TRADE & INDUSTRIAL POLICY STRATEGIES

A TALE OF LIFE AND DEATH: THE COAL VALUE CHAIN'S IMPACTS ON LOCAL COMMUNITIES IN SOUTH AFRICA

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TIPS supports policy development through research and dialogue. Its areas of focus are industrial policy, trade and regional integration, sustainable growth, and a just transition to a sustainable inclusive economy

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CONTENTS

ABBREVIATIONS

AMD	Acid Mine Drainage
CSI	Corporate Social Investment
CTL	Coal-to-liquids
ECD	Early Childhood Development
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GVA	Gross Value Added
IPCC	Intergovernmental Panel on Climate Change
MDC	Maputo Development Corridor
MEC	Minerals-Energy Complex
NGOs	Non-Governmental Organisations
PV	Photovoltaic
SMME	Small, Medium and Micro Enterprises

1. INTRODUCTION

The coal value chain plays a structural role in the South African economy. Coal is core to electricity generation, chemicals production and several other industrial activities. But the coal value chain is also a significant source of greenhouse gas (GHG) emissions and other environmental impacts. The value chain accounted for 60% of South Africa's GHG emissions in 2019. In 2020, Eskom and Sasol accounted for 45% and 10% of total emissions respectively (Makgetla and Patel, 2021).

To keep global temperatures from exceeding 1.5°C compared to the pre-industrial era, the Intergovernmental Panel on Climate Change (IPCC) recommends that coal-powered electricity should account for only 1% of the global electricity mix by 2050 (Taylor et al., 2018). And, according to International Energy Agency estimates, to be on a global net-zero emissions pathway, coal demand should decline by 98% by 2050, accounting for less than 1% of total global energy (IEA, 2021). Effectively, no new unabated coal plants should have been approved for development from 2021. Unabated coal should be phased out by 2030 in advanced economies and 2040 globally, to reach net-zero emissions electricity worldwide.

In line with the Paris Agreement on Climate Change, countries around the world, including South Africa, have committed to phasing out coal and other fossil fuels. Due to international and domestic climate change, action and policies, coal is facing multifaceted risks.

On the domestic side, the 2019 Integrated Resources Plan for Electricity (IRP) outlines government's plan to decrease coal-powered generation capacity from 71% in 2019 to 43% in 2030 (DMRE, 2020; Merchant, 2018). Eskom, the country's power utility, which consumes over 80% of domestic coal, has begun decommissioning its old power stations. Eleven units at Hendrina, Grootvlei and Komati closed in 2019, and the power utility has announced a decommissioning schedule which plans to close six ageing coal power stations by 2030, two more by 2035, and a further three by 2043 (Centre for Environmental Rights, 2019; Eskom, 2018). Sasol, which consumes 10% of domestic coal, announced plans in 2020 to cut GHG emissions by between 6%-10% in 10 years, by pivoting away from coal towards gas, renewable energy and green hydrogen (Sasol, 2020a).

In the long term, coal exports also face significant risks. In volume terms, South Africa exports 50% of its coal. Of that, 73% is exported to four countries: India (36%), Pakistan (18%), China (13%) and South Korea (6%) (Trade Map, 2022). While coal will remain central to China's energy mix, India, Pakistan and South Korea have committed to increasing their renewable energy capacity and decreasing their reliance on (imported) coal. India's government is stepping up efforts to reduce its reliance on thermal coal imports and improve energy security. The country is rapidly transforming its national electricity system through a significant increase in renewable energy capacity. Despite increases in coal imports from South Africa amid the Russia invasion of Ukraine, India still plans to significantly cut thermal coal imports as part of its energy resilience strategy (Mining Technology, 2020). Pakistan also plans to replace imports with domestic coal. To address its power sector's financial crisis, the government announced plans to convert existing plants using imported coal to use domestic coal instead (Institute for Energy Economics and Financial Analysis, 2020). South Korea has announced plans to achieve net-zero emissions by 2050. The plan aims to replace coal-fired power plants with renewable energy. Coal power generation is expected to fall by 23% by 2030 and 30 coal-powered plants will be shut down by 2034. Furthermore, South African coal exporters seeking opportunities in other markets are likely to be disappointed in the long run. As coal markets dry up, South Africa will see increased competition from Indonesia, Australia and Russia (Nicholas and Buckley, 2019).

Coal investments have also seen a significant decline both locally and domestically. Coal majors have started to divest from South Africa's assets. Other coal companies have announced they will no longer invest in new thermal coal projects. Major global investors are diversifying their holdings away from fossil fuels. Since 2018, financial institutions, including South African banks, have restricted coal financing (Mills, 2021; Pearce, 2020).

The transition away from coal is, as such, inevitable. Coal workers and the areas where coal is concentrated are vulnerable to this transition. Furthermore, this new transition comes on top of an existing unequal situation. As such, labour unions, communities, civil society, government, and also businesses, have made calls for a just transition away from coal. Just transition is an inclusive process and outcome, which offers social protection and guarantees to workers, communities and small businesses in industries that are in decline due to climate change impacts. It aims to ensure minimum disruptions for workers and communities that are dependent on unsustainable industries and energy resources, and ideally set a course through which vulnerable stakeholders are better off (Montmasson-Clair, 2021).

The just transition agenda is rooted in democracy and social dialogue between workers, communities, government and businesses. Workers and communities depending on fossil fuels and extractive industries can disproportionately incur the costs of these industries and their exit. A genuine just transition encompasses a range of enabling social interventions to empower vulnerable groups and ensure their resilience against climate shocks while making an effort to address social and economic inequality, poverty and unemployment (Hermanus and Montmasson-Clair, 2021a; 2021b; Makgetla et al., 2019).

This working paper unpacks the impacts of a transition away from coal on affected communities in South Africa. It takes a multi-layered approach highlighting the economic, social, and environmental impacts coal has had to date and the implications of a transition on communities. It is outlined as follows: Sections 2, 3 and 4 discuss the economic, socio-economic and environmental impacts of coal-related activities and their closure on communities. Section 5 concludes with policy implications.

2. BREAD ON THE TABLE: A SOURCE OF ECONOMIC DEVELOPMENT

The historical development of the coal value chain in South Africa has been a defining feature of the country's economy. The mineral endowment has been a source of economic activity, employment and economic development for the country and has provided a livelihood to many.

2.1. A source of economic activity

The coal value chain runs deep, from coal mining and transport to power generation, petrochemical production, steel making and cement production. In addition, many industrial activities, such as aluminium smelting, have been historically linked to the supply of abundant, cheap electricity based on coal-fired power generation (Montmasson-Clair et al., 2022). Other sectors of the economy have also depended on electricity supply, and consequently the coal value chain, to some degree.

South Africa is the 8th largest coal miner in the world. By value, coal is South Africa's single largest export product at the six-digit HS code level, and 4th largest at the four-digit HS code level (Trade Map, 2022). In 2020, coal exports generated R4.5 billion in revenue. Coal accounted for 24% of the value added in the mining sector in 2020 and generated R130.5 billion in total sales. In 2018, the coal industry contributed 5.4% to gross domestic product (GDP) and, in 2020, coal mining directly employed 91 649 people (Makgetla and Patel, 2021; Minerals Council, 2019).

Coal is the primary energy source fuelling electricity generation in South Africa, essentially through South Africa's national utility Eskom. Over 80% of installed electricity capacity still relied on coal as a feedstock in 2018, and over 86% of electricity was generated from coal in 2018 (Department of Energy, 2019).

Furthermore, Sasol's coal-to-liquids (CTL) operations, which relies on four vertically-integrated mines, accounted for about 10% of South Africa's coal use in 2019. The Secunda Synfuels plant, the world's largest CTL plant, produced about 20% of South Africa's fuel needs in 2019 and provides domestic feedstock to the country's chemical industry (Sasol, 2020a).

Coal is also key to the production of iron and steel, as an input into the blast oxygen furnaces, and chemical energy in the reductant to transform iron-oxide ores into steel. In addition to direct coal use, steelmaking requires large amounts of electricity (CorsaCoal, n.d.). In 2019, ArcelorMittal South Africa, the dominant national steel producer, consumed 3.5% of Eskom's electricity (Makgetla and Patel, 2021).

Coal feeds into the production of cement, as a fuel source in the making of clinker. Burning coal to fire kilns is the primary method of cement production in South Africa (Department of Mineral Resources, 2018). In addition, coal ash produced at coal-fired power stations can be used as a component in cement rotary kiln feeds and a mineral additive in concrete mixes.

The availability of cheap and abundant coal-based electricity has also played a key role in the development of South Africa's aluminium industry. The aluminium industry owes its origins to a coal beneficiation strategy linked to the abundant power available in the 1980s to 2000s (Aluminium Federation of South Africa, 2017). The primary aluminium producer consumed about 10% of Eskom's electricity in 2020 (Eskom, 2021).

Beyond the direct activities, the coal value chain underpins many other businesses, either indirectly relying on or supplying the coal value chain, or servicing the people employed in it. Suppliers to the value chain provide a variety of goods and services. These can range from bottleneck or strategic commodities (such as equipment, machinery and utility vehicles) to routine commodities (such as stationery, toiletries, office and grounds cleaning, food and beverages, personal protective clothing, consumables and spares) (Molefe and Ashworth, 2004). Machinery and equipment maintenance, parts and repairs are also services that rely partly on the coal value chain. For instance, in 2019, Anglo American South Africa spent R1.3 billion on mine-community suppliers, primarily for routine commodities. Of these supplier contracts, 90% of the companies were 100% black-owned (Anglo American South Africa, 2019). Anglo American reportedly spent R121 million on local procurement through its Zimele programme in 2016. The programme funds were spent on 110 companies that employ close to 4 000 people. Over the last 30 years, the Zimele programme has funded more than 2 300 small, medium and micro enterprises (SMMEs) and supported more than 50 000 jobs (Anglo American South Africa, 2019). Similarly, Sasol has supported over 700 small businesses and disbursed over R65 million in loans to black-owned SMMEs from 2008 to 2017 (Sasol, 2021).

Coal transportation is another key adjacent economic activity. Eskom transports coal to its various coal-powered plants through a fleet of over 2 000 trucks, contracted through 58 logistics contracts. Transnet Freight Rail carries coal for export. In 2019, about 20% of Transnet's revenue was from coal contracts (Transnet, 2019). The coal line starts in Mpumalanga and descends from the Highveld for 580km through KwaZulu-Natal to Richard's Bay. The Richard's Bay Coal Terminal is a 24-hour operation and is the single largest coal export terminal in the world, exporting more than 69 million tonnes per annum (Makgetla et al., 2019).

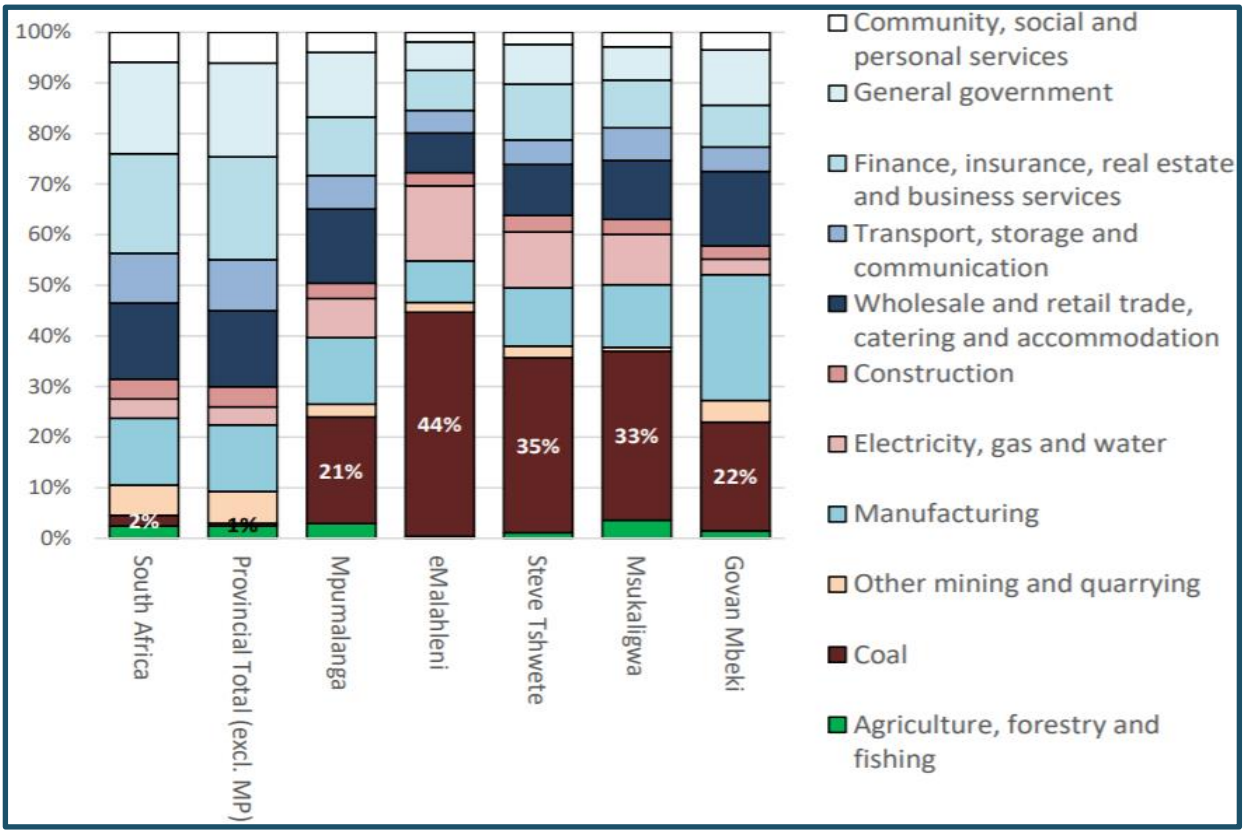
Coal-related activities are particularly central in Mpumalanga where the coal value chain is concentrated. About 80% of coal production (in volume) originates from four municipalities, namely eMalahleni, Steve Tshwete, Govan Mbeki and Msukaligwa.[1]

Coal-powered electricity generation is also concentrated in Mpumalanga, with 11 out of 13 Eskom coal-fired power stations located in the province. Sasol's CTL facility, the largest coal liquefaction plant in the world, is also located in Mpumalanga, in Secunda in the Govan Mbeki municipality (Makgetla and Patel, 2021; Mpumalanga Government, 2008).

As shown in Figure 1, coal mining accounted for 2.4% of the country's Gross Value Added (GVA) in 2018, and 21% of Mpumalanga's GVA (Makgetla and Patel, 2021). Furthermore, it is a dominant economic activity in coal-dependent municipalities, contributing to 44% of GVA in eMalahleni, more than a third in Steve Tshwhete and Msukaligwa and 22% in Govan Mbeki in 2018.

[1] Remaining coal-related activities are located in Mpumalanga (Ermelo), Limpopo (Soutpansberg and Waterberg), KwaZulu-Natal (Kliprivier, Nongoma, Utrecht and Vryheid) and Free State (Sasolburg and KaNgwane).

Figure 1: GVA segmentation for selected locations, 2018



Source: (Makgetla et al., 2019) calculated from Quantec EasyData

2.2. A source of employment and livelihood

Corresponding to its economic weight, the coal value chain is a source of employment in the country, particularly in coal-dependent regions. At present, about 150 000 people are directly employed in the coal value chain in South Africa. About three out of four of these jobs are inherently linked to the production and transport of coal. Mining accounts for the lion's share, with about two-third (91 600) of total direct jobs. Transport-related jobs stand around 15 000, spilt between Transnet Freight Rail (an estimated 12 000), the Richards Bay Coal Terminal (about 500) and coal trucking (about 200 small businesses employing 2 000-4 000 people). The remaining direct coal jobs are located at the point of consumption, essentially in power generation (an estimated 10 000), petrochemical production (close to 18 000), steelmaking (more than 6500) and cement production (about 7 000) (Hermanus and Montmasson-Clair, 2021a).

In addition to direct jobs, the value chain indirectly supports a wide array of activities, creating employment opportunities in the country, especially in coal-dependent communities. Although the data on indirect employment opportunities arising from the coal value chain is limited, literature based on United States coal mining towns shows that there is a 4:1 employment ratio for direct and indirect employment, meaning when 100 direct coal jobs are created 25 indirect jobs are created. In South Africa, according to a SRK Consulting report for Eskom, the ratio is estimated at around 1:2 (Headley and Bezdek, 2020; SRK Consulting, 2017). In addition, workers in coal mining support on average 3 to 10 dependents (Burton et al., 2018).

Furthermore, people employed in the coal value chain fare better than those in many other parts of the economy. The median income for coal miners was R7 000 a month in 2019 (Makgetla, 2021). The average annual remuneration of coal contractors, who make up 59% of the industry, was R142 000 in 2020 (Minerals Council, 2021). The median pay in coal mining and heavy chemicals was over R10 000 a month in 2017, and close to R15 000 for electricity workers, compared to just over R5000 for other formal workers (Makgetla et al., 2019).

The relatively high earnings of coal mine workers will make it more difficult to develop equivalent livelihoods when coal employment declines.

Employment in the value chain is furthermore a key source of social safety. Although the role of contractors has grown significantly over the last two decades (to reach 59% of the coal mining workforce in 2020), the country's labour movement has been instrumental in securing relatively better-paid, stable employment within an organised labour force with access to collective bargaining, advancing labour rights and worker interests.

Over 70% of miners are union members, compared with 67% of workers in electricity generation and 45% in basic chemicals. In the formal economy as a whole, union membership stands at only 35%. Most coal workers report that they get leave and have written contracts in line with labour law requirements. In addition, 80% of workers in the coal value chain had retirement funds in 2017, compared to less than 60% of other formal workers. Similarly, the coal value chain has a greater level of participation in the Unemployment Insurance Fund than the rest of the economy, ranging from over 90% in coal to around 75% in basic chemicals (Hermanus and Montmasson-Clair, 2021a; Makgetla and Patel, 2021).

In addition to employment related to production, the small businesses which service mining activities and mine workers in the coal towns are also a source of employment.

Box 1: Eskom power stations planned for decommissioning

Eskom has a decommissioning plan for its ageing power stations. In 2019, Camden, Grootvlei, Hendrina, Komati and Kriel power stations were slated to be decommissioned by 2030. These power plants are older than 40 years and reaching their designed end of life.

Decommissioning of these power stations will have a significant impact on the workers and local communities. They directly employ between 600-1500 workers each. The estimated indirect employment is double that of direct employment (KPMG, 2017). According to the KMPG (2017) report, by 2050, the decommissioning of Eskom's power stations could lead to around 20 000 job losses for coal miners.

Eskom is expected to provide social and labour plans for workers; however, the details of the plans are not available. In addition to the direct Eskom employees, contractors will also be impacted by the decommissioning of power stations. Contractors are more vulnerable as they are not Eskom employees, meaning they will not get a retrenchment package or any other measures designed to shield workers from job losses. Contractors tend to have links to the local communities as they sub-contract people from the communities.

Table 1 highlights the economic impact of these power stations on their local communities (KPMG, 2017). The estimated combined economic impact of the power stations stood at R32.8 billion in 2014/15-2015/16, for an estimated government revenue of R9 billion a year. Household income linked to the five plants was estimated to be R21.1 billion on average a year. Collectively, the power stations contributed R9.6 billion to local municipality GDP in 2014/15-2015/16.

Table 1: The economic impact of Eskom's coal-fired power stations

Indicator	Camden	Grootvlei	Hendrina	Komati	Kriel
Workforce is primarily from	Ermerlo (96%)	Rest of South Africa (67%)	Middleburg (52%)	Rest of Mpumalanga (55%)	Kriel (55%)
Contribution to local municipal GDP	R1.1 billion (9.3%)	R0.5 billion (1%)	R2 bn (4.3%)	R1.4 billion (2.9%)	R4.6 billion (7.7%)
Contribution to provincial GDP	R4.4 billion	R3.b billion	R3.4 billion	R2.9 billion	R5.7 billion
Direct jobs (share of local municipality workforce)	3315 (8.2%)	1102 (1.2%)	6085 (6.5%)	2729 (2.9%)	13 297 (8.9%)
Mpumalanga tax revenue	R982 million	R793 million	R880 million	R693 million	R1.4 billion
Household income	R1.5 billion	R1.2 billion	R2.9 billion	R2 billion	R2.9 billion

Source: KPMG; Van Seventer et al., 2019.

The Hendrina, Komati and Grootvlei power stations are among the first plants of Eskom's fleet to be decommissioned due to age. In 2021, Eskom prepared proposals for repurposing the Komati, Grootvlei and Camden power stations. The repurposing and repowering proposals could include a combination of natural gas, renewable energy and battery storage projects. The purpose is to use the existing infrastructure to reduce the cost and complexity of connecting new plants onto the grid (Global Energy Monitor, 2022)

Komati is set to be the flagship power station in Eskom's Just Energy Transition project for subsequent repowering projects. Komati is planned to be repowered using solar photovoltaic (PV), and wind technology, supported by 244MWh battery storage. In addition to repowering Komati, a containerised microgrid assembly factory has been established. Furthermore, Eskom is planning a 500kW agrivoltaic pilot plant, which combines solar photovoltaic technology with agricultural activities. Eskom will also provide a training facility that will provide three-to-four year courses for Eskom employees and members of the surrounding community. Eskom plans to launch repowering projects for 1.2GW at Grootvlei, 2GW at Hendrina, and 1.56GW at Camden.

2.3. Access to infrastructure

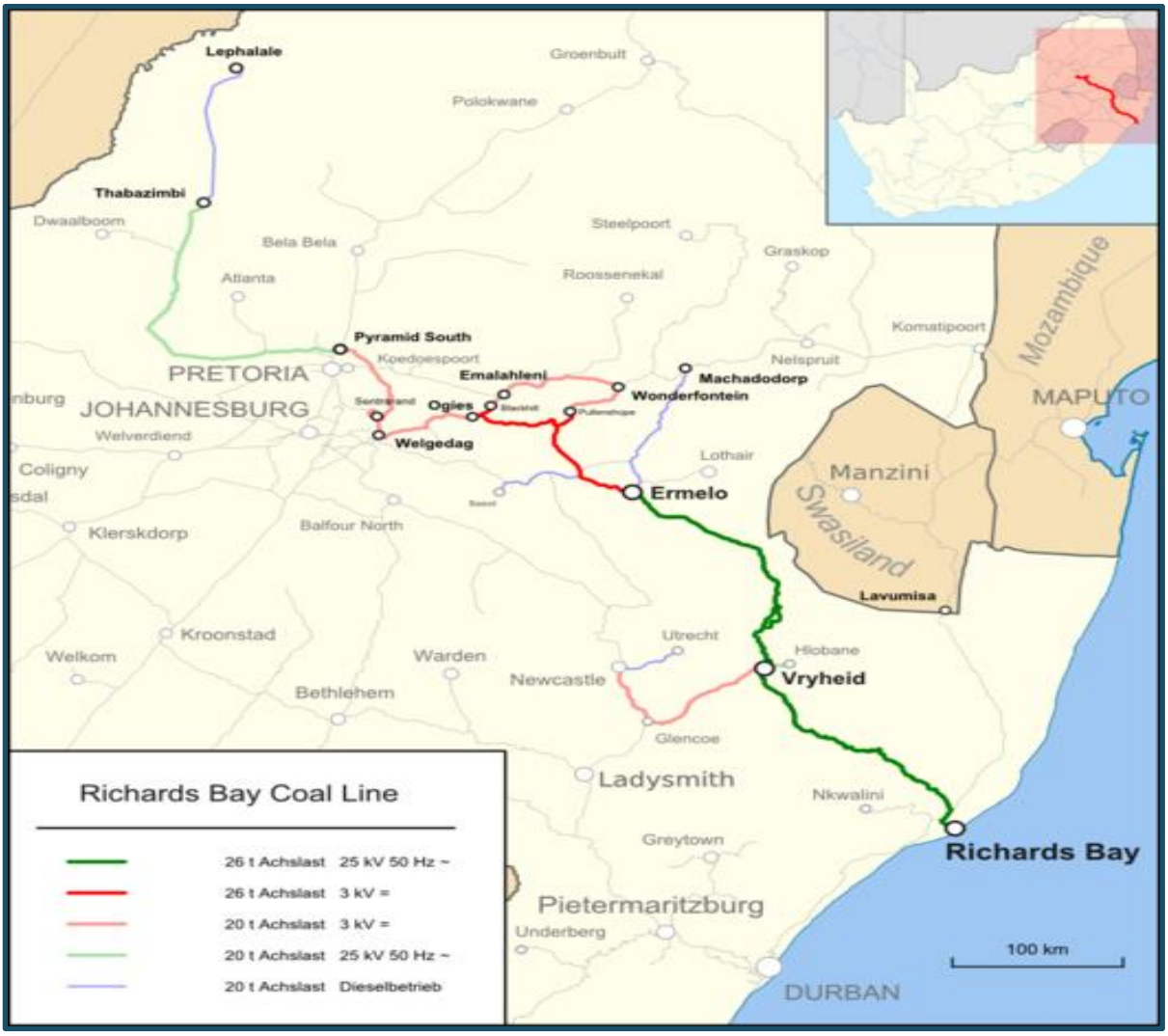
Communities that depend on a single industry have long-standing investments in infrastructure, businesses, public institutions, skills and information systems to support it. They have not built up a similarly supportive environment for other productive activities.

The development of the coal value chain has historically shaped the rollout of strategic infrastructure in the country. The extraction of South African's coal endowment has been integral in the development of energy, water, transport (road, rail, ports) and other strategic infrastructure in the country. The Minerals-Energy Complex (MEC) allowed for the accumulation of productive and infrastructural capacities. With state support, extensive physical infrastructure and technical expertise were developed over decades to serve the MEC (Ashman, 2015).

2.3.1 Transport infrastructure: Ports, rail and road freight

The Richards Bay Harbour is the primary export port for coal in South Africa, exporting 95% of the country's coal. The remaining 5% is exported through Durban Harbour, and Beitbridge and Groblersbrug border posts (RBCT, 2014). The Richards Bay Harbour is managed by Richards Bay Coal Terminal, a consortium of large coal producers and exporters. To transport coal from deposits to Richards Bay, the Mpumalanga to Richards Bay Freight Coal Line was created (Transnet, n.d.). As shown in Figure 2, the rail line starts at Mpumalanga's coal fields, descends from the Highveld through rural KwaZulu-Natal and terminates at Richards Bay. There are other rail links connecting Richards Bay with Durban and Eswatini and Mpumalanga to the north. In addition to coal, steel, ferrochrome, granite, aluminium, grain and wood are also transported. The Mpumalanga to Richards Bay rail line is run by Transnet Freight rail, the largest division of rail operator Transnet.

Figure 2: The Mpumalanga Richards Bay rail line



Source: Railways Africa, 2015

In addition to the coal rail line, the Maputo Development Corridor (MDC) has been a key infrastructure asset that developed on the back of the coal endowment. The MDC runs through Gauteng and Mpumalanga to export via Matola Coal Terminal in Maputo. It consists of road, rail, border posts, port and terminal facilities. The MDC also links with industrial centres in Gert Sibande, steel producing areas of Nkangala and agricultural/tourism areas of Ehlanzeni district municipalities. The corridor

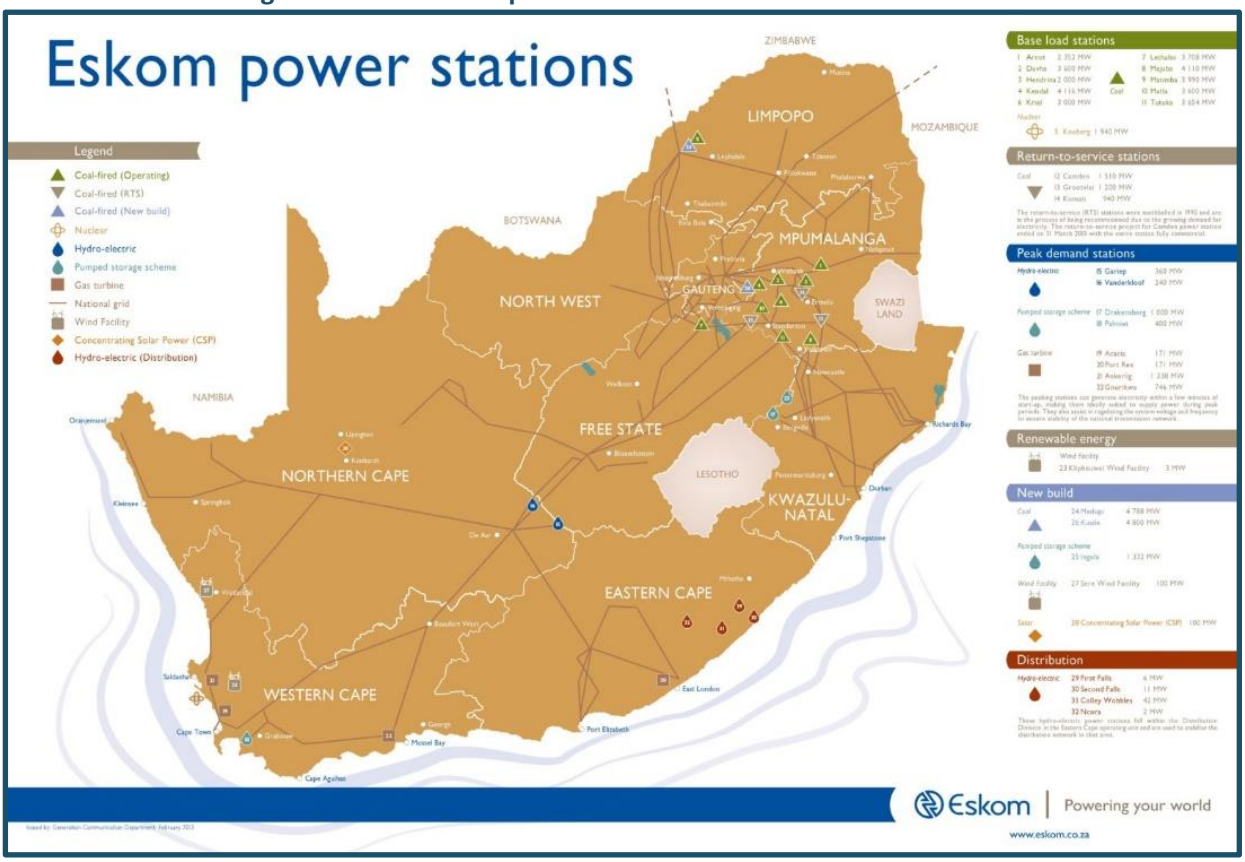
connects South Africa's northern hinterlands with Mozambique's capital, Maputo and its two ports, Maputo and Matola (Mpumalanga Department of Public Works, Roads and Transport, 2015).

Coal mines and power plants have typically supported the building of road infrastructure. Eskom's power stations are located close to mines and Eskom often relies on road freight to transport coal. Road lengths[2] in 2010 stood at 1732km, 840km, 1067km and 454km for eMalahleni, Steve Tshwete, Govan Mbeki and Msukaligwa respectively. At the same time, coal haulage by road has grown considerably on Mpumalanga's provincial roads. This has contributed to the deterioration of the provincial roads. The Mpumalanga Department of Public Works, Roads and Transport has limited funds for frequent rehabilitation and maintenance needs related to the coal haulage network. Eskom has been forced to contribute towards road improvements or use long alternative routes (Mpumalanga Department of Public Works, Roads and Transport, 2015).

2.3.2 Electricity, water and telecommunications

Eskom is the primary provider of electricity in South Africa. Eskom supplies about 90% of South Africa's total electricity demand, the remaining is met through IPPs, municipalities (distribution utilities), imports. Eskom is responsible for generation, transmission and distribution of electricity. Figure 3 shows the distribution of the power infrastructure in the country, highlighting the concentration of infrastructure in the country's main historical supply (Mpumalanga) and demand (Gauteng) centres. The majority of the power infrastructure has followed the development of the coalfields located in Mpumalanga. A significant proportion of substations and transmissions lines are in the Gauteng province, due to its significant power demand.

Figure 3: South Africa power and distribution infrastructure



Source: Eskom, 2020.

[2] Including paved roads, gravel roads and tracks.

To support coal mining and power generation, water infrastructure around their facilities have been built to service operations. Eskom alone consumes 10 000 litres of water per second. The water is sourced from three main water management systems: the Upper Olifants River Water Management Area, the Upper Vaal River Water Management Area and the Limpopo Water Management Area. Infrastructure, through a network of pipelines and pumping systems in and around these water management systems, has been built to service the power stations (Pather, 2004). Municipalities, such as Hendrina, Komati and Grootvlei, have benefited from the development of the water infrastructure.

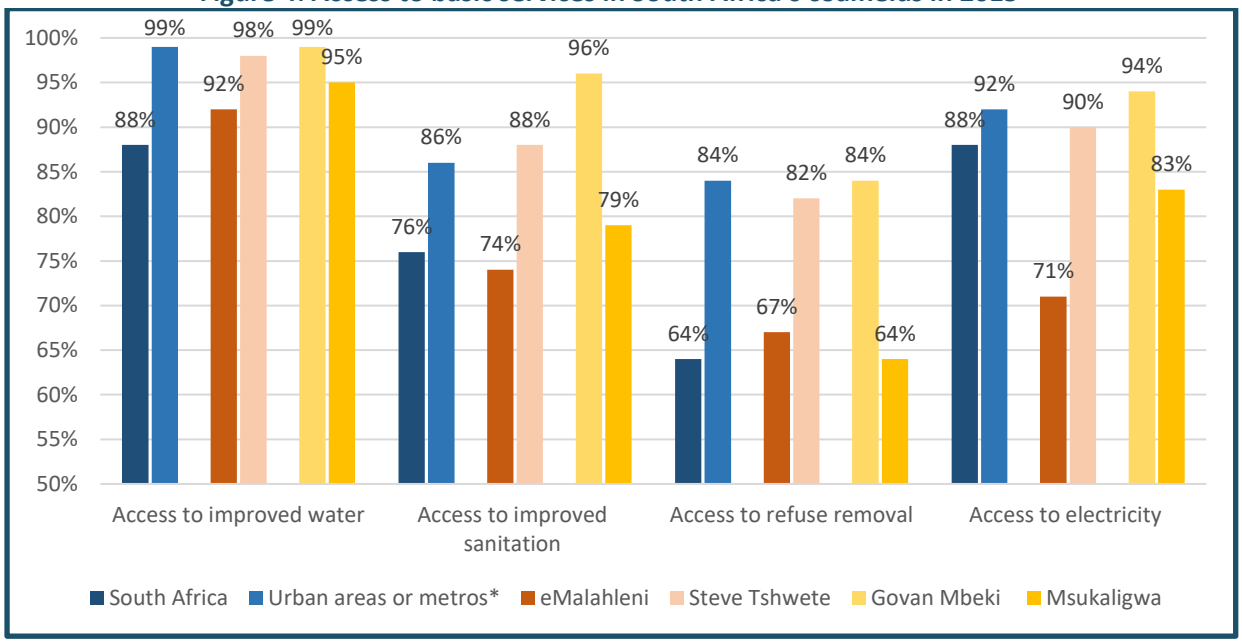
Eskom Telecommunications is one of its core businesses. To provide services, Eskom has built its own fibre-optic telecommunications network. It provides ICT services for critical operational systems and distribution links and communications across 1 400 nodes comprising power stations, substations and office operations, besides others. Eskom also has its own radio network, made up of conventional all-informed radio network that covers all of South Africa. The radio network can be used without modification except for the addition of modem arrays at the control points.

Furthermore, Eskom's power lines can be used to carry fibre for internet connectivity. Every power line includes a duct with core fibre strands in it. Internet service providers can use the existing power lines to expand internet connections.

2.4. Access to services

The development of bulk infrastructure has, to some extent, trickled down to the provision of services at the community level. As shown in Table 2, access to basic services in South Africa's coalfields is on par or better than in most parts of the country. However, performance varies significantly between municipalities and remains overall below the access in metropolitan areas. Quality of access is also very variable from one community to another. In addition, some services, such as access to sanitation and refuse removal, are still problematic.

Figure 4: Access to basic services in South Africa's coalfields in 2015



Source: Authors, based on Statistics South Africa, The state of basic service delivery in South Africa (2016)
*calculated average of all South African metros

eMalahleni is the poorest performing among the four main coal-reliant municipalities in service delivery. Service delivery issues for informal settlements have intensified protests since around 2012

(Ndlovu-Nachamba and Segodi, 2020). As municipalities' struggle with the decline in coal-related economic activity and workforce, the existing service delivery issues are set to be exacerbated.

Moreover, coal mines and Eskom have provided many of the local public services, including water supply, sewage and waste management. Coal mining companies, in collaboration with local government, non-governmental organisations (NGOs) and community leaders, have supported community projects through their Corporate Social Investment (CSI) spending. Although generally *ad hoc*, CSI spending has contributed to improving the living conditions of many communities. As coal-related economic activity declines, these contributions will be phased out and associated service provision will have to be picked up by local government.

Below are illustrative examples of services provided by the key companies in the value chain:

- Since 2018, Sasol has supported the Govan Mbeki local municipality by investing approximately R60 million in water infrastructure projects. This funding has been dedicated to upgrading sewer networks in the surrounding townships, and fixing and repairing water leaks. As part of its Social and Labour Plans, Sasol has upgraded the Greylingstad sewer and wastewater treatment works, constructed a water pipeline from eMbalenhle to Charl Cilliers and completed a storm water drainage system in Lebohang Township in Leandra (Sasol, 2020b). Sasol also has a RDP housing insulation programme in eMbalenhle, near Secunda where 500 houses were completed in June 2018. Sasol has also supported the establishment of HIV support facilities and healthcare facilities improvement. Through its support of local government, Sasol has constructed four pump stations in the Govan Mbeki Local Municipality town of Kinross. Sasol has also completed the installation of four electrical substation switchgears and panels for Govan Mbeki Local Municipality (Sasol, 2020b).

- Anglo American, in partnership with the Department of Basic Education, has developed several education facilities and programmes targeting building skills and leadership capacity. These projects provide adult basic literacy for employees, community members and contractors (Anglo American South Africa, 2019). Anglo American's early childhood development (ECD) programme has supported 100 ECD sites and non-fee primary schools in their communities. The mining house has also supported housing developments near its mines, through the provision of roads, electricity and sewage (Anglo American South Africa, 2019).

- Eskom supports the local municipalities in proving basic services near its power stations. At the Hendrina Power Station, Eskom owns the only petrol station and store in the locality. The local farmers' small businesses and the general community rely on the store and petrol station (Makgetla et al., 2019). Eskom has, moreover, supported the building of community healthcare centres, providing medical equipment, supported rural school infrastructure development and food security in the Grootvlei, Ermelo and Balfour communities to name a few. Eskom has also made a significant contribution to local infrastructure through the development of roads, telecommunication, sewage, railways and other infrastructure to support community development (ESI Africa, 2019; SRK Consulting, 2017). In Hendrina, the power station provides all refuse removal services in Pullenshope and the Woestalleen mines.

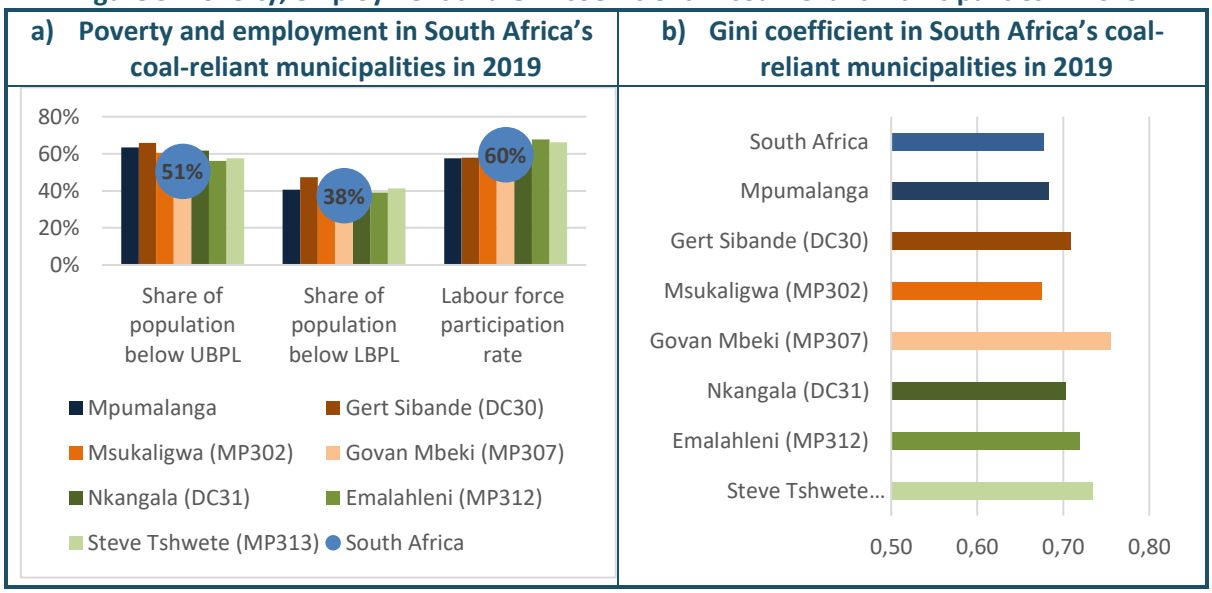
3. SILENT KILLER: A SOURCE OF SOCIO-ECONOMIC VULNERABILITY

While the coal value chain has been a key driver of economic activity, employment and economic development, it has at the same time been an underlying factor of vulnerability for the South African economy and society. As the country transitions towards a low-carbon trajectory, the impact of the closure and restructuring of power, mining and industrial facilities will be greatly felt by local communities and workers, affecting employment, economic activity and government revenues. At the same time, the country's dependence on coal (as an energy source and a source of economic activity) has locked in significant vulnerability into the economy and society.

3.1. Persistent poverty issues

South Africa has high levels of poverty, inequality and unemployment nationwide. In the coalfields, the economic activity and associated employment brought by coal-based activities have not led to an improved performance in poverty and inequality. Levels of poverty and inequality in Mpumalanga's four most coal-dependent municipalities are relatively high compared to national rates and lower than the provincial poverty rate.[3] Figure 5a shows, using the South African Upper Bound Poverty Line (UBLP) rate in 2019, that poverty in eMalahleni, Steve Tshwete, Govan Mbeki and Msukaligwa was 56%, 58% 61% and 60%y, compared to 63% for the province and 51% nationally. Excluding Steve the vulnerable municipalities. In these municipalities black Africans were 90% of the population in 2019. Although unemployment levels in these municipalities are lower than the national average, high unemployment persists. In 2019, labour force participation in eMalahleni, Steve Tshwete, Govan Mbeki and Msukaligwa was 68%, 66%, 67% and 60% (Quantec, 2021), compared to 60% nationally.[4] In addition, high inequality levels in Mpumalanga's coal region persists.[5] As illustrated in Figure 4b, on average, inequality is higher in Nkangala, and even more in eMalahleni and Steve Tshwete, than the rest of the country.

Figure 5: Poverty, employment and Gini coefficient in coal-reliant municipalities in 2019



Source: Authors, based on data from Quantec, Series on Poverty lines and Headcounts by 2011 municipality/ ward-based metro region, Labour – Employment and unemployment by 2011 municipal/ward-based metro region level and Gini coefficient 2011 local municipal/ward-based metro region level, downloaded October 2021. *Note:* UBPL = South African Upper Bound Poverty Line; LBPL = South African Lower Bound Poverty Line.

[3] Compared to Metropolitan municipalities and larger cities

[4] The province's unemployment rate was slightly lower than the national average (30.8%) at 27.8% in 2020.

[5] Mpumalanga is the 6th most unequal province in the country with a Gini coefficient of 0.62.

3.2. Economic displacement and dependency

In coal-endowed municipalities, the activities associated with the value chain have effectively displaced other economic sectors. Agriculture and tourism have been pushed to other areas of the country, including in Mpumalanga. The remaining activities, except for some manufacturing and agricultural production,[6] are directly or indirectly linked to the coal value chain. Economic activities, such as retail, transport, food and accommodation, and even government services, largely support coal value chain activities and the people employed in them.

The coal value chain has entrenched suppliers that directly or indirectly provide goods and services to coal mines, Eskom, Sasol and Transnet, among others. In 2019, the coal industry spent R61 billion on procuring goods and services, most of which was on local suppliers (Minerals Council, 2019). These suppliers are also at risk of losing their revenue and employment as coal mines and power stations close. Other vulnerable groups include informal and formal businesses that provide goods and services to workers, managers and their families. These businesses can include food, accommodation, and other retail services that cater to the population of mining towns (Makgetla et al., 2019).

As a result, the municipalities have heavily undiversified economies relying on coal and coal-related activities. This is particularly the case for eMalahleni. Municipalities display a mix of characteristics which is typical of mining towns. They have a narrow economic base that is highly dependent on coal, are isolated geographically to some degree (despite their relative proximity to the economic centre of Gauteng), and display a coal mining "identity" where successive generations of coal miners tend to stay in coal mining, and where remuneration for working in the coal sector pays relatively well compared to other economic opportunities for the same level of education (Makgetla and Patel, 2021).

3.3. A source of employment vulnerability

In 2019, the value chain as a whole employed around 150 000 formal workers and was the main source of livelihoods in eMalahleni (Witbank), Steve Tshwete (Middelburg), Govan Mbeki (Secunda) and Msukaligwa (Ermelo). The young median age, combined with relatively high pay for workers with a matric or less would make it difficult for these workers to find equivalent employment if they were retrenched (Makgetla et al., 2019).

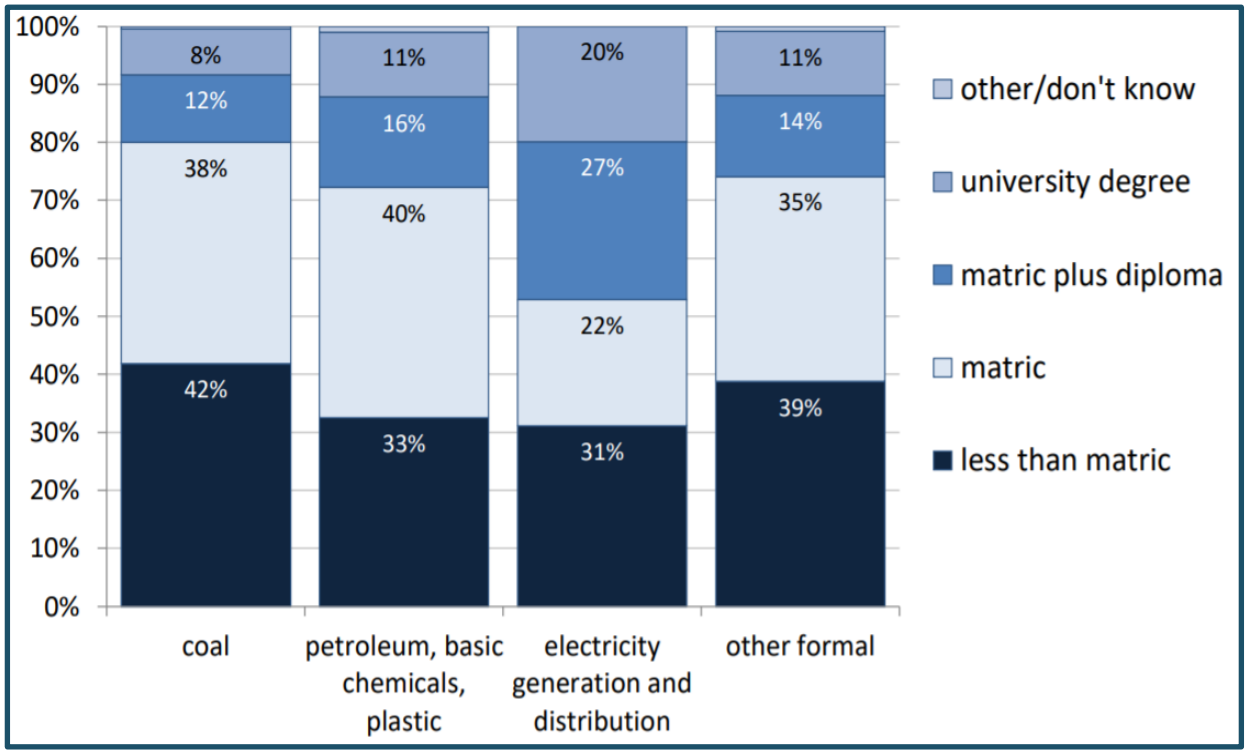
While the coal value chain accounts for only about 1% of national employment, coal mining and power generation account for 5% of Mpumalanga's formal employment, with 76% of coal employment located in the four hotspots of Mpumalanga. Coal mining accounts for 26%, 17%, 14% and 11% of total employment[7] in eMalahleni, Steve Tshwete, Msukaligwa and Govan Mbeki respectively (Makgetla et al., 2019).

Education levels in coal mining are slightly lower than the norm for other formal workers. Figure 6 shows that coal workers with a matric or less comprised 80% of the coal labour force compared to 53% in electricity, 73% in heavy chemicals and plastic workers, and 74% of formal workers outside the value chain.

[6] The Gert Sibande and Nkangala districts for instance host plastics, concrete and furniture manufacturing, among others.

[7] Coal employment is male-dominated, with only 15% of workers in mining being female. Downstream industries have higher shares of women in the workforce – base chemicals has 31% while petroleum has 25%.

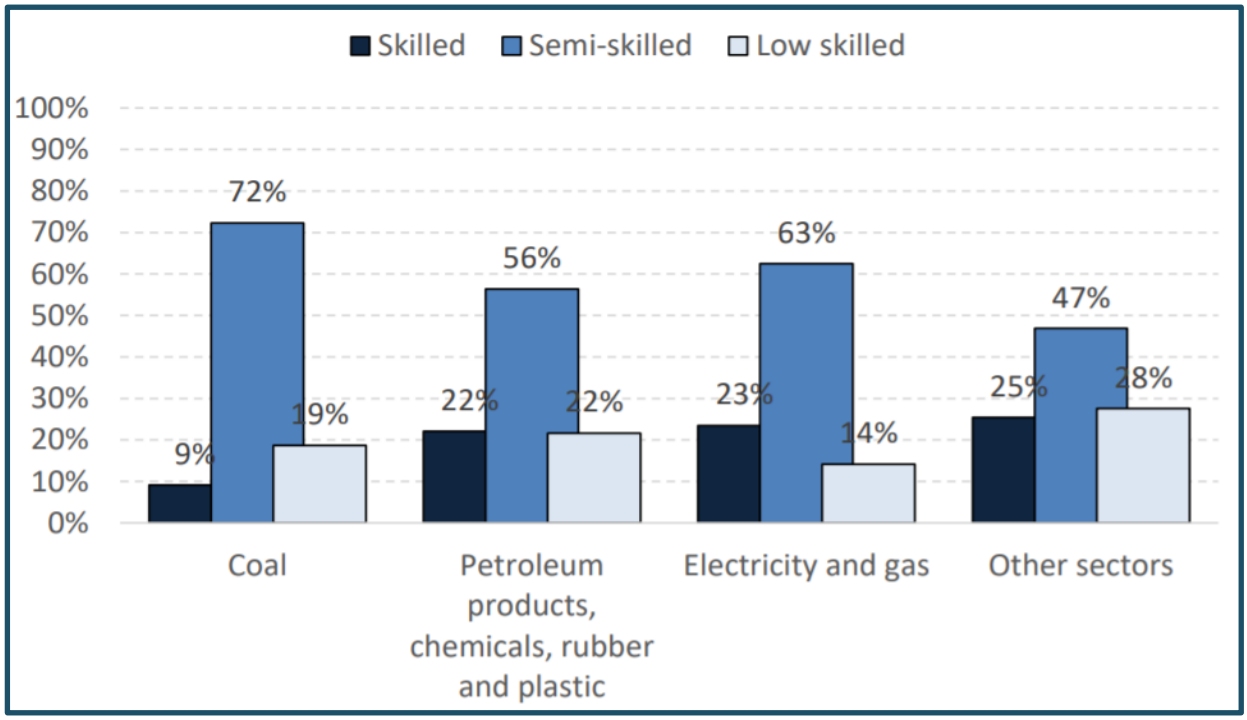
Figure 6: Education levels in the coal value chain, 2017



Source: Makgetla et al., 2019.

Most of this workforce receives specialist training, however, resulting in being categorised as "semi-skilled". As shown in Figure 7, 72% of coal workers are categorised as semi-skilled, while 19% are low-skilled workers and only 9% are skilled. Yet, the majority of coal workers are at risk of being unable to transfer their skills to other sectors, making shifting to other sectors difficult for these workers (Makgetla et al., 2019).

Figure 7: Skills profile in the coal value chain



Source: Makgetla et al., 2019, calculated from Statistics South Africa Labour Market Dynamics.

Although 80% of coal workers have pension funds, compared to less than 60% of other formal workers, the median age of coal workers was 38 years in 2019. This means that early retirement is not a viable option for many coal workers if coal mine closures take place before the mid-2030s as predicted.

3.4. Negative Impacts on other productive activities

Mining activities dramatically alter the natural environment. Mining contributes to the sterilisation of soil, a loss of biodiversity and wildlife, the contamination of ground and surface water, land degradation and a loss of arable land.

South Africa has only 1.5% of potential arable soil, with 46% of that land being in Mpumalanga. Mpumalanga is at the heart of South Africa's maize triangle, making it crucial for food security.

Current coal mining and related activities have reduced arable soil by 225 217 hectares (about 26%) since coal mining began in Mpumalanga. The continuation of coal mining in the region would have further long-term effects on agricultural production and food security in the country (Bureau of Food and Agriclutural Policy, 2012).

Coal mining also affects agricultural yields. Farmers in the Middleburg district in Steve Tshwete reported crop losses on fields close to mines of about 1.5-2 t/ha in 2012. These losses are primarily attributed to black coal dust. The dust has also impacted animal farming in the district (Bureau of Food and Agricultural Policy, 2012).

The contamination of water through Acid Mine Drainage (AMD) has furthermore adversely affected the agricultural sector in the province, through soil and water pollution. AMD contributes to damaging crop cells and limited nutrient uptake. It can lead to significant losses in plant biomass and lower crop yields (Campbell et al., 2017).

The water pollution from coal mining has also caused water contamination in the Mpumalanga Lakes district. The lakes are known for their extensive bird and frog life, wetlands and a variety of flowers. The lakes lie in a depression leading to pollution in the lakes accumulating without the chance of being flushed out to the ocean through the river network. Continued pollution from mining activities would lead to the lakes being toxic and lifeless (Munnik, 2010).

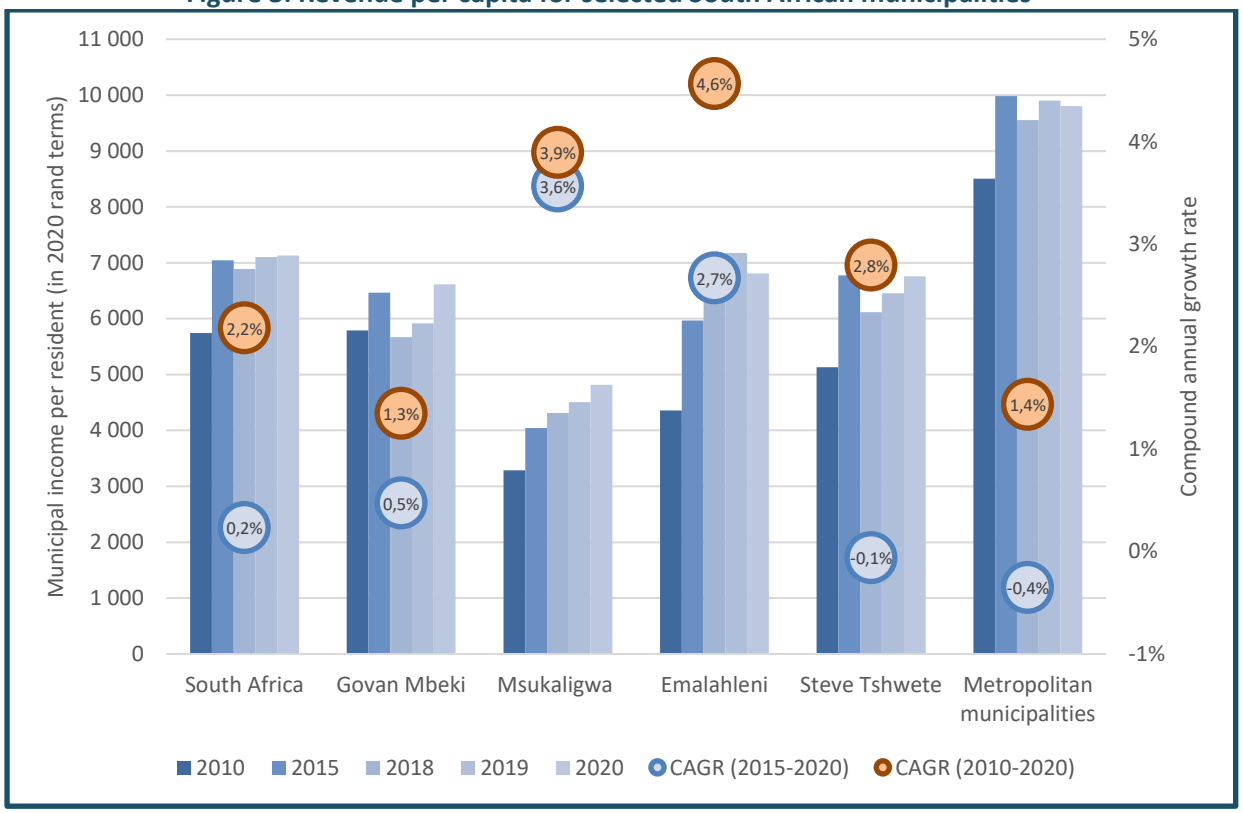
The contamination of water from mining activities has had a deleterious impact on tourism activities. Besides the reputation stigma, which makes it difficult to develop tourism activities close to coal mining, direct impacts have hindered the development of tourist attractions. Mining has led to a loss of grasslands and wetlands along with the species that live in them, particularly in the Upper Olifants River. The Loskop Dam, part of a nature reserve in the Olifants River, has experienced a die-off of fish, turtles and crocodiles, which is widely thought to be the result of water quality in the river (Hobbs et al., 2008).

3.5. A source of vulnerability in service delivery

As the vulnerability of coal workers and coal-reliant communities increases, local governments have a key role in mitigating part of that vulnerability. However, like most municipalities, affected towns are under-resourced. As depicted in Figure 8, annual budgets are at approximately R6 000 per resident, compared to more than R11 000 in metropolitan areas (Hermanus and Montmasson-Clair, 2021b).

Going forward, it is also not clear how affected and overstretched municipal governments will be able to sustain (let alone enhance) service delivery as the budgets (capital and operating expenditures) of these municipalities show that they are under-resourced.

Figure 8: Revenue per capita for selected South African municipalities



Source: Authors, based on municipal budget data from Statistics South Africa, Series on Income and Expenditure for Rates and General, Housing and Trading and Combined Services by Municipality, downloaded from www.easydata.co.za in November 2021 and municipal population data from Quantec, Series on Population, Number of Households and Densities by population group at 2011 local municipal/ward-based metro region level downloaded from www.easydata.co.za in November 2021.

Mining companies have provided their workers with built hostels and mining villages within their local communities to allow them to be close to the mines. Initially, this housing was single-sex compounds or hostels. By the 1980s, a vast majority of mineworkers lived in these hostels. As apartheid ended, more options emerged for mineworkers, such as bond and rental subsidies became available (Ntema et al., 2017). As mines and power stations shut down due to the decline in coal, the bond houses purchased by workers are another obstacle to their migration out of coal towns. Residents are reluctant to let go of their assets as they believe it will provide value for future generations (Campbell et al., 2017). In many instances, workers who have been retrenched from power stations and mines have lost their jobs and their housing, as salaries and housing subsidies end. At the Tweefontein mine, for instance, the mining company found it too cumbersome to rent out or sell these houses. These houses were either left abandoned or demolished (Munnik, 2010).

Box 2: The impact of gold mining on communities

South Africa's goldfields region, located around Lejweleputswa district municipality in the Free State, provides a local example of how mine closures can affect communities. With the decline of gold mining, largely for geological reasons, the Matjhabeng local municipality has experienced economic and social decline and lost its economic dominance in the province. As gold mining declined, mining employment fell from 180 000 in the mid-1980s to less than 30 000 by 2013 (Marais, 2013b). The loss of the mining workforce lead to the deterioration of standards of living, increased poverty and unemployment for those who remained. The population declined sharply from 180 000 in 1990 to 36 000 in 2010, as many workers emigrated (Marais and Cloete, 2016). The goldfields region's GVA declined by -1.8% per annum between 1996 and 2001.

Where the mines were the major property owner, the real estate market collapsed resulting in a decline in property rates, service rates, and taxes for the municipalities. Due to the subsidised housing policies, the decline of gold created a housing attachment issue, particularly among low-income households. Indeed, Marais (2013a) found that workers were less likely to relocate if they owned a house in the mining town. The provision of housing and homeownership in mining areas locked households into their locations. The households which wanted to sell their houses were unable to due to the decline in average housing prices. Asset ownership has, paradoxically, entrenched households in poverty as they find it difficult to sell or leave their houses. In turn, the risk of non-payment of municipal rates and taxes created an additional revenue problem for municipalities. The dismantling of housing compounds that mining companies had owned also led to an increase in informal settlements as workers who resided in mining hostels lost their housing (Marais, 2013a; Marais and Nel, 2016).

The gold mine closures also affected local businesses. The region experienced large-scale business closures. This contributed to a further decline in employment opportunities. Employment-creating opportunities were also affected by the large-scale outward migration of young skilled workers (Marais et al., 2020).

Other effects of the mines closing were weakening community ties and breakdowns in social links. The closures collapsed social institutions, such as religious groups, women's groups, sporting federations and other recreational groups. The closure of mines was also associated with a decline in telecommunications infrastructure, school and housing facilities. Mine closures also increased criminal activities, illegal mining and gang activity (Sesele et al., 2021).

Mining is male dominated and many of the women in towns were not afforded employment opportunities. When retrenchments began, this placed further financial pressure on households. The closure of mines contributed to family breakups as many of the men who could gain other employment opportunities often left their families. This placed additional pressure on women to provide for their families (Sesele et al., 2021). As men were more likely to find jobs in the formal sector, many women resorted to seeking income in the informal economy, generally characterised by insecure, irregular jobs with low pay.

Overall, the lack of economic diversification in the Free State's goldfields led to a collapse in the regional economy. Decades later, certain areas have still not recovered from the decline in gold. The social and economic decline of the Free State goldfields has been disastrous and a provincial and national strategy was required to address the plight of mining towns and their residents.

4. LOSS AND DAMAGE: A SOURCE OF SOCIO-ENVIRONMENTAL DEGRADATION

The environmental impact of mining is well documented. Coal-related activities result in acute land, air, water and noise pollution that pose a threat to the health of workers and communities. The closure of mining activities leaves a legacy of long-term environmental impacts.

4.1. A source of health impacts

Air pollution

Mpumalanga has some of the most polluted air in the country. This is largely due to the concentration of the coal value chain in the province, primarily Eskom's coal-fired power generation and Sasol's CTL operations.

According to Greenpeace (Meth, 2018), Mpumalanga is a hotspot for nitrogen dioxide, a pollutant that comes from burning coal and other fossil fuels. North American Space Administration (NASA) satellite data shows that, after Russia, South Africa has the second-worst sulphur dioxide emissions in the world, largely due to emissions coming out of Mpumalanga.

In 2014, the province was declared an air-quality priority area by the Minister of Environmental Affairs due to the elevated levels of carbon dioxide, sulphur dioxide, nitrogen dioxide and particulate matter. The levels of sulphur dioxide, nitrogen dioxide and particulate matter in the Mpumalanga Highveld are more than double the maximum recommended by the World Health Organisation (Munnik, 2019).

The air pollution from the coal value chain can result in cancer and silicosis, asthma, heart and lung diseases and other respiratory issues for residents and workers. A 2004 Nedlac study found that the exposure to air pollution in Mpumalanga resulted in about 8 700 hospital admissions a year (Shongwe, 2018). Eskom admitted that pollution from its coal-fired power stations kills an estimated 320 people a year, although independent studies by NGOs such as Greenpeace suggest the number could be closer to 2 200 (Kings, 2020).

In addition to the hundreds of premature death caused by elevated levels of pollution, thousands more suffer from bronchitis, asthma and other respiratory tract diseases. In a 2014 study, groundWork found that the health risks from Eskom's outdoor pollution resulted in about 51% of all hospital admissions and deaths in the area. The pollutants from power generation and mining have a profound impact on the health of children, the elderly, pregnant women and those suffering from heart and lung disease, asthma and other respiratory issues (Kings, 2020). In a vicious circle, many local residents are furthermore unable to obtain employment as they fail medical examinations conducted by employers (such as mines), as a result of the impact on mining and power generation activities.

Land and water pollution

Every stage of the coal value chain requires direct use of water. Coal mining (both underground and surface mining) requires groundwater to be pumped out to dry the area. This disrupts groundwater flows and lowers water tables (Forrest and Loate, 2017). Burning coal to produce electricity is a water-intensive process. In about one second, Eskom consumes the same amount of water as a single person uses in a year, based on the minimum of 25 litres of water a day. South Africa is already a water-scarce country and a net importer of water. The coal mining and electricity industry have worsened this (Simpson et al., 2019). Building more coal-fired power stations, like Medupi and Kusile, and increasing coal mining to supply them would further send South Africa into a water deficit.

Apart from large water consumption, coal mining has led to water pollution through AMD. This places severe risks on water security in the country and is one of the most serious and complex immediate water quality and mining-related problems. AMD occurs from the drainage of underground mine

shafts, runoffs and discharges from open pits. AMD outflows can originate from both operating and abandoned mines. It is estimated that nearly 200 million litres of AMD pollute the water resources in the country per day. The impacts of AMD can be severe and long-lasting, requiring expensive and substantial interventions to treat (Forrest and Loate, 2017). It increases the heavy metal content and changes the pH levels of water. AMD results in highly acidic water that contains sulphides, salts and high concentrations of metals which can have serious consequences on health, wildlife and biodiversity (Tempelhoff et al., 2014).

The water in Mpumalanga has been compromised due to the continuous contamination by both the coal and gold industries. At times, the pH levels, sulphate concentrations and metal levels have been too high for human consumption. For instance, the pollution of the Boesmanspurit Dam resulted in contaminating the water supply of the town of Carolina. In 2012, the municipality declared the water unsafe for consumption. Residents reported that the water had a rusty, brownish, and often greenish colour that would change the colour of laundry. The water tasted strange and bitter. When used for cooking, the meals would taste strange and the water affected their skin when used for bathing. The residents pointed to the mines as the source of the water contamination, as a result of the mines' old water infrastructure beginning to deteriorate from 2011. The effects of the heavily contaminated water on health included gastrointestinal problems, such as vomiting, diarrhoea and abdominal pains, as well as long-term effects such as kidney problems/failure (Bureau of Food and Agricultural Policy, 2012; McCarthy and Humpries, 2012).

Furthermore, both underground mining and open cast mining contribute to long-term land degradation, AMD and the acidification of soil. Even after mining activities have stopped, closed mines can continue to contaminate the water and soil. In the Ermelo area, there are cases of rehabilitated mines decanting acid water for five to 20 years after closure. Most rehabilitation specialists argue that the soil can be rehabilitated to only 70% of its pre-mining potential if rehabilitated properly. Absent of any soil intervention, it can take about 100 years or more for soil to become fertile after a mine is filled, in the case of surface mining. Some high potential soils which were mined can never be rehabilitated due to the damage caused by the release of effluences and the contamination of water (Munnik, 2010; Shongwe, 2018).

South Africa's track record for rehabilitating closed mines is poor. At least, since 2011, no large coal mine has been granted closure, meaning these mines have not been rehabilitated and are largely abandoned. South Africa's landscape is littered with unrehabilitated mines. The law requires mining companies to ringfence money to cover rehabilitation costs, however, large mining companies tend to sell the mines to smaller companies once most of the resource has been extracted, thus transferring the rehabilitation liability to a smaller owner that cannot necessarily afford it. The rehabilitation costs then fall to the state. If mines are not sold to smaller companies, they are simply put under "care and maintenance" or abandoned. The state does not have the resources to track down those responsible for rehabilitation. Again, there are often insufficient protected funds available to cover the rehabilitation costs (Centre for Environmental Rights, n.d.; Makgetla and Patel, 2021)

Blasting and noise pollution

Blasting and noise pollution from coal mining also has a detrimental impact on the health of workers and communities. Workers and residents near the mines have reported hearing loss and increased anxiety. The continuous explosions make local children nervous and hinders their ability to learn. Ground vibrations are a regular occurrence in areas close to mines, frightening for small children to the elderly (Rall, 2018).

Blasting also releases particulate matter dust which is transported into houses through the air. Particulate matter can cause premature death in people with heart or lung disease, aggravated asthma, decreased lung function and other respiratory issues. In Dannhauser, in KwaZulu-Natal,

activists and residents have protested against coal mining activities as the continuous blasting emits heavy black smoke which adversely impacts the health of residents (groundWork, Centre for Environmental Rights, Human Rights Watch, and Earthjustice, 2019).

Residents in Ligazi, a small informal settlement next to the Middleburg stream mine, where blasting is a regular occurrence, have reported that the land buckles and sinks in unexpected ways. Residents report countless sinkholes as a result of mining activities in their areas. The sinkholes pose a danger for residents, particularly children and late-night travellers. It has been reported that smoke sometimes comes out of the sinkholes, filling up houses, particularly in informal housing structures (groundWork, Centre for Environmental Rights, Human Rights Watch, and Earthjustice, 2019).

Explosions from blasting also cause nearby houses to crack and shake, like in Dannhauser. Residents fear that their houses will not withstand the continuous blasting. In Middleburg, community activists report that some houses have even collapsed (Simpson et al., 2019).

4.2. A source of social-cultural degradation

Historically, the coal value chain has dispossessed many indigenous people from their ancestral land. The government has, in the past, used mining laws to override legal protections for informal land rights. This has resulted in the loss of land and livelihoods for many indigenous people (Skosana, 2020).

The development of the coal value chain has led to the displacement of households and the disruption of people's connection to their land and ancestors. Numerous communities have been relocated from their land and, at times, have had their ancestral graves desecrated. Ancestral graves have deep spiritual, religious and cultural importance for people. The damage to ancestral graves results in communities losing their spiritual security, heritage, identity and sense of belonging (Skosana, 2019).

For instance, in Tweefontein, about 120 families were displaced as a result of coal mining. These families were moved to make way for the Goedgevonden mine owned by Glencore. In the relocation, about 1 000 graves were moved from the Tweefontein farm. Former community members have reported the loss to their land is unquantifiable. The loss of the graves has erased the evidence of the historical ties of the communities to the land and, above all, disrespected their ancestors (Skosana, 2020).

In 2018, a court ruled that mining companies were required to get permission from local communities to mine on their ancestral land. The case was presented by the Xolobeni community, home to 75 households that depend on their ancestral land for food, livestock grazing, medicinal plants as well as agricultural and tourism activities. This ruling represents an achievement for local communities, and land and mining rights in South Africa. Before this ruling, companies were only required to consult communities. The judgement provides a tool for communities to protect their land (Ellis, 2020).

Coal mining has also fragmented the social structure of local communities. Many communities, where mining has been proposed, have been torn apart. Those who have opposed mining have been met with harassment, threats of violence, intimidation and even assassinations. Some activists have been banished from their communities for opposing mining activities. Moreover, many attacks against environmental activists have gone unreported in South Africa (Schwarz and Mokgalaka, 2019). Mining activities have generated artificial tensions between environmental, health and sociocultural priorities on the one hand, and jobs and livelihoods on the other, causing further divisions in many communities.

Tensions between communities have also emerged as a result of coal-related activities. Communities increasingly compete with coal mining and power generation activities for water and land for livestock grazing and growing food. In addition, the pollution from the coal value chain has compromised the water supply and has made the land unfarmable in many instances, increasing the competition for resources at the local level.

5. CONCLUSION

Planning for and implementing a just transition is urgent. Coal-related activities, while a source of economic development, have had disastrous impacts on communities and their environment. The transition away from coal, which is already underway and will accelerate in the coming decades, is set to further deepen these impacts.

The communities of eMalahleni, Steve Tshwete, Govan Mbeki and Msukaligwa (among others) have lived for decades at the rhythm of coal mining, artificially stuck between the need for employment and livelihood, and the right to a healthy environment, safety and well-being. The just transition agenda offers an opportunity, and effectively commands, to overcome this false dichotomy.

It requires first to acknowledge the starting point. The past and current situation in the coalfields is highly unjust. Achieving a just transition is therefore not only about cushioning the impacts of the phase out, but also about rectifying the damages linked to the past and existing activities. Assuming otherwise would perpetuate decades of inequality in access to economic opportunities, services and a healthy, safe environment. This requires acknowledging the fundamental difference between a transition to a low-carbon economy and a just transition to a green and inclusive economy.

Second, the scale of the distress created by the transition ought to be internalised by all decision-makers. The absence of a strong response, with economic diversification and social support at its core, would lead to ghost towns, widespread destitution and an increase in poverty and inequality. The social safety nets available in South Africa, while laudable, are inadequate to provide sufficient levels of resilience to affected workers and communities. Similarly, the perilous situation of affected municipalities cannot be underestimated. On their own, they do not have the means to spur economic diversification or improve service delivery, particularly in the face of regional economic decline.

Third, achieving a just transition requires marshalling all stakeholders into action. Only collaborative thinking and implementation will garner the necessary human, financial and knowledge resources to establish the conditions for a just transition. The extent of the challenges cannot be overstated. Government can notably build evidence, broker consensus and provide the direction of travel. It can also drive action through its structural and catalytic roles, both at national and local levels. Businesses, both public and private, carry a historical responsibility in implementing a just transition, including but not limited to investing in new, sustainable activities and business models. Workers and communities are crucial to co-design and co-implement the just transition process. Organised structures, such labour unions, also have in many cases the ability to invest in transformative initiatives.

With this in mind, action is urgent for people are already being left behind. While the just transition journey will be incremental, it should be ushered. It starts with rehabilitating and closing one mine, repurposing one power plant, opening one new factory, creating one new community structure, providing one more safety net, co-creating one intervention.

REFERENCES

Aluminium Federation of South Africa. 2017. Aluminium Industry in SA. Available at: http://www.afsa.org.za/aluminium-industry-in-sa/ (Accessed 3.17.20).

Anglo American South Africa. 2019. South Africa Transformation Performance Report 2019.

Ashman, S. 2015. Coal and the Post-Apartheid Minerals Energy Complex. Society for the Advancement of Socia-Economics.

Bureau of Food and Agriclutural Policy. 2012. Evaluating the impact of coal mining on agriculture.

Burton, J., Caetano, T. and McCall, B. 2018. Coal transitions in South Africa – Understanding the implications of a 2oC-compatible coal phase-out plan for South Africa. University of Cape Town, Cape Town.

Campbell, M., Nel, V. and Mphambukeli, T. 2017. A thriving coal mining city in crisis? The governance and spatial planning challenges at Witbank, South Africa. In *Land Use Policy 62, 223–231.* Available at: https://doi.org/10.1016/j.landusepol.2016.12.027

Centre for Environmental Rights. 2019. Submissions on Eskom's Application for Suspension, Alternative Limits and/or Postponement of Compliance with the Minimum Emission Standards for 10 of its Coal-Fired Power Stations.

Centre for Environmental Rights, n.d. Full Disclosure – The Truth About Mining Rehabilitation in South Africa. Available at: https://fulldisclosure.cer.org.za/2018/ (accessed 9.2.21).

CorsaCoal. n.d. About Corsa Coal Corp. - Coal in Steelmaking [WWW Document]. URL https://www.corsacoal.com/about-corsa/coal-in-steelmaking/ (accessed 9.2.21).

Department of Energy. 2019. The South African Energy Sector Report.

Department of Mineral Resources, 2018. South African Minerals Industry.

DMRE. 2020. Intergrated Resource Plan 2019. Department of Mineral Resources and Energy.

Ellis, E.. 2020. Eastern Cape: Game-changing Xolobeni judgment orders applications for mining licences to be made public Daily Maverick. 14 September 2020, Available at: https://www.dailymaverick.co.za/article/2020-09-14-game-changing-xolobeni-judgment-orders-applications-for-mining-licences-to-be-made-public/ (Accessed 9.2.21).

Eskom. 2021. Submission to NERSA – Ten-year Negotiated Pricing Agreement for the Hillside Aluminium Smelter (Pty) Ltd in Richards Bay, uMhlathuze Local Municipality, KwaZulu-Natal.

Eskom. 2020. Eskom power stations. Eskom Generation Division Map.

Eskom, 2018. Transmission Development Plan 2019 to 2028.

Forrest, K. and Loate, L.2017. Coal, water and mining flowing badly. Society Work & Development Institute (SWOP.)

Global Energy Monitor. 2022. Grootvlei Power Station. Available at: https://www.gem.wiki/Grootvlei_Power_Station (Accessed 9.5.22).

Meth, O. 2018. New satellite data reveals the world's largest air pollution hotspot is Mpumalanga South Africa. Greenpeace. Available at: https://www.greenpeace.org/africa/en/press/4202/new-satellite-data-reveals-the-worlds-largest-air-pollution-hotspot-is-mpumalanga-south-africa/ (Accessed 9.2.21).

groundWork, Centre for Environmental Rights, Human Rights Watch, and Earthjustice. 2019. “We Know Our Lives are in Danger”: Environment of Fear in South Africa’s Mining-Affected Communities. Human Rights Watch.

Headley, T. and Bezdek, R. 2020. How Many Coal-Dependent Jobs Are There and How Important Are They?. Fortnightly. Available at: https://www.fortnightly.com/fortnightly/2020/06/how-many-coal-dependent-jobs-are-there-and-how-important-are-they (Accessed 9.2.21).

Hermanus, L. and Montmasson-Clair, G. 2021a. Making sense of jobs in South Africa’s just energy transition: Managing the impact of a coal transition on employment. Policy Brief. Just Urban Transitions and Trade & Industrial Policy Strategies.

Hermanus, L. and Montmasson-Clair, G. 2021b. Get the shovels out: Death of the coal industry must bring new beginnings in Mpumalanga. Daily Maverick. Available at: https://www.dailymaverick.co.za/article/2021-05-10-get-the-shovels-out-death-of-the-coal-industry-must-bring-new-beginnings-in-mpumalanga/ (Accessed 9.2.21).

Hobbs, P., Oelofse, S. and Rascher, J., 2008. Management of Environmental Impacts from Coal Mining in the Upper Olifants River Catchment as a Function of Age and Scale. In *International Journal of Water Resources Development 24*.

IEA. 2021. Net Zero by 2050. International Energy Agency. Paris.

Institute for Energy Economics and Financial Analysis. 2020. IEEFA: Pakistan announces ‘no new coal-fired power’. Available at: http://ieefa.org/ieefa-pakistan-announces-no-new-coal-fired-power/ (Accessed 12.18.20).

Kings, S. 2020. Eskom lied to hide its deadly levels of pollution. Mail & Guardian. 29 April 2020. Available at: https://mg.co.za/article/2020-04-29-eskom-lied-to-hide-its-deadly/ (Accessed 9.2.21).

KPMG. 2017. Economic Impact Assessment of five of Eskom’s coal power stations – Camden, Grootvlei, Hendrina, Komati, Kriel.

Makgetla, N. 2021. The Just Transition in Coal. Working Paper for the Presidential Climate Commission. Trade & Industrial Policy Strategies.

Makgetla, N., Montmasson-Clair, G., Maseko, N. and Patel, M. 2019. National Employment Vulnerability Assessment: Analysis of potential climatechange related impacts and vulnerable groups. Trade & Industrial Policy Strategies.

Makgetla, N. and Patel, M. 2021. The Coal Value Chain in South Africa. Trade & Industrial Policy Strategies. Pretoria.

Marais, L. 2013a. The Impact of Mine Downscaling on the Free State Goldfields. In *Urban Forum 24, 503–521.* Available at: https://doi.org/10.1007/s12132-013-9191-3

Marais, L. 2013b - Resources policy and mine closure in South Africa: The case of the Free State Goldfields. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0301420713000366

Marais, L. and Cloete, J. 2016 - Patterns of territorial development and inequality from South Africa’s periphery: evidence from the Free State Province https://www.rimisp.org/wp-content/files_mf/1467322392188_Lochner_Marais_Jan_Cloete.pdf

Marais, L., Denoon-Stevens, S. and Cloete, J. 2020. Mining towns and urban sprawl in South Africa. In *Land Use Policy 93, 103953.* Available at: https://doi.org/10.1016/j.landusepol.2019.04.014

Marais, L. and Nel, E. 2016. The dangers of growing on gold: Lessons for mine downscaling from the Free State Goldfields, South Africa. In *Local Economy 31, 282–298.* Available at: https://doi.org/10.1177/0269094215621725

McCarthy, T. and Humpries, T. 2012. Contamination of the water supply to the town of Carolina, Mpumalanga, January 2012. In *South African Journal of Scien*ce. Available at: https://www.researchgate.net/publication/262480926_Contamination_of_the_water_supply_to_the_town_of_Carolina_Mpumalanga_January_2012

Merchant, E. 2018. IPCC: Renewables to Supply 70%-85% of Electricity by 2050 to Avoid Worst Impacts of Climate Change. Greentech Media. Available at: https://www.greentechmedia.com/articles/read/ipcc-renewables-85-electricity-worst-impacts-climate-change (Accessed 3.23.21).

Mills, E. 2021. S Africa's Exxaro to halt further coal investments. Argus. 4 February 2021. Available at: https://www.argusmedia.com/en/news/2183865-s-africas-exxaro-to-halt-further-coal-investments (Accessed 7.20.21).

Minerals Council, 2021. Facts and Figures 2021.

Minerals Council, 2019. Facts and Figures 2019.

Mining Technology. 2020. Indian ministry to stop thermal coal imports from FY24. Available at: https://www.mining-technology.com/news/india-stop-thermal-coal-imports/ (Accessed 7.19.21).

Molefe, N. and Ashworth, S. 2004. Transformation of the coal mining procurement supply chain. CoalTech 2020.

Montmasson-Clair, G. 2021. A policy toolbox for just transitions. Trade & Industrial Policy Strategies. Pretoria.

Montmasson-Clair, G., Hermanus, L., Patel, M. and Wolpe, P., 2022. Beyond coal: opportunities to diversify the economies of Emalahleni and Steve Tshwete local municipalities. Trade & Industrial Policy Strategies and Just Urban Transtions.

Mpumalanga Department of Public Works, Roads and Transport, 2015. Mpumalanga Province Freight Data Bank –Roads, Infrastructure. Available at: http://www.safiri.co.za/mpfdb/roads-infrastructure.html (Accessed 7.26.22).

Mpumalanga Government, 2008. Office of the Premier — Mpumalanga Provincial Government Available at: http://www.mpumalanga.gov.za/otp (accessed 9.2.21).

Munnik, V. 2019. Coal Kills. Society Work & Development Institute (SWOP).

Munnik, V. 2010. The Social and Environmental Consequences of Coal Mining in South Africa: A case Study.

Ndlovu-Nachamba, C. and Segodi, S. 2020. Mpumalanga municipalities fail to deliver services to informal settlement. Mail & Guardian 19 July 2020. Available at: https://mg.co.za/news/2020-07-19-mpumalanga-municipalities-fail-to-deliver-services-to-informal-settlements/ (Accessed 7.26.22).

Nicholas, S. and Buckley, T. 2019. Briefing Note: South Korea Shifting Further Away from Coal. Significant Implications for Australian Coal Exports. Institute for Energy Economics And Financial Analysis.

Ntema, J., Marais, L., Cloete, J. and Lenka, M. 2017. Social disruption, mine closure and housing policy: evidence from the Free State Goldfields, South Africa: In *Natural Resources Forum 41, 30–41.* Available at: https://doi.org/10.1111/1477-8947.12117

Pather, V. 2004. Eskom and Water. Proceedings of the Biennial Conference of the Water Institute of Southern Africa, Cape Town. 2-6 May 2004.

Pearce, F. 2020. As Investors and Insurers Back Away, the Economics of Coal Turn Toxic. Yale E360. Available at: https://e360.yale.edu/features/as-investors-and-insurers-back-away-the-economics-of-coal-turn-toxic (Accessed 9.2.21).

Quantec, 2021. Poverty Headcount as percentage of population.

Railways Africa, 2015. Transport Watchdog for South Africa. Available at: https://www.railwaysafrica.com/news/transport-watchdog-for-south-africa

Rall, K. 2018. South Africa: How Mining Damages Communities and the Environment. Human Rights Watch. Available at: https://www.hrw.org/news/2018/08/27/south-africa-how-mining-damages-communities-and-environment (Accessed 9.2.21).

RBCT. 2014. RBCT Richards Bay Coal Terminal. Available at: https://rbct.co.za/about-rbct-4/who-we-are/ (Accessed 7.26.22).

Sasol. 2021. Enterprise and Supplier Development. Available a: https://www.sasol.com/sustainability/social-investment/enterprise-and-supplier-development (Accessed 9.2.21).

Sasol. 2020a. Sasol Limited Climate Change Report for the year ended 30 June 2020.

Sasol. 2020b. Sasol Limited Sustainability Report for the year ended 30 June 2020.

Schwarz, B. and Mokgalaka, R., 219. Interview: The Dangers of Opposing Mining in South Africa. Human Rights Watch.

Sesele, K., Marais, L., Van Rooyen, D. and Cloete, J., 2021. Mine decline and women: Reflections from the Free State Goldfields. In T*he Extractive Industries and Society 8, 211–219.* Available at: https://doi.org/10.1016/j.exis.2020.11.006

Shongwe, B.N. 2018. The impact of coal mining on the environment and community quality of life: a case study investigation of the impacts and conflicts associated with coal mining in the Mpumalanga Province, South Africa.

Simpson, G.B., Badenhorst, J., Jewitt, G.P.W., Berchner, M. and Davies, E., 2019. Competition for Land: The Water-Energy-Food Nexus and Coal Mining in Mpumalanga Province, South Africa. Front. In *Environ. Sci. 7, 86.* Available at: https://doi.org/10.3389/fenvs.2019.00086

Skosana, D. 2020. Mine, not yours: When will mining companies realise ancestral land cannot be valued in rands and cents? Daily Maverick. 2 December 2020. Available at: https://www.dailymaverick.co.za/opinionista/2020-12-02-mine-not-yours-when-will-mining-companies-realise-ancestral-land-cannot-be-valued-in-rands-and-cents/ (Accessed 8.26.21).

Skosana, D., 2019. Dispossession and the desecration of ancestral graves by mining corporations in Tweefontein (Ogies), South Africa. Society Work & Development Institute (SWOP).

SRK Consulting, 2017. Eskom Generation Fleet Renewal Project: Socio-Economic Study.

Statistics South Africa. 2016. The state of basic service delivery in South Africa: In-depth analysis of the Community Survey 2016 data.

Taylor, M., Weaver, M. and Davidson, H. 2018. IPCC climate change report calls for urgent action to phase out fossil fuels – as it happened. The Guardian. 8 October 2018. Available at:

https://www.theguardian.com/environment/live/2018/oct/08/ipcc-climate-change-report-urgent-action-fossil-fuels-live (accessed 12.18.20).

Tempelhoff, J.W.N., Ginster, M., Motloung, S., Gouws, C.M. and Strauss, J.S. 2014. The 2012 acid mine drainage (AMD) crisis in Carolina's municipal water supply. In *African Historical Review 46, 77–107*. Available at: https://doi.org/10.1080/17532523.2014.943978

Theron, A. 2019. Eskom Development Foundation invests in local community. ESI-Africa. 30 July 2019. Available at: https://www.esi-africa.com/regional-news/southern-africa/eskom-development-foundation-invests-in-local-community/ (Accessed 9.2.21).

Trade Map, 2022. List of products exported by South Africa. Available at; https://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1%7c710%7c%7c%7c%7cTOTAL%7c%7c%7c4%7c1%7c1%7c2%7c2%7c1%7c1%7c1%7c1%7c1 (Accessed 7.26.22).

Transnet. 2019. Freight Rail 2019. Available at: 2019 https://www.transnet.net/InvestorRelations/AR2019/Freight%20Rail.pdf

Transnet, n.d. Port of Richards Bay. Corporate Brochure. From Fishing Village to Port City. Available at: https://www.transnetnationalportsauthority.net/OurPorts/RichardsBay/Documents/Richards%20Bay%20Port%20Brochure.pdf

Social Accounting Matrix, 2017 (This needs to change to) -

Van Seventer, D., Bold, S., Gabriel, S. and Davies, R. 2019. A 2015 Social Accounting Matrix (SAM) for South Africa. SA-TIED Working Paper. March 2019. Available at: https://sa-tied.wider.unu.edu/sites/default/files/pdf/SATIED_WP35_vanSeventer_Bold_Gabriel_Davies_March_2019.pdf