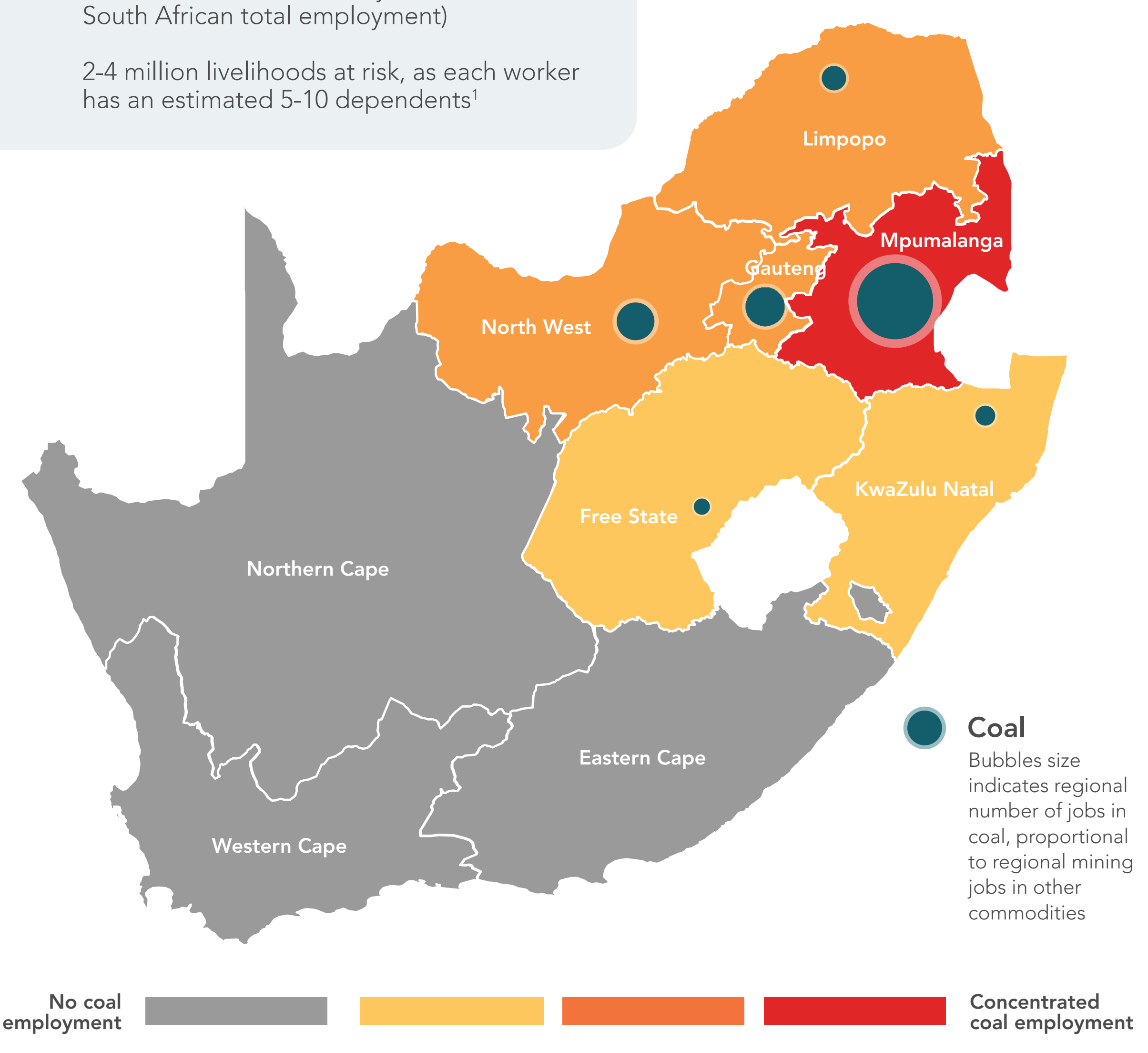
Given South Africa's challenging socio-economic starting point and unique decarbonisation challenge, South Africa will also require significant global support, including preferential green funding, trade support, support in capacity-building and skill development, and technology- and IP-sharing (linked to the Green H_2 economy, for example).

Figure 12 | South Africa's coal mining regions will be impacted by global and local decarbonisation

Coal mining regions in the Northeast are at risk to be hardest hit from local and global decarbonisation

~80.000 direct jobs and a total of ~300.000 to ~400.000 coal value chain jobs at risk (~3% of South African total employment)

2-4 million livelihoods at risk, as each worker has an estimated 5-10 dependents[1]



1. SA mining industry average for # of dependents per worker

Source: Stats SA, Minerals Council South Africa, NBI-BCG project team

Figure 13 | A Just Transition in South Africa is about more than creating jobs

The Framework has been developed in close collaboration with various key South African stakeholders as part of the Climate Pathways project

VISION

A well-managed shift towards environmentally sustainable economies & societies for all

CHALLENGES & OPPORTUNITIES

Across sectors socio-economic risks need to be identified and mitigated, and opportunities realised

BUILDING BLOCKS

Building blocks of a transition which contributes to social upliftment and the eradication of poverty and inequality in South Africa

COLLABORATION

Collaboration across all spheres of society will be critical

Source: NBI-BCG Project Team


For South Africa, the Just Transition is a shift towards **environmentally sustainable economies** and **societies for all**. Such a transition needs to be well managed and contribute to the goals of **decent work, social inclusion** and the **eradication of poverty** for all South Africans.
Power
Petro-chemicals and Chemicals
Agriculture, Forestry, and other Land Use
Transport
Heavy Manufacturing
Buildings and Construction
Mining
Other sectors of today and the future
Job creation & decent work
Infra. planning & rollout
Social protection
Economic inclusion & participation
Ecological restoration
Funding
Training, capacitation & skilling
Managing geo. & cultural dislocation
Service delivery, and access to infra. & markets
Ownership
Education
Policy & governance
Coordination and collaboration between public sector, private sector and civil society

The direction South Africa needs to take now

MAKE THE RAMP-UP OF RENEWABLES A NATIONAL PRIORITY

South Africa's Just Transition to a diversified and competitive net-zero economy **hinges on access to affordable, reliable and clean energy.** In the context of South Africa's current energy crisis – which reached new depths in 2022, the transition to a renewables-dominated energy system becomes even more urgent, given that it is the key to addressing today's power supply shortfalls in a fast and affordable way. Furthermore, people must be at the centre of this transition and pursuing a renewables-dominated energy system will be a step forward in establishing a diversified and competitive economy that creates new skills and jobs, **lifts people out of poverty, and reduces unemployment and inequality.**

Achieving this requires a renewables roll-out at an unprecedented scale and speed as well as clarity on how this will support and enable a Just Transition. By 2050, 190 GW of renewables need to be deployed. This means that on average, every year for the next three decades, **~6-7 GW of renewables** need to be connected to the grid. Building at this rate will help address the short-term power crisis and put South Africa on track to a competitive low carbon economy. Enabling new technologies, specifically in the nascent hydrogen economy will play an important role in the transition in the long term, with transition fuels playing a supportive role in enabling the roll out of renewables at scale in the short and medium terms.

To capture the opportunity presented by the green H_2 economy, the average **annual build rate could double, reaching up to 18 GW p/a. post-2040** as green H_2 demand ramps up. To put this in context, South Africa's current ~5 GW of installed renewable capacity took more than ten years to install. To address this challenge, the **modernisation, strengthening and expansion of the grid is a key priority.** Without it, the required scale of renewables cannot be connected to the homes and businesses that so urgently require clean, reliable, and affordable sources of energy.

During the announcement of his **10-Point Power Crisis Plan, President Cyril Ramaphosa detailed a set of policy reforms and actions aimed at relieving the current electricity capacity shortages, and enabling increased uptake of renewable energy generation**, including the lifting of the licensing requirements of embedded generation projects above 100MW; reducing legal and regulatory obstacles to new generation capacity from design to implementation; and doubling the amount of power procured from wind and solar generation in Bid-Window 6. This announcement is significant and goes a long way to supporting a Just Energy Transition to a more sustainable energy system that aligns better with our national climate commitments.

South Africa's transition to net-zero will require massive investments. Overall, more than **ZAR 6 trillion is required over the next three decades to decarbonise the whole economy** - of which more than half, around ZAR 3 trillion, is needed in the power sector. This means that around **ZAR 690 billion in funding** is required **within the next eight years** in the power sector alone. Further funding will also be required to cover the social cost of the net-zero transition. The President's announcements, once implemented, will open the door to further investment and he has made a strong call to the private sector, and to individual homeowners, to participate.

Without fast and large-scale renewables deployment with the commensurate grid investments, all other activities needed to achieve net-zero, capture new green economic opportunities, and maintain and grow economic and trade opportunities will not be achievable. Delaying the roll-out of renewable energy capacity at scale will dramatically worsen South Africa's financial situation. It will increase the cost of creating an affordable, reliable, decarbonised power system; it will further decrease the global competitiveness of South Africa's economy; and it will destroy opportunities to diversify our economy.

Implementation of the President's 10-point plan will address many existing barriers and allow **visibility** on a **clear pipeline of investible green projects** to enable the large-scale deployment of renewables. Once implemented, the President's 10-Point Power Crisis Plan will also remove many of these barriers. In addition, trade support and provision of concessional finance from developed countries to stimulate new green industries and mitigate transition risk will be critical. With Africa having only contributed ~3% of cumulative emissions globally and expected to be disproportionately affected by the physical risk of climate change – developed countries must play their part in enabling South Africa's Just Net Zero transition.

COORDINATE A NATIONAL GREEN INDUSTRIES INCUBATION AND AN ECONOMIC DIVERSIFICATION APPROACH

Building large-scale, renewable energy will alone create more jobs over time than are at immediate risk in "sunset" industries - such as the local coal or liquid fuels industry. For example, if South Africa can localise elements of the renewables energy value chain, ~2.4 million cumulative net job years can be created by 2050 in the power sector alone, and a further ~2.5 million cumulative net job years if South Africa captures the green H_2 opportunity.

In addressing both the challenge and the opportunity, the need to ensure a Just Transition and create enhanced economic opportunities for jobs displaced through the transition is urgent for the sectors at risk. In the coal value chain new 'green' jobs can and must be established ahead of the decline in jobs in the coal value chain – an inclusive strategic workforce and economic planning approach at national level is critical to enable the coordination required to ensure that no one is left behind.

However, **this will not be enough to solve the existing structural challenges of the economy and ensure a Just Transition. New economic opportunities must be pursued** with an unparalleled focus, leveraging South Africa's competitive advantages around the availability of high-quality renewables, access to key commodities, existing knowledge and skills, critical infrastructure, - such as port and rail infrastructure, trade partnerships and a growing, young population. It is through these interventions that a Just Transition that creates new jobs, skills and livelihoods can be realised.

This includes opportunities around the **localisation of renewable energy value chains**, the establishment of a **globally competitive green H_2 ecosystem**, and the creation of **decarbonised, energy-intensive manufacturing hubs** including, for example, an export corridor for green steel and synthetic fuels. The window is now opened to create an enabling business environment and reset South Africa's socio-economic trajectory.

National Business Initiative

5TH FLOOR, 61 KATHERINE STREET, DENNEHOF, 2196
PO BOX 294, AUCKLAND PARK, JOHANNESBURG 2006, SOUTH AFRICA
0861 123 624 (0861 123 NBI)
WWW.NBI.ORG.ZA
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