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Futures food for thought



Planning for employment effects of climate change in the mining sector

Takeaway

The entire mining sector in South Africa is vulnerable to climate change and to job losses as a result of the impact of climate change and the international trade responses to address climate change.

Every province has mining operations and related infrastructure in place and needs to plan now for the employment effects of climate change. There are key mitigation and adaptation interventions that could create jobs in some mining sub-sectors as well as beyond the mining sector, which need to be explored.

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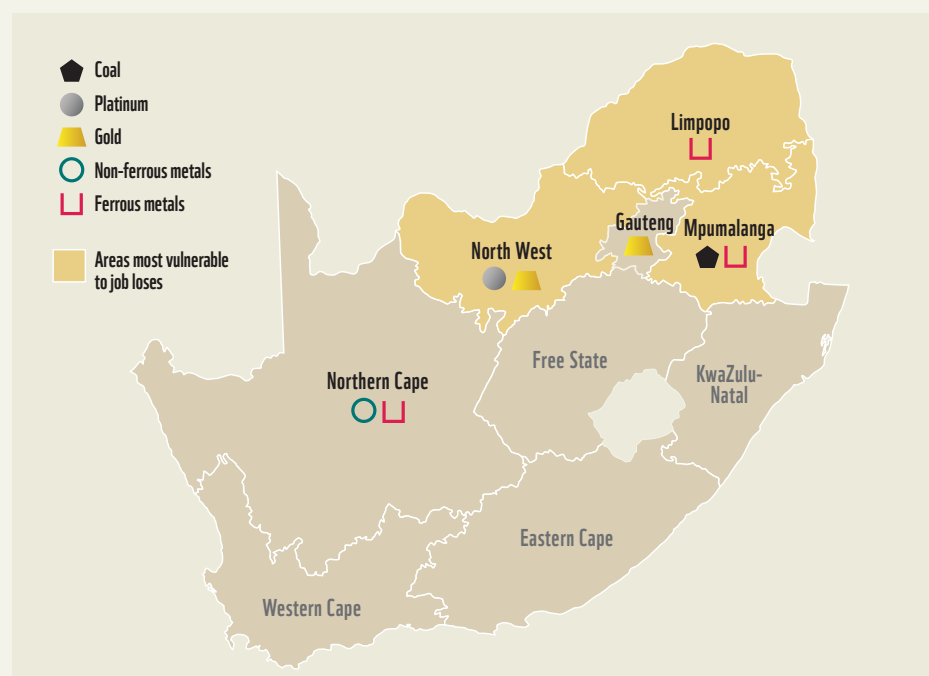
THE CLIMATE SITUATION IN THE SECTOR

Vulnerability to climate change impacts

The South African mining sector revolves around the mining of coal and lignite, diamonds, gold, platinum, ferrous, non-ferrous, and other precious metals and minerals. The entire mining sector is vulnerable to climate change and to job losses as a result of the biophysical impacts, international trade responses, and mitigation and adaptation efforts to address climate change. Coal and lignite mining is the most vulnerable, and is expected to face close to 6% job losses by 2030.¹

Although there are threats to all mining sub-sectors in each province, this map shows those mining sub-sectors that are particularly vulnerable to job losses. The mining sub-sectors in North West, Limpopo and Mpumalanga are particularly vulnerable.

Provinces expected to face most severe job losses by 2050, because of high vulnerability to climate change



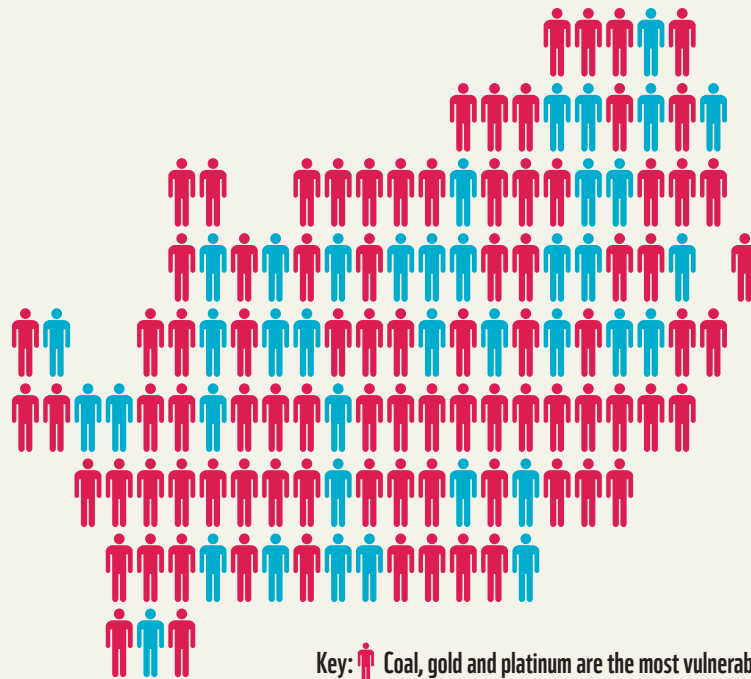
¹ The Department of Environmental Affairs (DEA), the Economic Development Department (EDD), together with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, appointed Stratecon to conduct NEVA and to develop Sector Jobs Resilience Plans (SJRPs) to address the (potential) job losses for vulnerable sectors due to the effects of climate change. The final report is entitled, *Employment Effects of Climate Change in South Africa: National Employment Vulnerability Assessment (NEVA) Sector Jobs Resilience Plans* (shortened here to NEVA, 2017).



Employment in mining and quarrying

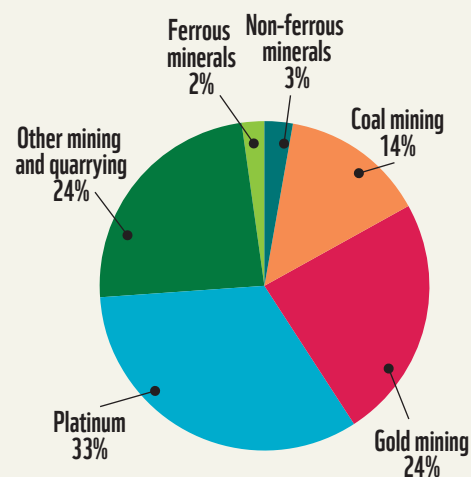
2015: Mining sector in South Africa, 2015^{2 3}

484 300
people employed
in the mining
sector

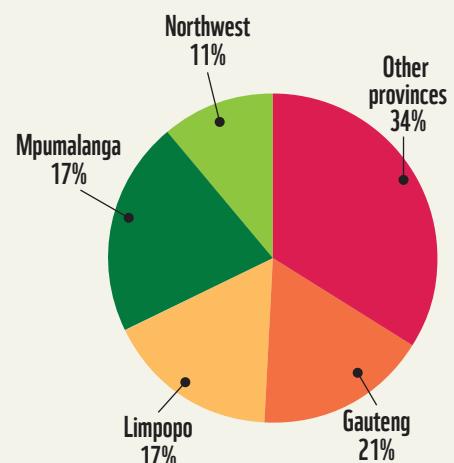


Coal, gold and platinum collectively account for almost 70% of jobs in mining sector, and are most vulnerable to job losses.

Employment in mining sub-sectors in South Africa, 2015



Employment in different provinces in three most vulnerable mining sectors – coal, gold and platinum, 2015



² Adapted from NEVA, 2017.

³ Stats SA, 2017. *Statistics South Africa Nesstar Data Set*. Retrieved from Quarterly Labour Force Statistics (4th Quarter, 2015): <http://interactive.statssa.gov.za.8282/webview>.

BIOPHYSICAL IMPACTS

are those direct climate change impacts such as drought, increased rainfall, extreme weather events and temperature changes.

Biophysical impacts

The biophysical impact of climate change can lead to as many as **14 700 job losses** across all sectors in South Africa.⁴

- Energy intensive sectors, namely gold and platinum, use 47% and 33% of the mining sector's annual electricity output, respectively.⁵ Both sectors are expected to lose most direct jobs – platinum is expected to lose 4 900 jobs and gold 3 500.
- Coal is also expected to lose some 2 200 jobs.

The NEVA developed two scenarios representing two extremes of possible outcomes: a “best-case” scenario, generally associated with warmer-wetter conditions; and a “worst-case” scenario, generally associated with hotter-drier conditions. According to the **worst-case scenario** by 2015, the biophysical impacts on mining are expected to be particularly severe in Limpopo and Mpumalanga.⁶

Provincial percentage change in mining and quarrying sector employment by 2050 for worst case biophysical impacts⁷

Sub-sector	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	Northern Cape	North West	Western Cape
2015: Employment (mining and quarrying)	1 000	35 000	105 000	8 000	76 000	61 000	22 000	172 000	3 000
Percentage (%) change in employment – worst biophysical conditions (2050)									
Coal & lignite	-5%			-5%	-5%	-5%			
Gold		-5%	-5%					-5%	
Platinum					-5%	-5%		-5%	
Ferrous minerals					-5%	-5%	-5%		
Non-ferrous minerals					-5%	-5%	-5%		
Other mining & quarrying resources	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%

⁴ NEVA, 2017.

⁵ Gaylor Montmasson-Clair, 2016. Mining, energy and low-carbon economy in South Africa: A platinum case study. Draft paper submitted to the 2016 TIPS Forum. Trade & Industrial Policy Strategies. Available online at: http://forum.tips.org.za/images/forum%20papers/2016/58c2c3_9792bb8acf91422c84020d0cd5bf625b.pdf.

⁶ NEVA, 2017.

⁷ NEVA, 2017.



INTERNATIONAL TRADE IMPACTS

are those impacts that arise because of the changed demand for goods as trading partners implement policies to reduce their own carbon emissions.

CARBON CAPTURE AND STORAGE (CCS)

is the process of capturing waste CO₂ from large sources and transporting and depositing it where it will not enter the atmosphere, for example underground.

International trade implications

The major source of vulnerability in the mining sector arises from the evolving response to climate change in international trade. The ongoing transition in national energy systems is bound to change the traditional models of energy production and consumption. Countries, financial institutions (including the World Bank), and sovereign wealth and pension funds are starting to increase their investment in clean energy technologies such as wind, solar and electric batteries at the cost of carbon-intensive economic activities and projects.

Such a shift could manifest itself in reduced demand for coal and increased demand for metals and minerals needed to manufacture windmills, solar panels and electric batteries, as well as trade restrictions on sectors that continue to remain carbon intensive. If left unaddressed, these changes could potentially lead to job losses.

It is estimated that various international trade responses to climate change could account for between **9 400 to 52 800 job losses in 2030** against a business-as-usual scenario in South Africa.⁸ In the worst case scenario (52 800 job losses):

- Platinum would lose **16 800** jobs, gold **11 900**, and coal **9 900**.
- Ferrous minerals, non-ferrous minerals and other mining and quarrying products are expected to collectively lose **6 300** jobs.

Factors unrelated to climate change are also expected to influence the ability of various sub-sectors to generate employment. One such factor is the dominance of exports to other countries, for example the export of minerals to China and coal to India, and the lower demand for these export goods. Already both China and India have announced plans to pursue ambitious targets for solar and wind energy. India along with France has also set up International Solar Alliance which aims to support solar resource-rich countries for the massive deployment of solar energy. These developments provide strong signals for transitioning away from a fossil fuel-based energy system and towards an increase in appetite for metals and minerals that will serve as the raw material for wind and solar energy. The sooner the South African mining sector starts transitioning towards these changes, the less vulnerable it will be to the legislative, political or economic shifts of its trading partners away from fossil fuels, and the easier it will be to avoid job losses in the mining sector.

8 NEVA, 2017.



An off-shore wind turbine comprises of 80% steel by mass. The average copper requirement for a single 5 MW on-shore turbine is 8 tonnes compared to 30 tonnes for an off-shore turbine, as a result of the grid connection requirements.



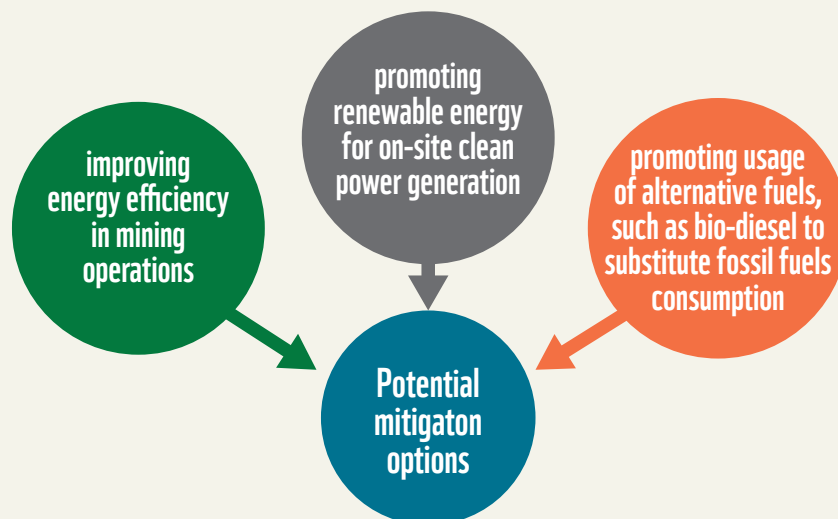
Mitigation/adaptation/mitidaption interventions

In line with South Africa's Nationally Determined Contribution (NDC) towards the Paris Agreement, mitigation and adaptation interventions need to be undertaken. Except for coal and lignite mining, all mining sub-sectors are expected to witness some job gains on account of these interventions, particularly in platinum mining. These job gains could be related to new infrastructure development such as windmills and solar parks, but could also be maintenance-related. Although small, these job gains create incentives to undertake mitigation and adaptation interventions in some sub-sectors and provide some significant options to explore.

MITIGATION EFFORTS

are those interventions undertaken to reduce carbon-emissions.

Key mitigation options for the mining sector

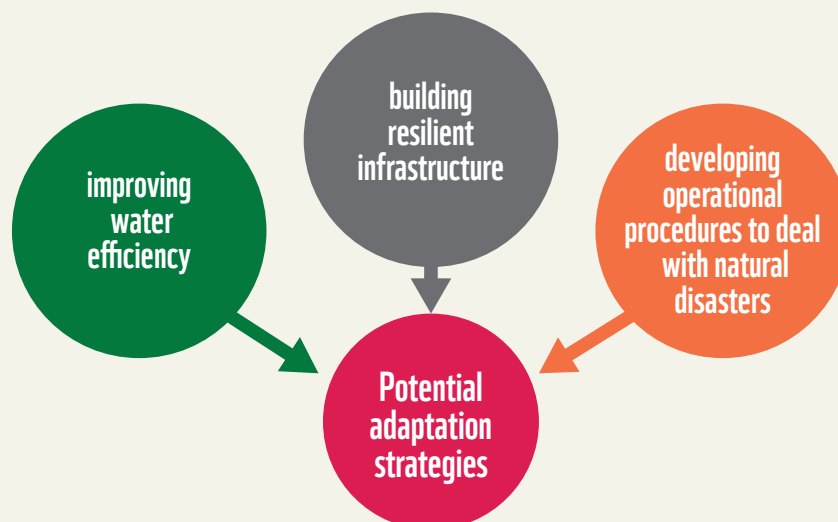


There are also important adaptation strategies that could help to minimise vulnerability to the impacts of climate change.

ADAPTATION EFFORTS

are those interventions undertaken to adapt to the biophysical impacts of climate change.

Key adaptation strategies in the mining sector



looking at work



Governments distribute a limited number of CO₂ “credits” to companies. Companies can only emit as much CO₂ as they have credits for. Those below their CO₂ limit can sell credits to companies that exceed the limit. The same applies to emissions trading between countries.

Job risks and barriers to re-employment in other sectors

A substantial percentage (70%) of the labour force in the coal and gold mining sub-sectors which are expected to be worst hit by job losses are semi-skilled, although coal mining employs some skilled labour.

The table below provides an overview of the job losses expected by 2030 in the mining sector, under two climate change scenarios:

- **Worst** biophysical impacts and setting up of an **emission trading system** to help companies mitigate their carbon emissions.
- **Best** (least) biophysical impacts and setting up of a **no-lose crediting system**.

Employment impacts in mining sub-sectors⁹

Employment impacts, 2030		Climate change		Mitigation & adaptation	Net job impact		% change in net jobs	
Sub-sector	Employment SA	Worst & emissions trading	Best & no-lose crediting		Worst & emissions trading	Best & no-lose crediting	Worst & emissions trading	Best & no-lose crediting
Coal & lignite mining	74 441	-4 210	-4 041	-412	-4 622	-4 453	-6%	-6%
Gold mining	163 223	-6 258	-6 006	664	-5 594	-5 342	-3%	-3%
Platinum mining	150 358	-5 796	-5 524	979	-4 817	-4 545	-3%	-3%
Ferrous mineral mining	41 312	-1 615	-1 512	562	-1 053	-950	-3%	-2%
Non-ferrous mineral mining	14 241	-577	-516	345	-232	-171	-2%	-1%
Other mining and quarrying products	111 273	-4 297	-4 297	739	-3 558	-3 347	-3%	-3%

The following aspects stand out from this table:

- Coal and lignite mining is expected to witness a high percentage of job losses due to climate change (between 4 041–4 210). A further 412 are expected if it adopts mitigation and adaptation measures. As a result, **6% job losses** are expected in the sub-sector.
- While the platinum sector is expected to lose 5 524–5 796 jobs due to climate change, it is also expected to generate close to 1 000 new jobs by undertaking mitigation and adaptation interventions. As a result, it manages to bring down job losses in the sub-sector to only **3%**.

NO-LOSE CREDITING SCENARIO

is when carbon emission targets are taken on voluntarily by developing countries for some sectors. The 'no-lose' feature means that developing countries would not face compliance penalties if they exceeded their carbon emissions targets.

Skills development

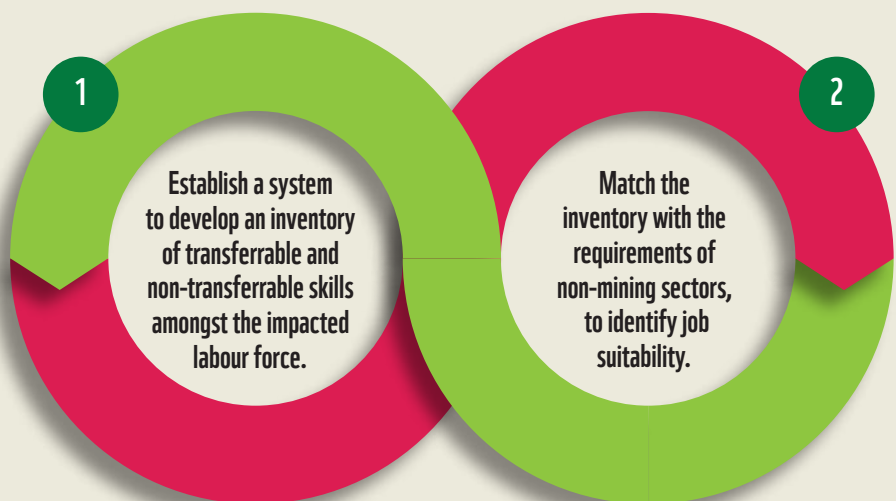
All mining sub-sectors are expected to lose jobs to a certain degree. It will therefore be important to make strategic and timely investments in shifting employees to non-mining operations or new mining sectors, particularly those working in coal and lignite mining, but also in gold and platinum mining. This also requires strategic investments in training unskilled and semi-skilled employees to shift to other mining operations.

However, major challenges would remain in addressing job losses, for example:

- There are within-sector constraints in moving from underground mining to opencast mining. Each requires a different set of skills.
- It might be difficult to transfer skilled labourers to other sectors, as they might lack the required specialised skills.
- It might not be possible to accommodate the majority of the unemployed labour force within other mining sub-sectors. Therefore investments are needed to transfer new skillsets.

Even without climate change, gold mining is already considered a sunset industry because of the difficulty in reaching deeper ore deposits. Thus options for addressing employment vulnerabilities outside of mining need to be seriously considered.

A two-pronged approach is needed



Job or livelihood opportunities

Mitigation employment opportunities

- Energy-efficiency interventions have limited job creation potential. In the mining sector such interventions might include for example, installing efficient Heating, Ventilation and Air Conditioning (HVAC) systems and variable speed drives in pumps and coolers in new clean power plants. Employment can be generated during the construction phase of these plants.
- Operation and maintenance-related jobs that can provide longer-term employment opportunities can also be created.
- Using alternative fuels such as biofuels (growing crops for fuel purposes) can generate more job opportunities, and also has an indirect impact on the agriculture sector.

Adaptation employment opportunities

- Building resilient infrastructure and developing operational procedures to deal with natural disasters can provide substantial employment generation opportunities.
- Due to the site-specific nature of adaptation interventions, job creation will also be site-specific. This can provide job stability to employees, however, there is limited mobility, growth opportunity or skills portability.

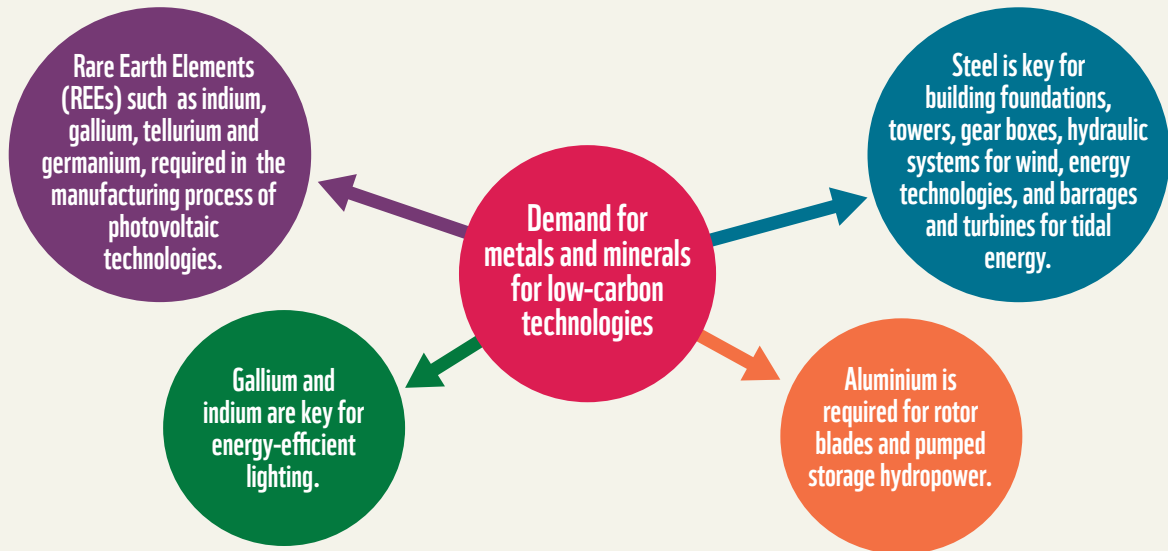
The shift to a low-carbon economy presents new opportunities to the mining sector

According to the World Bank, the technologies that will play an important role in the clean energy shift are expected to be “more material intensive in their composition than current traditional fossil fuel-based energy supply systems”.¹⁰ This implies that there will be a growing demand for certain metals and minerals to support the **clean energy transition**.

10 World Bank, 2017. *The Growing Role of Minerals and Metals for a Low Carbon Future*.



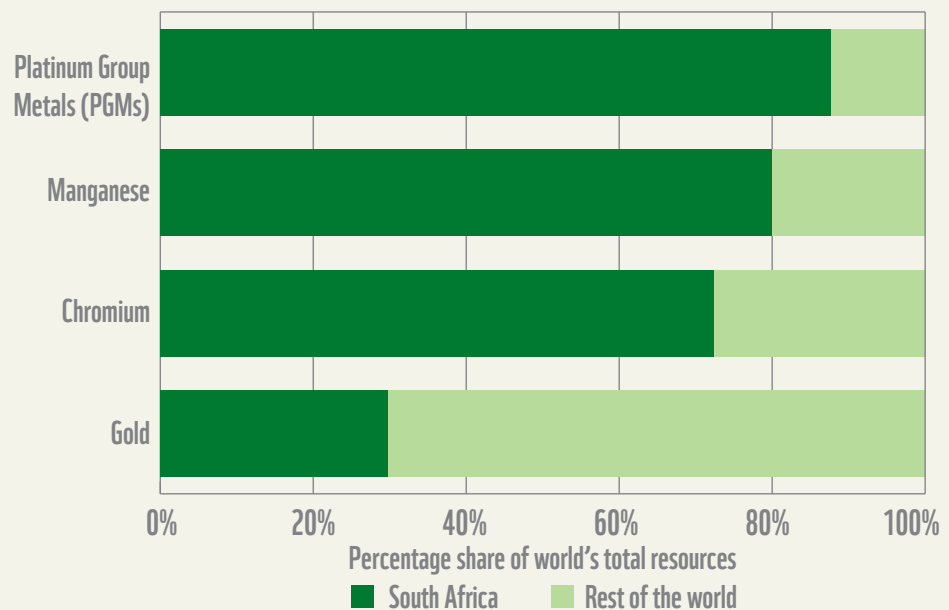
Growing demand for metals and minerals for low-carbon technologies¹¹



Key opportunities

South Africa has the mineral deposits, already produces some of them, and has the infrastructure and skills required for the development of these minerals, which lie at the heart of a low-carbon transition. This presents an important opportunity for the mining sector to transfer some employees from one sub-sector to another.

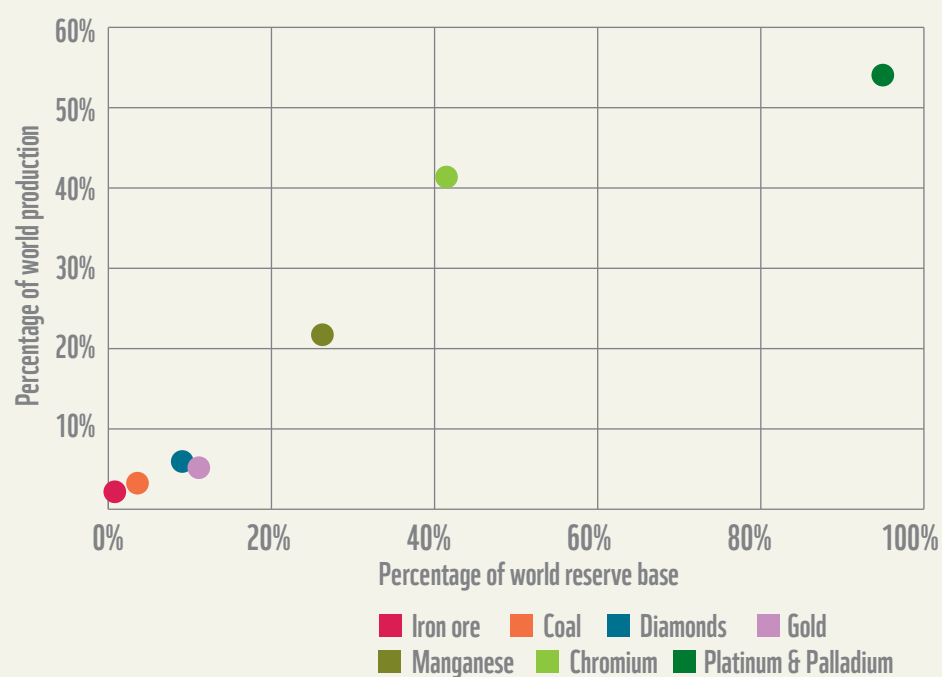
South Africa's percentage share of world's total resources of specific metals



¹¹ Adapted from NEVA, 2017.



South Africa's mineral resources (percentage of world's total reserves)¹²



¹² Baxter, R., 2016. *Mining in South Africa: The challenges and the opportunities*.



In addition:

- The Bushveld Complex is thought to contain some of the richest ore deposits on earth, including the Platinum Group Metals (PGMs), tin, iron, titanium and chromium.¹³
- South Africa accounts for 80% of identified manganese resources. The cumulative demand for manganese in 2013–2050, in the 2 °C scenario compared with the 6 °C scenario, is expected to increase by 2 590%.¹⁴
- Deposits of heavy rare earth oxides such as europium, terbium and dysprosium are thought to be available.¹⁵

In terms of global production of mineral resources, South Africa accounts for:

- Over 40% of ferrochromium, PGMs and vanadium
- 51,7% of global ferrochromium exports and 54% of alumino-silicates.

Shifting the existing skillset

There is a disincentive in the coal and lignite sub-sector to undertake mitigation and adaptation interventions as they will potentially lead to job losses. However, the transition to clean energy and low-carbon technologies is actually contingent on the availability of the metals and minerals, and creates new opportunities to shift miners away from coal and lignite without requiring a substantial shift in the existing skillset.

To ensure that job opportunities are maximised and that employees are assisted with identifying and securing these opportunities, it is important to engage with key stakeholders to coordinate the shift away from coal mining in a planned manner towards other mining sub-sectors and also towards non-mining sectors.

13 Hydrogen South Africa (HySA), 2015. Hydrogen and Fuel Cell Technologies. Frequently Asked Questions. Department of Science and Technology, Republic of South Africa and South African Agency for Science and Technology Advancement (SAASTA).

14 World Bank, 2017. *The Growing Role of Minerals and Metals for a Low Carbon Future*.

15 Frontier Rare Earths. Undated. Zandkopsdrift rare earth project comprises an area of approximately 60,000ha in the Namaqualand region of the Northern Cape Province of South Africa and includes the Zandkopsdrift rare earth deposit. Available at <http://www.frontierrareearths.com/zandkopsdrift-rare-earths-project/>.

FOOD FOR THOUGHT

- Unemployment creates financial and emotional stress. It is also often stigmatised. How can unemployment be destigmatised, for example by using the **unemployment period as an opportunity to update and enhance the worker's skillset**?
- Institutional and financial support is needed to set up a training organisation to provide unemployed workers with the pertinent skills that are in sync with the demands of a changing work environment. Such an organisation could also provide workers with a peer group with whom to consult and draw on for motivation.
- **Further research** is needed into the models adopted by different countries to address unemployment and how the mechanism used were established. For example, Nordic countries such as Sweden and Norway have social security systems that provide continuous support, training and feedback to individuals during the unemployment phase as a means to enable them to upgrade their skillset.
- **Implementation gap** – the gap between policy-stated objectives and actual implementation of the policy – is often cited as a common problem in South Africa. How can a mining policy aimed at addressing job loss from climate change be made immune to the implementation gap? Who will have the key responsibility for closing this gap?
- What are the **non-climate drivers** that can be tapped to adapt the mining sector to the challenges posed by climate change?
- What can be done to **address trade restrictions** arising due to climate change?



TALKING POINTS

- In sub-sectors facing unavoidable job losses, can **partial employment** (e.g. 50%, 75% employment) be a means to avoid retrenchment?
- What needs to be done to make **future skills easily accessible and transferrable** in the labour market?
- Is **infrastructure development** a sustainable and long-term solution to address challenges posed by climate change to the mining sector?
- What is **sustainable mining**?





Futures food for thought

The climate change mitigation debate in South Africa needs to move from improving efficiency within a projection of the existing economy, to innovation and options beyond the constraints of the current dispensation and structure of the economy. It may take step changes in the development path to achieve mitigation adequate to South Africa domestic and international commitments, and maximise economic development and social wellbeing. Business models presently unconsidered may be waiting in the wings.

The 'Low-carbon development frameworks in South Africa' project seeks to deepen understanding of, and reveal opportunities for, transitions to a low-carbon economy. It facilitates and develops contributions at the intersection of climate change mitigation, economic development and socio-economic dimensions, across immediate, medium and long-term horizons.

Working variously with government, business and labour, the project reaches from providing input to emerging government mitigation policies and measures; through investigating the business and socio-economic case for selected mitigation initiatives which hold growth potential in energy, transport, industry, waste, and land use; to analysing potential future economic trajectories and the systemic opportunities offered by these.

This paper is one in a set of 'Futures food for thought' papers. It examines the potential employment effects of climate change in the mining sector, and the planning needed to minimise job losses and maximise job opportunities.

The project is funded by the International Climate Initiative (IKI) of the Federal Ministry for the Environment (BMUB) of Germany, and implemented by WWF South Africa.

WWF South Africa's Policy and Futures Unit undertakes enquiry into the possibility of a new economy that advances a sustainable future. The unit convenes, investigates, demonstrates and articulates for policy-makers, industry and other players the importance of lateral and long term systemic thinking. The work of the unit is oriented towards solutions for the future of food, water, power and transport, against the backdrop of climate change, urbanisation and regional dynamics. The overarching aim is to promote and support a managed transition to a resilient future for South Africa's people and environment. The organisation also focuses on natural resources in the areas of marine, freshwater, land, species and agriculture.

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