

Coal and the Environment: Some implications for South Africa

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DECLARATION

I Ntuthuko Makhombothi declare that this Research Report is my own, unaided work. It is being submitted for the degree of Master of Business Administration at the University of the Witwatersrand, Johannesburg. It has not been submitted before any degree or examination at any other University.



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1 day of JUNE 20 24 in Sandton, Johannesburg

ABSTRACT

South Africa's coal industry faces an existential threat from the need to transition to a low carbon economy. This study analyses the implications of the Just Energy Transition (JET) on the coal industry of South Africa using mixed methods approach and secondary data from industry reports, government reports and academic sources. The study demonstrates the significant economic contribution of coal to the GDP, employment and energy security, while evaluating the JET framework against international principles. Although the JET framework is largely aligned with international principles, there are some areas for improvement. The decommissioning of the Komati power station illustrates the shortcoming in the distributive, restorative and redistributive justice. The findings suggest a need for a balanced JET that ensures economic growth, energy security and environmental sustainability. Further research is required to develop transition pathways that mitigate against the negative socioeconomic consequences for coal dependent communities.

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1. INTRODUCTION

The transition to a low-carbon economy and the need for sustainable energy practices have put significant pressure on the global coal industry. The United Nations Sustainable Development Goal 7 (SDG 7) stresses the importance of “affordable and clean energy” (United Nations, 2016b, p.21). The emphasis on “clean” relates to SDG 3 (“good health and well-being”), SDG 7 (“climate action”) and SDG 15 (“life on land”). On the other hand, the emphasis on “affordable” relates to SDG 1 (“no poverty”), SDG 8 (“decent work and economic growth”), SDG 10 (“reduced inequalities”), SDG 11 (“sustainable cities and communities”) and SDG 3 (good health and wellbeing) (United Nations, 2016b).

Thus, the impact of coal on the environment is intrinsically tied to the United Nation’s SDGs. The term just energy transition encapsulates these dimensions. In short, it refers to the transition towards lower carbon technologies which do not adversely impact society, jobs and livelihoods. This study focuses on the implications of a Just Energy Transition (JET) for South Africa's Coal Industry. This is done against the backdrop of the country's current energy crisis, the importance of coal to the economy and the need to strike an appropriate balance between coal and renewable energy sources to ensure that South Africa can attain SDG 7 (“affordable and clean energy”).

In short, the primary objective of this study is to consider the challenges and opportunities facing the coal industry in South Africa arising from the pressures to transition to cleaner energy sources whilst ensuring energy security to underpin the much-needed economic growth in South Africa. The study is based on desktop research and a mixed methods analysis to address the research objectives. The analysis primarily relies on secondary data, which is sourced *from inter alia*, industry reports, government reports, expert research reports and other publicly available reports and data. The research findings of this study enhance our understanding of the challenges and opportunities associated with the transition to a low-carbon economy for the domestic coal industry in South Africa.

1.1. Problem Statement

The coal industry faces challenges from increasing pressure from climate action lobby groups (Cala et al., 2021; Mathu & Chinomona, 2013; Norouzi, N and Fani, M, 2021; Todd & McCauley, 2021; Ziervogel et al., 2014). Commercial banks have started to curtail financing for new coal projects due to concerns about the environmental impact of these investments (Plantinga & Scholtens, 2021; World Coal, 2023). However, these challenges provide opportunities for coal companies to invest in renewable energy and clean coal technologies (Energy Capital & Power, 2022; Exxaro, 2021; Nwokolo et al., 2023; Reuters, 2023).

The coal industry in South Africa contributes significantly to the country's economy, particularly in employment, infrastructure development and government revenue (Mathu & Chinomona, 2013; Mbedzi et al., 2018; Mbedzi et al., 2020). Coal has been a reliable and affordable energy source that has supported economic growth in South Africa. However, the industry is now under increased scrutiny due to its significant greenhouse gas emissions (International Energy Agency, 2022).

However, given South Africa's power crisis and resultant frequent load shedding, coal is an significant contributor to the energy mix (Davis et al., 2019). This will probably be the case for some time, given that coal-fired power plants provide a stable base load of electricity (Khobai & Sithole, 2022), which enhances the reliability and security of the energy supply. Further, the intermittent and limited capacity of renewable energy sources underscores the importance of coal in the energy mix for baseload energy in South Africa. However, this reliance on coal comes with significant carbon emissions and adverse implications for the environment (Brown & Spiegel, 2019; Mbedzi et al., 2020).

South Africa's commitment to reduce carbon emissions in line with international climate goals (Department of Forestry, Fisheries & the Environment, 2021) is an indication of the government's commitment to the transition to clean energy sources. However, South Africa must balance the importance of coal production for economic development (i.e. address the immediate challenge of energy supply shortage) with the need to transition to cleaner energy sources to meet climate commitments. In this

regard, the use of clean coal technologies is critical to mitigate the environmental impact of coal (Baker et al., 2014; Henneman et al., 2016; Poore & Mathu, 2011; Todd & McCauley, 2021).

The study analyses the threats and pressures facing South Africa's coal industry in the context of a transition to a low-carbon economy. By examining the industry's contribution to the economy, the importance of coal in country's energy mix, the need to transition to renewable energy and the dichotomy this presents, the study aims to identify what an "appropriate" or "balanced response" would entail to cater for South African interests in general.

1.2. Objectives of the Study

The primary objective of this study is to analyse the implications of a "Just Energy Transition" on South Africa's coal industry. This primary objective is divided into the following two sub-objectives.

- Evaluate South Africa's JET framework against internationally set principles.
- Analyse the economic implications of a JET for the coal mining industry and the communities dependent on the industry.

1.3. Research Questions

The following research questions inform the analysis in this study:

1. What is the Just Energy Transition?
2. What is the contribution of the coal industry to the country's economy?
3. What are the implications of the Just Energy Transition for the country with a specific focus on (a) the potential threats and opportunities for South Africa's coal industry? (b) a "balanced approach" to the energy challenge for South Africa entail?

1.4. Justification of Study

Climate change has become a global issue, with global policymakers emphasising the need for urgent action to reduce greenhouse gas emissions and transition to cleaner energy sources (Mahadev, 2021). Pursuant to addressing the challenge of climate change the global community, through the United Nations adopted SDG 7 as indicated in the this chapter. However, South Africa relies heavily on coal for its national energy sector and faces challenges in meeting its commitments to the Paris Agreement (Van Wyk, 2022). Understanding the threats posed by climate change and the environmental pressures on the coal industry is critical for informed decision-making (Zhironkin & Cehlár, 2021).

South Africa's economy and energy supply are highly dependent on coal (Khobai & Sithole, 2022). The decisions by investors and financial institutions to re-evaluate financing new coal projects highlight the changing dynamics and increasing concerns about the environmental impact of coal (Energy Capital & Power, 2022; Plantinga & Scholtens, 2021; Schuster, 2022; World Coal, 2023). Examining the challenges and opportunities facing the coal industry will contribute to an insightful understanding of the industry's role in the transition to a sustainable energy economy.

1.5. Operational Definitions

The term ***Just Energy Transition*** (JET) refers to a transition from energy systems based on fossil fuels, to sustainable, low-carbon alternatives with the aim of combating climate change without compromising the principles and objectives pertaining to social justice, sustainable development and inclusiveness (Bainton et al., 2021; Heffron & McCauley, 2018; McCauley et al., 2019). A JET recognises the need to shift to renewable energy sources, improve energy efficiency and implement policies and practises, but this should prioritise social justice, job creation and community well-being (Burton, 2018; Renaud et al., 2021; Todd & McCauley, 2021). It emphasises a fair and just transition for workers and communities affected by the transformation of energy sectors so that no one is left behind and the burdens and benefits of transition are shared equitably (Müller & Claar, 2021a).

The term **renewable energy** refers to energy derived from renewing natural resources such as the sun (solar), wind, water (hydro), biomass, geothermal and tidal energy (Elavarasan, 2019; Raghuvanshi, 2008; Nwokolo et al., 2023). Unlike finite fossil fuels, renewable energy sources offer a sustainable and environmentally friendly alternative for electricity generation, heating and transportation (Elavarasan, 2019; Kumar. J & Majid, 2020; Owusu & Asumadu-Sarkodie, 2016; Raghuvanshi, 2008). They help mitigate climate change, reduce air pollution, improve energy security and promote sustainable development.

Clean coal technologies are production processes and technology that minimise the environmental impact of coal-based power generation by improving energy efficiency, reducing greenhouse gas emissions and reducing the release of pollutants from coal combustion and processing (Chen & Wu, 2022; Ko et al., 2021; Morimoto et al., 2023). Examples include carbon capture and storage (CCS), integrated gasification combined cycle (IGCC) and advanced combustion technologies (Shirmohammadi et al., 2020; South African National Energy Development Institute, 2020). These technologies improve the sustainability of coal as an energy source by reducing its environmental footprint.

2. LITERATURE REVIEW

Bainton et al. (2021), Heffron & McCauley (2018) and McCauley et al. (2019) identify three dimensions that must be considered when defining JET; these include the social, economic and environmental factors. The “Just’ in JET is unpacked in this section.

Just Energy Transition (JET) refers to an equitable and inclusive transition from high-carbon energy systems to low-carbon alternatives which entails not compromising on social, economic, and environmental justice (Bainton et al., 2021; Heffron & McCauley, 2018; McCauley et al., 2019). It emphasises the need to ensure that the burdens and benefits of the energy transition are equitably shared among all stakeholders, particularly vulnerable communities and workers in the fossil fuel industry (Müller & Claar, 2021; Renaud et al., 2021). Beyond simply reducing greenhouse gas emissions, JET also includes considerations of social justice (Müller & Claar, 2021), economic resilience, and community empowerment (Barnes, 2022).

The term "Just" implies that the transition to a low-carbon economy and the associated changes in energy generation should be equitable, inclusive and take into account social, economic and environmental justice (Müller & Claar, 2021; Mutezo & Mulopo, 2021; Renaud et al., 2021; Todd & McCauley, 2021). It emphasises the need to minimise potential negative impacts on workers, communities and vulnerable groups while promoting opportunities for inclusive economic growth and inclusive sharing of benefits (Müller & Claar, 2021a; Mutezo & Mulopo, 2021; Renaud et al., 2021; Todd & McCauley, 2021; Nwokolo et al., 2023; Pedersen & Andersen, 2023).

Scholars present different and complementary perspectives on JET, with some advocating for universal access to affordable, clean energy for all and mitigating negative impacts on disadvantaged communities (Barnes, 2022; Renaud et al., 2021). Others emphasise a just transition for workers and communities reliant on the fossil fuel industry (Nel et al., 2023), promoting retraining programs, job creation in renewable energy sectors, and social protection measures (Cock, 2019; Müller & Claar, 2021; Nel et al., 2023; Winkler et al., 2021).

The implementation of JET relies heavily on policy frameworks that include renewable energy targets, carbon pricing mechanisms and incentives for community-driven renewable energy projects (Cock, 2019; Müller & Claar, 2021). Stakeholder engagement, participatory decision-making processes, and collaboration between government, business, and civil society are highlighted to ensure inclusivity and avoid social conflict (Brown & Spiegel, 2019; Mbedzi et al., 2020; Winkler et al., 2021; Nwokolo et al., 2023). Additionally, it has been argued that research should focus on evaluating the effectiveness of different JET strategies and approaches in achieving a sustainable transition (Hirt et al., 2020; Price, 2022; Nwokolo et al., 2023).
The Significance of JET

The social equity and justice aspects of JET are of crucial importance. It aims to ensure that the costs and benefits of the energy transition are shared equitably among all stakeholders, especially marginalised communities (Baker & Burton, 2018). By addressing the needs of disadvantaged groups, JET seeks to prevent or minimise social injustices associated with large-scale transformations and close the energy

poverty gap (Baker et al., 2014; Müller & Claar, 2021). Further, JET plays a key role in improving energy security and resilience by diversifying energy mix, reducing reliance on fossil fuels and promoting decentralised and community-based renewable energy systems (Newell & Mulvaney, 2013; Winkler et al., 2021; Nwokolo et al., 2023).

The importance of JET lies in its potential to create a sustainable and equitable energy future that addresses the challenges of climate change, environmental degradation, social inequality and energy security (Nel et al., 2023). However, there needs to be more research in terms of quantitative assessments of the economic, social and environmental benefits of JET. More research is needed to demonstrate the positive impacts of JET, such as job creation, reduction of greenhouse gas emissions and improvement of energy security.

2.1. Some global perspectives of jet

This section highlights the guidelines for just transitions that have been advocated by the United Nations (UN) and the International Labour Organisation (ILO). This section will also highlight how JET is implemented in the European and Asian contexts.

The global energy landscape is changing due to increasing concerns about climate. Renewable energy sources are increasingly taking centre stage (Neha & Joon, 2021), with many countries adopting solar, wind and hydropower technologies (International Energy Agency, 2022). Efforts to decarbonise the energy sector have accelerated through the Paris Agreement and initiatives such as Mission Innovation (United Nations, 2016a).

The phase-out of fossil fuels, including coal, oil and gas, is gaining momentum (Winkler et al., 2021). However, geopolitical tensions, such as the Russia-Ukraine conflict, have increased global demand for coal and underscored the need for diversified energy sources (Li et al., 2022). International cooperation and partnerships promoted by organisations such as the International Energy Agency and the United Nations Framework Convention on Climate Change (UNFCCC) play an important role in addressing energy challenges and promoting sustainable solutions (Quitow et al., 2019; United Nations, 2016a). Global developments point to a shift towards cleaner

and more sustainable energy systems, driven by climate concerns and investments in renewable energy, decarbonisation and energy efficiency (Quitow et al., 2019). However, the current war poses threats.

At the Conference on Sustainable Development (United Nations, 2012), the United Nations acknowledged the need for countries to have different approaches in their transition to sustainable development and the green economy. This transition should be based on their specific needs and context. Further, the UN (2012) emphasised that a transition to a sustainable future had to consider the social, environmental and economic factors in the decision-making. This is vital to ensure that the overall path to sustainable development and a green economy underpins sustained, inclusive and equitable growth and does not worsen poverty levels in the country.

Following the United Nation's (UN) declaration on the transition to a green economy, the International Labour Organization (ILO) adopted "guidelines for a just transition towards environmentally sustainable economies and societies for all" (ILO, 2015, p.1). The ILO also emphasised that sustainable development must entail a holistic approach, taking account of social, environmental and economic dimensions and recognising the equal importance and interconnection of these dimensions.

The ILO (ILO, 2015) adopted seven guiding principles for policies of transitions, which include 1) a strong social consensus on the pathway, 2) the respect and promotion of rights in the workplace, 3) gender as an essential component of equitable outcomes, 4) an enabling environment for enterprises, workers, investors and consumers, 5) decent work and transparency on possible impacts on employment, provides social security, skills development and promotes social dialogue, 6) specific country context being accounted for, 7) international cooperation and coordination.

In 2022, the United Nations Development Programme (UNDP) and other organisations, such as the Worldwide Fund for Nature (WWF), formed the Alliance for a Just Energy Transformation (AJET) at COP27. Based on the guidelines outlined by the ILO for just transitions, AJET outlined eight principles and actions for a just energy transformation (Alliance for a Just Energy Transformation, 2022). Underpinning these

principles and actions are procedural, distributional, intergenerational, restorative and recognitional justice (Alliance for a Just Energy Transformation, 2022).

The eight principles adopted by the Alliance (AJET, 2022) state that a just energy transition must 1) be guided by science, 2) be fair, 3) be sustainable, ambitious and consistent, 4) be comprehensive, transparent and inclusive, 5) ensure stakeholder engagement, 6) be focused on climate justice, 7) uphold access to energy as sacrosanct, 8) guarantee access to justice, information and transparent decision-making.

According to AJET (2022), the first principle stresses the centrality of science-based decision-making in setting out transition plans in line with the Paris Agreement. This should include clear plans to decarbonise and eradicate fossil fuel dependency by 2050. The second principle places emphasis on the importance of distributive justice, ensuring that transitions do not deepen inequalities while privileging certain groups (AJET, 2022). This principle implores transition frameworks to take into account the vulnerable and marginalised and generations to come (AJET, 2022). The third principle calls for decisions on transitions to include the restoration of the environment and the promotion of social and development goals. The fourth principle calls for frameworks to be communicated clearly and with targets. It also underscores the importance of context-based transitions that involve communities from conception. The fifth principle speaks to the need to ensure that institutional arrangements that involve stakeholders are set up. Furthermore, the involvement of stakeholders at all phases of the transition leaves no one behind (AJET, 2022). The sixth principle seeks to ensure that there is justice in how climate finance and that there is a sharing of the costs of decarbonisation. The seventh principle focuses on the importance of ending energy poverty and ensuring that there is financing to deliver affordable and clean energy (UN, 2016b). The eighth principle underscores the importance of transparency when sharing information on transitions with stakeholders. It also emphasises the rights of communities and vulnerable groups.

The JET in Europe recognises the need for a holistic approach in its implementation (Martins et al., 2019; Streimikiene et al., 2021). Krawchenko & Gordon (2021) argue that the Just Energy Transition in Europe encompasses three main areas in the

literature: the jobs focus, the environmental focus, and the societal focus. Streimikiene et al. (2021) further emphasise the complexity of this process and point to the need to tackle energy poverty and vulnerability, especially in the context of implementing climate change mitigation measures. The JET framework in Europe is based on the fact that the continent does not have large fossil fuel reserves (Martins et al., 2019); however, Europe has a significant dependence on fossil fuels for energy production, even as it positions itself as a global leader in the adoption of renewable energy sources (Martins et al., 2019).

In Asia, JET is influenced by several factors, including economic growth, greenhouse gas emissions, and population size (Taghizadeh-Hesary & Rasoulinezhad, 2020). This transition is characterised by the creation of green jobs and green industries, the transformation of existing jobs, the phasing out of carbon-intensive activities and the search for pathways leading to the introduction of renewable energy and consumer demand management strategies (Diaz-Rainey et al., 2021; Sharpe & Martinez-Fernandez, 2021). The region's significant role in producing and consuming liquified natural gas and renewable energy components continues to shape the energy transition (Romsom & McPhail, 2020). China is leading in the development of renewable energy components and is undergoing a significant transition from heavy reliance on fossil fuels to low carbon energy consumption (He et al., 2022). However, the transition in Asia, particularly in the Association of Southeast Asian Nations (ASEAN) region, has been slow and poses a risk in meeting its environmental targets (Diaz-Rainey et al., 2021).

3. RESEARCH METHODOLOGY

This section outlines the research methodology. This study adopts a pragmatist paradigm, mixed methods with archival research and case study strategies. Purposive sampling is used to select secondary quantitative and qualitative data, followed by detailed data analysis techniques. The chapter also addresses the validity and reliability of the data, ethical considerations and the limitations of the research.

3.1. Research Paradigm

The research paradigm used in this research is a pragmatist one. Pragmatism as a research paradigm emphasises the practical application of ideas by integrating different methods to answer research questions (Saunders et al., 2009; Chan, 2017; Panya & Nyarwath, 2022) and focuses on the consequences of actions and the practical implications of research findings (Creswell, 2014).

By applying the pragmatist paradigm, the study analyses both statistical and other information to gain a better understanding of the implication of the JET for South Africa. The pragmatist paradigm allows for the use of mixed methods to address the research questions, adopting both objective and subjective perspectives to data analysis (Saunders et al., 2009).

3.2. Research Methodology

This study applies mixed methods to analyse the implications of the JET in South Africa and the economic contribution of the coal industry. Mixed methods combine quantitative and qualitative data to provide a comprehensive picture and analysis of the research problem (Denscombe, 2010; Sadan, 2014; Creswell, 2014). Secondary data is used, which is described by Watkins (2023) as the use of data that already exists for purposes of other research. This allowed the researcher to “draw data from government documents, scientific papers, statistical databases and other sources” (Panchenko & Samovilova, 2020, p.1).

3.3. Research Strategy

This study uses both archival research and case study strategies. Documentary data is collected from government databases to understand South Africa’s JET framework. This secondary data is sourced as archival data and used to address the research questions. A case study of the Komati power station is used to understand some implications of JET for South Africa.

3.4. Data Collection and analysis

Quantitative data on the economic contribution of the coal industry was obtained from Statistics South Africa and the Minerals Council of South Africa, as well as numerical data from academic papers and industry reports. This data was analysed using Microsoft Excel in tables and charts showing coal sales, employment and production trends. The documents were attained through desktop research, from the internet and academic journals. Qualitative data to understand the Just Energy Transition (JET) and its implications in South Africa was sourced from reports by Eskom, the Presidential Climate Commission and various academic studies. This study uses descriptive and interpretive approach to data analysis (Denscombe, 2010). It uses StatsSA statistics to graphically represent and interpret the economic contributions of the coal industry.

3.5. Ethical Considerations

Since this study has been conducted using secondary data and all relevant ethical protocols have been observed. The study provides references for all authorities using both in-text citations and a reference list.

3.6. Limitations of study

This study does not consider the entire value chain of the coal industry. The forward and backward linkages associated with the coal industry should be given more explicit attention in the analysis of future studies. Further, the analysis relies on secondary data which is publicly available. A useful follow-up to this study would be to undertake a more detailed analysis using primary data and information, which will provide better clarity at the microeconomic (community) level.

4. RESULTS

4.1. The economic contribution of the coal industry to South Africa

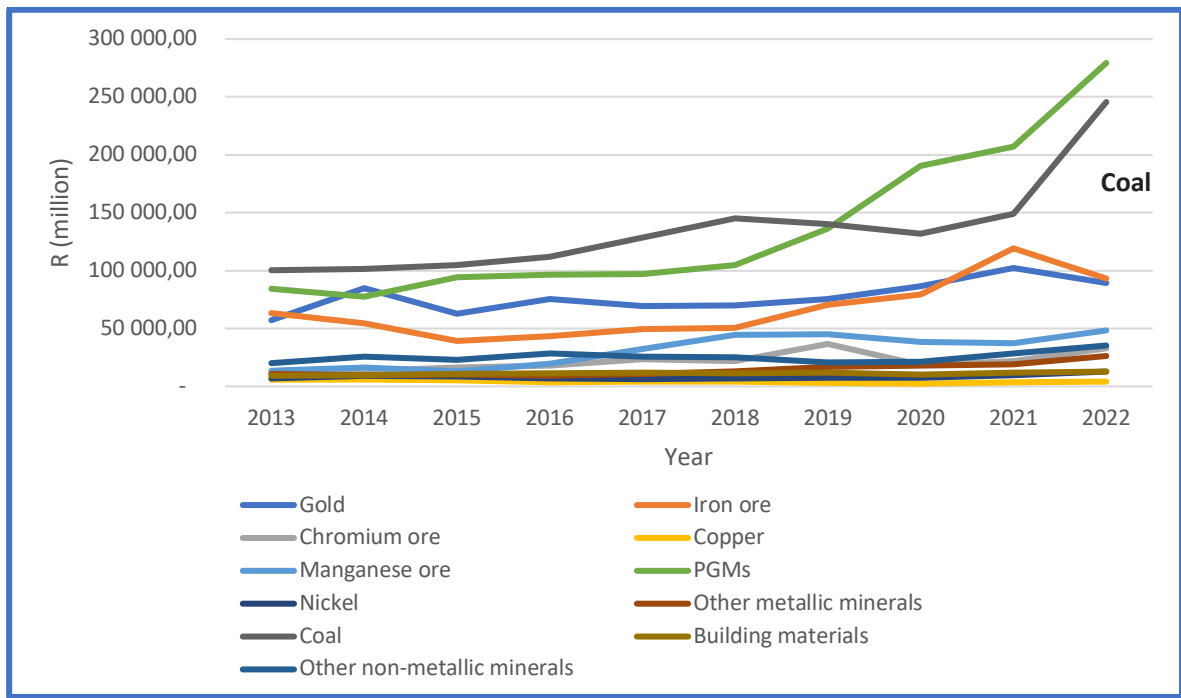
This section analyses the contribution of South Africa's coal industry to the economy. It covers the industry's economic contribution in terms of mineral sales, employment, energy security, and South Africa's coal reserves.

Wang (2023) indicates that the coal industry has a significant impact on the South African economy, contributing to exports, domestic energy consumption, Gross Domestic Product (GDP), employment and tax revenues. However, the coal industry is a double-edged sword (Wang, 2023), as it also comes with costs to the environment (Morosele & Langerman, 2020). According to Mirzania et al. (2023), South Africa's coal dependency presents risks to macro-economic stability because of severe socio-economic consequences of a transition away from coal for communities relying on the coal value chain.

4.1.1 Coal sales and export contribution in the mining sector

Figure 1 shows mineral sales over a ten-year period between 2013 and 2022 per commodity. Between 2013 and 2019, coal recorded the highest sales in mining. However, from 2020, PGM sales grew faster, but coal remains an important revenue generator, being the second largest contributor to mineral sales in South Africa.

Li et al. (2022) indicated that global coal demand increased as a result of the Russia-Ukraine conflict as evident by the coal sales growth of 65% between the years 2021 and 2022, as shown in Figure 1. The coal mining sector contributed 246 billion rands of all mining sales in 2022, representing 26% of all mining sales in South Africa (Minerals Council of South Africa, 2023a).



Source: Statistics South Africa (2023)

Figure 1 Mineral Sales between 2013 and 2022

According to the Minerals Council of South Africa (2023), South Africa is the fifth largest coal exporter in the world and has established a prominent position in the international coal market. Coal is the largest revenue generator from local mining sales and the second-largest earner of foreign currency in the mining sector (Minerals Council of South Africa, 2023). The economic impact is reflected in foreign exchange earnings, with coal contributing 10.13% to South Africa's foreign exchange earnings in 2020 (Mantashe, 2022; Minerals Council of South Africa, 2023).

The direct GDP contribution of coal mining declined from 2,3% in 2011 to 1,9% in 2020 (Makgetla & Patel, 2021) but the contribution of the coal value chain to South Africa's GDP was much higher at 5,4% in 2020 (Makgetla & Patel, 2021). The scholars defined the coal value chain as incorporating coal mining, electricity, exports and petrochemicals and the associated logistics and downstream industries.

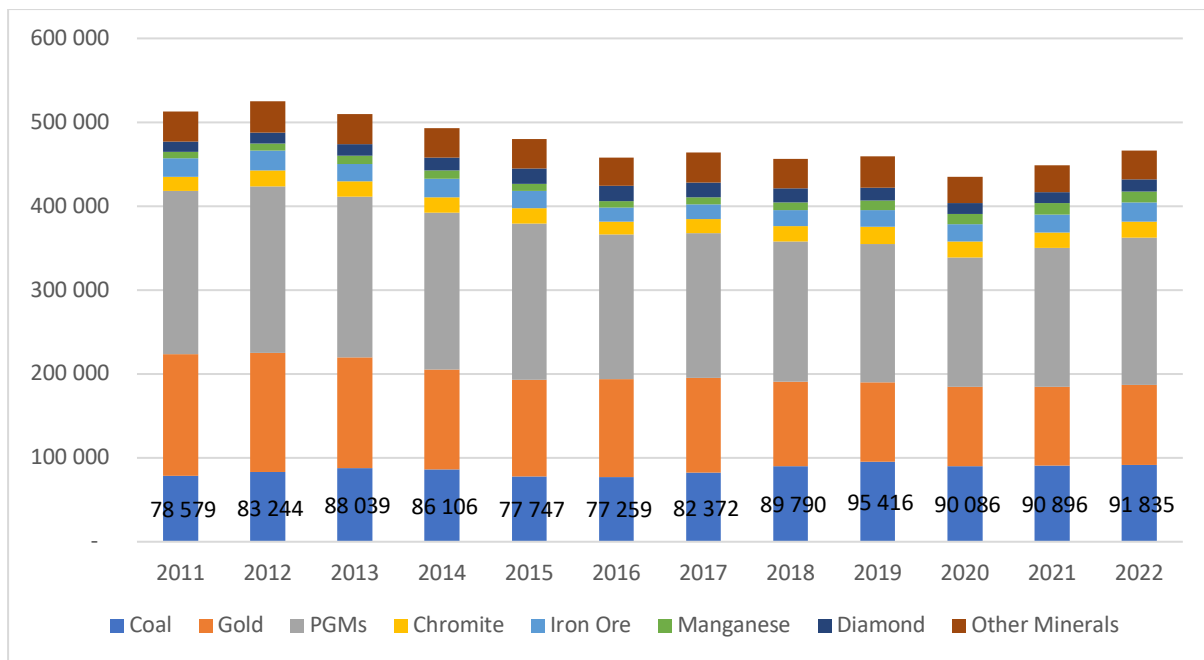
In summary, coal mining contributes significantly to the South African economy in terms of mining revenues, exports and the overall GDP. The economic contribution goes beyond direct revenues, influencing various downstream industries. It is

important for policymakers to factor in this contribution as the country transitions to a low-carbon economy. Policymakers must balance the positive contribution of the industry to the economy against the need to transition to an environmentally sustainable future.

4.1.2 Coal employment contribution in the mining industry

Figure 2 indicates that the mining industry employed 466,245 workers in 2022 with coal contributing 20% of all employment in mining, with 91,835 direct employment in the same year. According to Figure 2, coal has been the third largest employer in the mining sector for the past twelve years (between 2011 and 2022). Coal follows PGMs and Gold, respectively, which employed 175 288 and 95 051 in 2022. The graph (Figure 2) demonstrates how coal's employment contribution has been steadily increasing over the ten-year period. However, between 2019 and 2020, when the COVID pandemic started, coal saw a 5.6% contraction in employment, while the mining industry as a whole saw employment decline by 5.3% in the same period. Between 2020 and 2022, the coal sector has seen a steady increase in employment, demonstrating resilience and underlining its socio-economic importance.

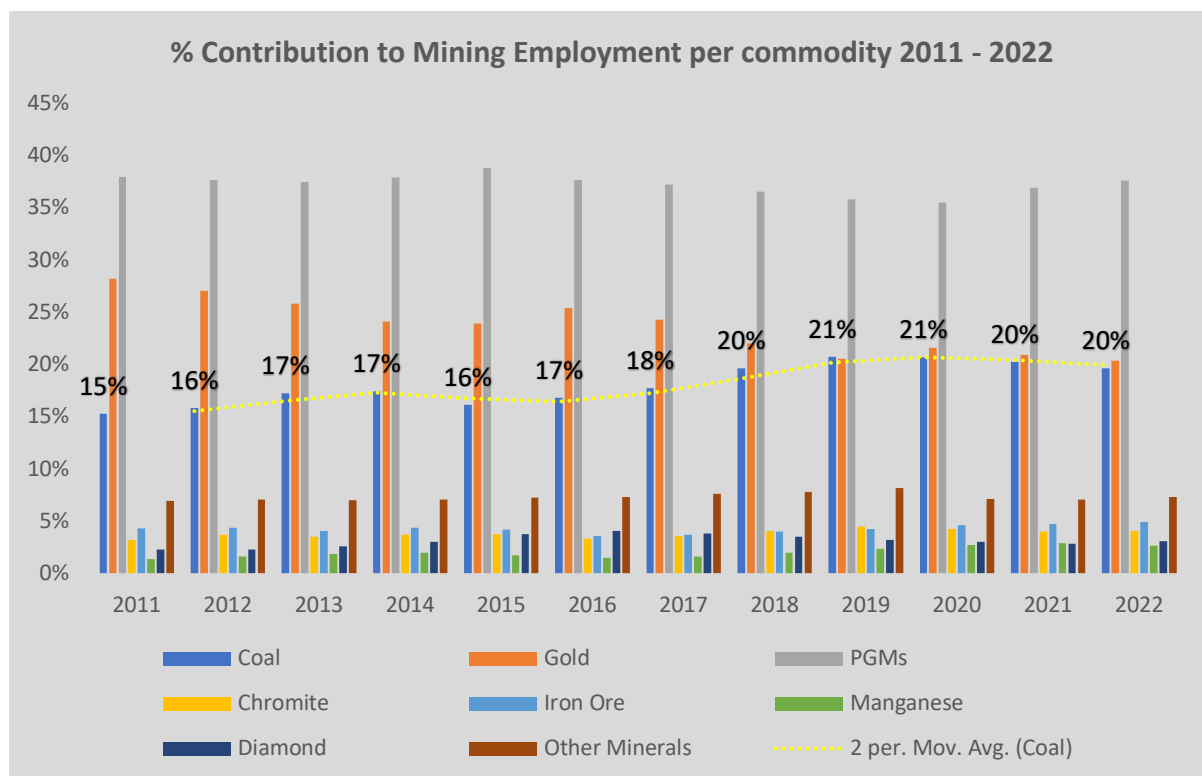
According to the Minerals Council of South Africa (2023), the wage income associated with these employment opportunities in 2022 totalled R29.6 billion rand and annual earnings per capita at R322 000, highlighting the sector's contribution to individual livelihoods and the economy.



Source: Minerals Council of South Africa (2023)

Figure 2 Mining Employment per Commodity

Figure 2 indicates the importance of coal as a significant employer in the mining sector. Coal is the third biggest employer after PGMs and Gold. Between 2011 and 2022, Coal has seen increases in its labour force while experiencing marginal declines since the COVID pandemic of 2020.



Source: Minerals Council of South Africa (2023)

Figure 3 Percentage Contribution to Mining Employment per Commodity

Figure 3 shows the percentage contribution of coal mining to employment in the mining sector in South Africa from 2011 to 2022. The Just Energy Transition in the context of South Africa should consider the significance of coal as a significant employer in the mining sector. This should inform policy in determining the pathway for South Africa's decarbonisation and the associated socio-economic impacts and how to mitigate impacts on workers. This is particularly the case given South Africa's high unemployment rate. Mining is a labour-intensive industry, with coal's contribution increasing over time from 15% to 20% of direct mining jobs (as shown in Figure 3). The JET should ensure that employment effects are given focal attention, ensuring that transition does not result in a net loss of employment.

4.1.3 Coal's contribution to energy security

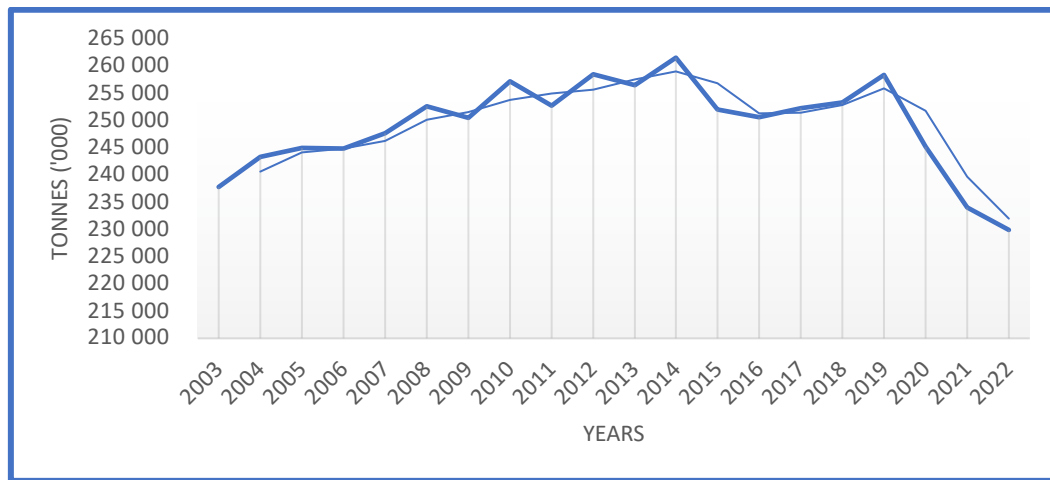
The role of coal in the South African energy landscape is of central importance, as it accounts for 65% of the primary energy supply. The sector's central importance to

electricity generation is evident by its contribution of 90% to the country's electricity generation (Department of Energy, 2017; Department of Mineral Resources and Energy, 2021). This dominance emphasises the intricate link between coal mining and energy security, which forms the basis for further economic activity.

The integration of the coal mining value chain goes beyond electricity generation. For example, 30% of liquid fuel consumption in South Africa is derived from coal, emphasising coal's versatility and importance in meeting diverse energy needs. In addition, coal is an essential resource for various commercial and industrial applications and provides electricity and heat through steam generation (Department of Mineral Resources and Energy, 2021).

4.1.4 Coal reserves in South Africa

The coal production numbers shown in Figure 4 show that between 2003 and 2014, coal production volumes have been increasing. Before the COVID pandemic, coal production volumes were stabilising towards the pre-2014 highs. Since the COVID-19 pandemic, coal production has declined by 11% between 2019 and 2022 (as shown in Figure 4). In contrast, as demonstrated earlier in Figure 1, during the same period (2019 – 2022), coal sales increased by 75.4% as a result of the rise in global coal prices.



Source: Minerals Council of South Africa (2023)

Figure 4 Coal Production between 2003 and 2022

Figure 4 shows how coal production has declined since the COVID-19 pandemic. A moving average is used to show the trend of coal production. According to the Department of Energy (2017), South Africa is a coal-rich country with coal reserves for about 200 years. In 2022, the country produced 229,9 million tonnes of coal (as shown in Figure 4), consolidating its position as the sixth-largest coal producer in the world (Department of Energy, 2017). Recoverable coal reserves in South Africa are between 15 – 55 billion tonnes (Wang, 2023).

The growing demand for high-tech products such as smart phones, electric vehicles, wind turbines, national defence and security application, has led increase focus on rare earth elements (REE) which are essential to manufacturing these products (Huang et al., 2018; Dushyantha et al., 2020; Eterigho-Ikelegbe et al., 2021; Fu et al., 2022). Research has confirmed the abundance of REEs in coal and its byproducts (Eterigho-Ikelegbe et al., 2021; Huang et al., 2018), while South Africa is endowed with significant coal reserves. This presents new possibilities for the role of coal in the transition as it can be used for renewable technologies needed in the green economy.

Beyond the macroeconomic level, coal mining is an economic anchor for the province of Mpumalanga. According to Nel et al. (2023), ten towns in this region rely on coal for their economic existence, emphasising the sector's role in regional development. Makgetla and Patel (2021) show that eMalahleni, Steve Tshwete, Govan Mbeki and Msukaligwa are heavily dependent on coal and its value chain as their economic

anchor, and they together constitute more than two-thirds of the countries value added in coal. This suggests that these communities will be the most affected by the transition and the inherent consequences. Thus, it is important for the impact of the transition on these communities to be taken into account when JET pathways are modelled to ensure that their interests are accounted for.

4.2 The implications of the just energy transition (jet) for south africa

This section considers some implications of JET for South Africa. This is explored considering the climate commitments, investment in renewable energy, and clean coal technologies, using the example of the Komati decommissioning and repurposing project.

South Africa faces unique challenges and opportunities in implementing the Just Energy Transition (JET). The country relies significantly on fossil fuels for electricity generation, which is a major obstacle to achieving the goals of JET due to its significant contribution to greenhouse gas emissions (Mathu & Chinomona, 2013; Mbedzi et al., 2020). However, reducing coal dependency is essential for South Africa to meet global climate goals and reduce its carbon footprint.

To address the current energy crisis, characterised by power outages and a tight supply situation, JET offers the opportunity to diversify the energy mix (Department of Mineral Resources and Energy, 2019), reduce dependence on centralised power grids and promote decentralised and renewable energy solutions. Investing in renewable energy projects such as solar and wind power can help reduce the strain on the national grid and ensure a more resilient and reliable energy supply (Neha & Joon, 2021; Nwokolo et al., 2023).

Finding the right balance between meeting energy needs, ensuring energy security and transitioning to sustainable energy sources is a critical consideration in implementing South Africa's JET. Clearly, reducing reliance on coal is necessary (Caetano & Merven, 2017), but the social and economic implications of a rapid transition need to be carefully considered (Nel et al., 2023).

The coal industry has always been a major employer, especially in regions where coal mining is concentrated (Nel et al., 2023). Therefore, JET should prioritise addressing the social and economic impacts on affected communities by supporting alternative livelihoods and implementing equitable transition measures (Müller & Claar, 2021). Achieving this balance between immediate energy solutions and long-term sustainability goals requires careful planning, active stakeholder engagement and policy frameworks that promote inclusive and equitable development.

4.2.1 South Africa's climate commitments

The Nationally Determined Contribution preparation process contributed positively to national climate policy processes in many countries (Röser et al., 2020). In line with the Paris Agreement, South Africa's NDC (CSIR, 2021) demonstrates its commitment to addressing climate change and promoting sustainable development. Compared to business-as-usual scenarios, the new NDC aims to reduce greenhouse gas emissions by 28% by 2025 and 43% by 2030 (CSIR, 2021). Table 1 provides the Green House Gas (GHG) emission targets set by South Africa in 2016 and the draft updates which are under consideration and consultation. These targets depend on international support for financing, technology transfer and capacity building.

Year	GHG emission target (2016)	Draft proposed update (2023)
2025	398 - 614 Mt CO ₂ -eq	398 - 510 Mt CO ₂ -eq
2030	398 - 614 Mt CO ₂ -eq	398 - 440 Mt CO ₂ -eq

Source: *Presidential Climate Commission (2023)*

Table 1 Nationally Determined Contributions proposed updates.

South Africa is focusing on diversifying its energy mix and increasing renewable energy production to meet its emission reduction targets. The NDC envisages shutting down 1.8 GW of coal-fired power plants by 2030 while acquiring 17.8 GW of renewable energy (CSIR, 2021). The NDC recognises the importance of global support for its implementation and seeks to foster collaborations with other nations and organisations to mobilise the necessary resources and expertise (CSIR, 2021).

To meet these climate commitments (as indicated in Table 1), South Africa is required to decommission 1.8 GW of coal-fired power stations by 2030. This will have significant consequences for the economy, the affected communities, and South Africa's energy security.

4.2.2 Renewable Energy Investment

As South Africa transitions to a low-carbon economy, coal companies are under increasing pressure to diversify their portfolios and invest in renewable energy sources. The opportunity for coal companies to invest in renewable energy represents an opportunity to reduce the damage to the environment and adapt to changing market conditions. This section reviews the literature on the potential for South African coal companies to invest in renewable energy technologies.

Energy Capital & Power (2022) reported that mining companies in South Africa are investing over \$3.8 billion in renewable energy projects, which will contribute towards the envisaged low carbon transition. Some of South Africa's major coal companies, such as Exxaro (Exxaro, 2021) and, Seriti and SASOL (Reuters, 2023), have also made significant investments in renewable energy, particularly solar and wind. Some scholars suggest that coal companies could leverage their existing infrastructure and expertise to invest in renewable energy initiatives such as solar and wind power, potentially generating new revenue sources ((Imasiku & Thomas, 2020; Price, 2022). However, this view has also been criticised by climate analysts and activists, like Schuster (2022), who suggest that the most significant negative impact on the environment comes from the actual use of the products produced by coal miners. The author suggests that coal miners should completely shift their businesses from producing and selling coal if their actions are to be considered as being consistent with climate action.

South Africa's coal producer, Sasol, has invested in a number of renewable energy initiatives, including a solar power facility in the Northern Cape. Exxaro Resources, another major coal producer, has also invested in wind power and other renewable

energy initiatives. It aims to produce at least 10 per cent of its energy from renewable sources by 2025 (Exxaro, 2021).

While the literature indicates that there are opportunities for coal companies to invest in renewables, more research is required to identify the specific strategies coal companies can use to transition to renewables. This includes determining whether coal companies should concentrate on developing their own renewable energy projects or forming partnerships with existing renewable energy companies. The regulatory framework for renewable energy and the potential financial incentives and subsidies available for renewable energy projects require additional research.

4.2.3 Investing in clean coal technologies.

The coal industry has received severe criticism for its impact on the environment, particularly its contribution to greenhouse gas emissions. Coal companies in South Africa are under increasing pressure to address these concerns by mitigating their environmental impact.

Investing in clean coal technologies such as carbon capture and storage (CCS) is one approach adopted by businesses (Ko et al., 2021). According to the South African National Energy Development Institute (2020), carbon capture technologies provide opportunities to maintain fossil fuels in the energy mix while still ensuring a reduction in greenhouse gas emissions. They are particularly relevant for countries like South Africa, which have large coal reserves and require baseload power, which intermittent renewable technologies are unable to provide.

However, detractors argue that these technologies are not a long-term solution and that the priority should be to eliminate coal completely. Further, the high implementation costs of these technologies render them unfeasible for many coal companies. Shirmohammadi et al. (2020) argue that the capital costs of deploying this technology in developing countries should be mitigated by international funding programs. South Africa received a grant from the World Bank to implement a CCS technology in Mpumalanga, which is expected to be online in 2023 (Reuters, 2021).

In general, coal companies in South Africa have responded inconsistently to environmental concerns. At the same time, some have taken action to invest in cleaner technologies and diversify into renewables. Others have been slow to act or have prioritised short-term solutions in response to a possible transition away from coal.

4.3. Analysing South Africa's the JET Framework

This section will unpack South Africa's Just Energy Transition Framework (JETF) and its three perspectives of distributive, procedural and restorative justice. This section further evaluates these against the global perspectives outlined above.

South Africa's JETF is intended to ensure that there is coordination and coherence among all stakeholders in the planning and implementation of a JET in the country (Presidential Climate Commission, 2022). The JET framework makes it clear that it is not solely focused on climate mitigation but rather seeks to centre the social and economic factors in transition in policy formulation.

According to the PCC (2022), JET is about enhancing the livelihoods of citizens in general through net-zero emissions by 2050 by fostering climate resilience. The commission further defines JET in the context of decent work for all, making sure that there is inclusion, poverty eradication and people-centred decision-making. JET, the commission argues, must protect vulnerable groups whilst securing their inclusion in new economic opportunities that accrue. The JET framework, in its definition, further indicates that JET must result in economical, localised, and diversely owned renewable energy. It underscores the importance of access to resources such as water and land in a sustainable way.

The framework also identifies what it regards as 'at risk value chains and sectors', which include the auto, coal, agriculture and the tourism value chains. For the purposes of this research, the coal value chain is relevant. The framework acknowledges that the transition will result in disruptions to the coal value chain, particularly in South Africa (PCC, 2022). The JET framework of South Africa states;

This will create significant risks to South Africa, including revenue loss from reduced coal exports; job losses across the coal value chain; and loss of the economic ecosystems around coal mining communities, potentially creating ghost towns without effective diversification (PCC, 2022, p. 11).

According to the framework, coal mining companies will also be directly impacted by climate change as their operations rely heavily on water (PCC, 2022). The transition will face the challenge of ensuring that coal mining changes its operating models while downstream industries adopt renewable sources of energy, away from fossil fuels (PCC, 2022). In the JET framework, the PCC (2022) acknowledges the huge job losses that may arise both directly and indirectly from coal mining. Emphasis is placed on the importance of local economic development strategies in coal mining towns and the potential of a renewable energy manufacturing industry to offset job losses. However, the framework does recognise that it will be difficult to find like-for-like jobs for mine workers.

The three principles underpinning the framework are distributive justice, restorative justice, and procedural justice (PCC, 2022). According to the framework, distributive justice aims to ensure the fair distribution of risks and opportunities during the transition, taking into account the three interrelated inequalities of gender, race, and social class. Restorative justice, on the other hand, focuses on addressing the damage and harm caused by climate change to individuals, communities, and the environment itself, with an emphasis on redress. The procedural justice principle is described by the framework as the empowerment of stakeholders (workers, communities, and small enterprises) in decision-making, in keeping with the principle of "nothing about us without us".

The principle of distributive justice in JET, as outlined in South Africa's framework, advocates for a shared distribution of risk and opportunities (PCC, 2022). This has been supported by various researchers (Müller & Claar, 2021a; Mutezo & Mulopo, 2021; Pedersen & Andersen, 2023; Renaud et al., 2021; Todd & McCauley, 2021b). The emphasis on skills and opportunities for vulnerable groups underscored by distributive justice also resonates with various scholars' definitions of JET. These scholars have argued that the JET should also promote the retaining of workers, the

creation of new jobs in the green economy and the importance of social protection measures (Cock, 2019; Müller & Claar, 2021b; Nel et al., 2023; Winkler et al., 2021).

This principle further aligns with the UN's emphasis on SDGs of '*not leaving anyone behind*' (UN, 2016b), and inequality levels are not worsened. The framework's focus on fair distribution also aligns with the ILO's (2015) guiding principles, emphasising equitable outcomes and consideration of vulnerable groups. It is also supported by AJET (2022) principles that emphasise fair transitions and inclusivity, especially with its focus on skills development and economic policies.

Restorative justice, according to the PCC (2022), is about redress, ensuring that communities form part of the ownership of the green economy, that energy poverty is ended, and that land that has been destroyed by climate change is restored. Newell & Mulvaney (2013) and Winkler et al. (2021) also identify the central role of Jet as ensuring energy security and promoting decentralised and community-based renewable energy systems.

Restorative justice finds expression in the third principle outlined in AJET's (2022) core principles, where the restoration of the environment and the promotion of social development are elucidated as central to a just energy transition.

The PCC (2022) identified procedural justice as an important principle that centres stakeholders within JET. The framework argues that all stakeholders must be part of policy formulation for transitions. This principle is also supported by a number of scholars who found that participatory decision-making and collaboration among stakeholders are critical to achieving inclusive transitions (Brown & Spiegel, 2019; Mbedzi et al., 2020; Winkler et al., 2021).

The guiding principles for a just transition of the ILO (2015) also support this framework's procedural justice principle when it calls for strong social consensus on the transition pathways and its emphasis on transparency. The framework also aligns with the core principles outlined by the Alliance for a Just Energy Transformation, which identify stakeholder engagement and access to information as key to transition policies (AJET, 2022). The principles also take forward the idea of procedural justice

when it calls for institutional arrangements that involve all stakeholders to be established at all phases of the transition.

South Africa's framework offers a more comprehensive approach by emphasising environmental justice through a focus on increasing resilience by protecting water resources, improving ecosystems (value chains), and future land-use practices (PCC, 2022). While the JET framework emphasises local stakeholder participation, there is also alignment on the importance of international cooperation, especially in the financing of the transition, as highlighted by the ILO (2015) and AJET (2022).

4.4. Evaluating the Komati decommissioning and repurposing project

This section will demonstrate the implications of JET using the Komati decommissioning and repurposing project as an example. This section draws on the PCC (2023) report entitled "Early Lessons and Recommendations from Komati Decommissioning and Repurposing Project". The section highlights how the Komati project fell short of meeting the standards set by the Just Energy Transition Framework, in particular distributive, procedural and restorative justice.

The Komati power station was commissioned between 1961 and 1966, with nine units producing a total of 1 GW of power (Eskom, 2023; Presidential Climate Commission, 2023). The decommissioning of the Komati power station was projected to take place after fifty years of its lifecycle and is planned for 2020 in the Integrated Resource Plan (DMRE, 2019).

In November 2022, Eskom (2022) announced that it was decommissioning the final operating unit of the Komati power station, which was producing 121MW at that time. According to the PCC (2023), the decommissioning of all nine units of Komati Power station started in 2018 (when the first unit was decommissioned) and continued until 2022 (when the last unit was decommissioned).

Pursuant to a just transition for the workers and communities affected by the transition, Eskom decided to leverage development finance to repower and repurpose the power station for 2020 MW of renewable energy and 150 MW of batteries (Eskom, 2022;

Presidential Climate Commission, 2023; World Bank, 2022). According to the World Bank (2022) loan funding of \$439.5 million, a further \$47.5 million of concessions and a \$10 million grant were made available for the repowering and repurposing project to support a just transition.

A year after the decommissioning, the PCC (2023) released a report on the Early Lessons and Recommendations from Komati's decommissioning and repurposing project. The PCC (2023) found that there were several challenges with this first JET project for the country. The key findings of the PCC (2023) were limited in scope given that they were limited to the confines of the power station itself, without inclusion of the broader value chain and community.

The PCC (2023) report found that workers and the community were not engaged meaningfully and inclusive. The Komati decommissioning report indicated that the timing and sequencing of the decommissioning were late and should have been communicated to the community well ahead of time since the IRP had already set out the decommissioning schedules. Further underscoring the importance of stakeholder engagement, the PCC (2023) indicates that there was inadequate involvement of the communities and workers in the conceptualisation of the transition projects. Furthermore, the report found that private sector resources could have been leveraged for the repowering and repurposing projects (since they were bankable), and the public purse could have been used to address the costs on the society of the decommissioning exercise to support the JET objectives.

The decision by Eskom to confine its JET considerations and interventions to the boundaries of the power station almost exclusively resulted in distributive injustice to the community. As indicated earlier in this research, the JET framework requires that both risks and opportunities of the transition be fairly distributed (PCC, 2022). However, in this project, Eskom focused mainly on internal stakeholders at the power station, which was mainly the employees who remained when the final unit was decommissioned (PCC, 2022). Since the decommissioning started in 2018 several workers were retrenched, and the stakeholders were concerned that opportunities for reskilling only considered the workers still employed by November 2022.

The project's limited scope also suggests distributive unfairness when it only considered the protection of jobs for employees directly employed by the power station and did not consider workers in the value chain whose jobs were also at risk (PCC, 2023). Distributive justice would also require the project of repurposing the power station for renewable energy and batteries to involve the community in ownership, job opportunities and training. Mirzania et al. (2023) also argue that Mpumalanga faces the challenge of distributive injustice as some of its communities become economically stranded. The scholar further underscores that communities are systematically excluded from participating in ownership and investment in renewable energy projects due to limited access to land, financing, and resources.

Redress of the damage caused to the environment and the negative health consequences to the community were not considered in the conceptualisation of the Komati decommissioning and repurposing project (PCC, 2023). The report indicates that the community required a health facility and that the project could have included this, focusing on alignments that may be linked to the emissions by the power station. The future of the economy in the affected communities around Komati was also left to the local government to conceptualise (PCC, 2023). Even though Eskom may not be directly responsible for the diversification of the local economies, restorative justice requires that there are institutional mechanisms that involve stakeholders like business, government, and community in defining the future for affected communities so as to alleviate the negative impacts of transition and ensure inclusive transitions (PCC, 2022; PCC, 2023).

From a procedural justice perspective, decision-making needed to involve all stakeholders, including those who are vulnerable to the impacts of the transition project (PCC, 2022). In the case of the Komati project, the community was consulted late and not part of the conceptualisation and design of the transition project (PCC, 2023). The report by the PCC (2023) indicates that some stakeholders made valuable suggestions about how the transition should have been designed only at the point of the review of this project. The engagements could have been more meaningful had the community, workers and other stakeholders been engaged in time. Examples of the community's suggestions included the deployment of clean coal technologies, the

repurposing of the power station as a museum for tourism, and several other uses for the assets at the power station (PCC, 2023).

The Komati project demonstrates several shortcomings in terms of South Africa's JET framework and may have led to unjust outcomes for stakeholders. It underscores the importance of ensuring that stakeholders are not left behind at all the phases of a transition to achieve just outcomes.

4.4.1. Impact of Komati decommissioning on Mpumalanga economy

Mpumalanga's output is driven by mining and manufacturing, with the largest contribution from mining at 27.7% (TIPS, 2022). The province's economy grew by 0.6% in 2022, slower than the national economy (TIPS, 2022). However, Mpumalanga has a population that is growing faster (1.7%) than the national average of 1.4% (Eskom, 2022).

Eskom (2021) conducted its study on the socio-economic impact of the Komati decommissioning, which indicated that there would be significant negative impacts on the Mpumalanga economy. According to Eskom (2021), the Mpumalanga economy will contract by 1.8% in 2026 due to the closures of power stations. The study suggests that output will decline by R1.57 billion between 2020 and 2022, leading to a cumulative decline of R6.36 billion by 2026. The Steve Tshwete Local Municipality, where the power station is located, has already experienced a 2% decline in GDP because of the decommissioning of Komati between the years 2017 and 2020 (Eskom, 2021).

Considering these findings, it is critical to adopt an inclusive decision-making approach to distributive justice and ensure transition pathways involve not only the power plant's internal stakeholders but also the broader community and various levels of government. Procedural justice must be observed in discussions about transition pathways, including in defining future economic opportunities to ensure equitable considerations of the impacts on the local economies. Failure to meaningfully engage communities could result in an unjust and unbalanced transition, where the burden is unfairly distributed between various stakeholders.

5. SUMMARY FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This section will provide the key findings of this study based on the qualitative analysis of the literature and the quantitative data sources. The findings will cover the alignment of South Africa's JET framework to international best practices, the contribution of coal to the South African economy, and the evaluation of JET practices using the Komati decommissioning and repurposing as a case study. The two objectives of this study are firstly to evaluate South Africa's Jet framework against internationally set principles and secondly to analyze the economic implications of a JET for the coal mining industry and communities dependent on the industry.

5.3. Summary findings

1. Contrasting South Africa's Just Energy Transition Framework with the international best practices set out in the UN's SDGs, the ILO and AJET guidelines suggest a lack of alignment on distributive, restorative and procedural justice. However, South Africa's frameworks go further to highlight the importance of transforming local economies dependent on coal to be resilient and diversify during and after the transition. The JET framework also aligns with international standards by placing significance on the cooperation of the international community in financing the transition. This finding addresses the first objective of this study by demonstrating that though the JET framework aligns with international principles, there are areas of where there exists misalignment which need to be closed.
2. The coal industry, which is significant to South Africa's economy, faces several challenges and opportunities because of JET. The transition is driven by the global pressure towards environmental sustainability by reducing carbon emissions. This study, whose primary objective is to consider the impact of JET, suggests nuances and complexity in the country which warrant specific attention. It highlights the need for a delicate balance between three important interrelated elements: fostering economic growth, ensuring energy security,

and advancing environmental sustainability. The transition, therefore, requires a balanced approach that carefully manages these interrelated priorities.

3. The study demonstrates the significant contribution of coal to the country's economy. The coal industry is a significant contributor to GDP, employment, and foreign exchange earnings. It also remains the largest contributor to electricity generation; this dependency emphasises the strategic importance of coal to energy security in the country. This presents complexity, suggesting that the transition must be achieved while not adversely impacting the economy. The finding shows that JET has a potential to erode the economic contribution of the industry and addresses the second objective of the study which seeks to analyse the economic implications of JET on the industry.
4. Mpumalanga, as a province, relies on coal for its output and employment; since the decommissioning of the first power station, Komati, the economy has seen a decline in GDP. The study demonstrates that the transition will lead to further negative impacts on the economy of the province. The socio-economic impact of the transition will be disproportionately shared by Mpumalanga, impacting the four key districts in the province and having a high potential to lead to unjust outcomes. This finding fulfills the objective of analysing the implication of the transition to industry and communities in Mpumalanga. It demonstrates that a coal reliant province like Mpumalanga will experience will contract by 1.8% by 2026 due to power station closures alone.
5. In evaluating JET practices in South Africa, to understand the implications for South Africa, the decommissioning project at the Komati power station was used as a case study. Applying the principles in the Jet framework and international best practice, the study found that the focus of transition efforts, particularly by Eskom, was too narrow, concentrating mainly on internal stakeholders at the power station. This approach resulted in distributive injustice, as the broader community and external stakeholders were not adequately considered. The JET requires a fair distribution of both risks and opportunities, yet in practice, this has yet to be fully realised, especially in terms

of reskilling opportunities and economic diversification for affected communities.

5.1 From a restorative justice point of perspective, the Komati project was arguably unjust, as it did not focus on restoring the environmental damage caused by coal to the communities, in particular the health effects. Eskom should have also facilitated a broad stakeholder approach towards diversifying the local economy by working with the community and the various levels of government. The study further points out that Eskom's approach was mostly confined to addressing the needs of internal stakeholders, particularly employees at the power station. This approach overlooked the broader community, especially those affected by retrenchments and lacking opportunities for reskilling. Ensuring a just transition requires a more balanced focus that includes both internal and external stakeholders.

5.2 Procedural injustice was highlighted by the lack of adequate involvement of communities and workers in the conceptualisation of transition pathways for the Komati power station. The findings further emphasise the importance of early and meaningful stakeholder engagement. The Komati decommissioning demonstrates the consequences of late and inadequate engagement with communities and workers. Stakeholders' contributions, such as suggestions for the deployment of clean coal technologies, were only considered at the review stage, indicating a missed opportunity for more inclusive planning. The study points out that Eskom's approach was mostly confined to addressing the needs of internal stakeholders, particularly employees at the power station. This approach overlooked the broader community, especially those affected by retrenchments and lacking opportunities for reskilling. Ensuring a just transition requires a more balanced focus that includes both internal and external stakeholders.

In summary, the findings of this study suggest that while the JET in South Africa is aligned with global sustainability goals, its implementation faces significant challenges. These include ensuring economic stability, engaging stakeholders effectively, addressing environmental and health impacts, and achieving distributive

and procedural justice. It underscores the importance of an inclusive and balanced transition that takes into account the broad spectrum of stakeholders.

5.4. Conclusions and Policy recommendations

The JET in South Africa represents a strategic shift towards environmental sustainability, primarily by reducing dependence on coal for energy generation. This transition aligns with the United Nations Sustainable Development Goals (SDGs), the International Labour Organisation (ILO) and the AJET guidelines and incorporates the principles of distributive, restorative and procedural justice. The local coal-dependent economy must become resilient and diversified to ensure economic stability and social justice during and after the transition.

The coal industry is a cornerstone of the South African economy and significantly contributes to GDP, employment and foreign exchange earnings. It continues to be an essential source of electricity generation, emphasising the strategic importance of coal to energy security. The scale of the industry and integration into the national economy emphasises the complexity and challenges of moving away from coal without adversely impacting the economy.

The transition poses significant challenges, particularly for regions such as Mpumalanga, which are heavily dependent on coal. There is a threat of economic decline, job losses and social unrest. The decommissioning of power stations such as Komati has already had a negative impact on local GDP and employment. However, there are also opportunities for economic diversification and the development of renewable energy sources. This transition can stimulate innovation, attract investment in clean coal technologies and renewable energy, and create new employment opportunities in emerging sectors.

The transition must balance economic growth, energy security, and environmental sustainability and ensure that it does not disproportionately impact communities dependent on the coal industry. This includes phasing out coal dependence at a pace that is economically sustainable while reducing emissions through clean coal technologies and increasing investment in renewable energy.

Procedural justice requires early and meaningful involvement of all stakeholders, including local communities, labour and government. This ensures a fair distribution of risks and opportunities and incorporates diverse perspectives into decision-making. The transition plan must include opportunities to reskill workers and strategies to diversify the local economy affected by the transition to a low-carbon economy.

The study emphasises the importance of a strategically balanced Just Energy Transition (JET) approach. This includes recognising the essential role of coal in the South African economy and understanding the broader implications of the transition. Therefore, the study proposes a set of recommendations that consider these dynamics to guide an effective and just transition process.

- To meet South Africa's climate commitments and achieve environmental sustainability, South Africa should engage in a JET pathway that entails a transition to renewables. This JET approach may offer significant environmental benefits but could also pose challenges for coal-dependent regions such as Mpumalanga, which could lead to socio-economic injustice. Further, this path may require significant investment and time to develop new industries and poses risks to energy security as renewables are intermittent.
- Alternatively, a JET pathway that incorporates the coal industry while increasingly phasing in renewable energy sources could be pursued. The deployment of clean coal technologies could mitigate the impact on the environment. This JET approach could strike a balance between socio-economic stability and environmental sustainability. However, it may require significant investment in technology and support for smaller coal producers. This approach may offer a balanced and phased transition that allows time for the development of new green industries and reduces the abrupt impact on coal-dependent communities.
- The action being recommended for Eskom is to integrate the Just Energy Transition Framework in its implementation of transition projects. At the core of

the focus should be the timely engagement and involvement of both internal and external stakeholders in the conceptualisation and design of transition pathways for its various power stations.

- The three levels of government, national, provincial, and local government, should develop strategies to integrate and align industrial policy, local development plans, and integrated development plans to the need to diversify local economies that are highly dependent on coal power stations. It is imperative that the socio-economic impact of the transition are given particular attention for the regions that are heavily dependent on the coal industry
- Research institutions, the coal industry, Eskom and the government could conduct in-depth studies on clean coal technologies in the context of South Africa. This is particularly the case given South Africa's huge coal reserves. South Africa has a comparative advantage in coal, the challenge is to use this advantage to the country's benefit whilst embarking on the sustainability path.
- Future research should focus on the role of rare earth elements found in coal and its by products in the future green economy that South Africa seeks to pursue.
- Researchers should conduct studies on decommissioning strategies that accord with restorative, procedural and redistributive justice outlined in the JET framework. This research should seek to address mitigating strategies on the socioeconomic impacts of JET in coal dependent communities.
- Research should also focus on transition pathways for fossil fuel dependent developing economies of the South. Making comparisons between South Africa's JET pathways with similar economies in the developing world.

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