

School of Mining Engineering



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**A JUST ENERGY TRANSITION: CHALLENGES AND BENEFITS IN THE SOUTH
AFRICAN COAL MINING INDUSTRY**

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DECLARATION

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ABSTRACT

This research report investigates the transition to renewable energy (RE) in South Africa, focusing on the challenges, benefits and opportunities involved in shifting from a fossil fuel-dependent energy system to sustainable energy sources like solar and wind. The study explores how various stakeholders, including employees from Seriti Resources, Thungela Resources, Glencore, Eskom, the Department of Mineral Resources and Energy (DMRE) and community members in coal-dependent regions, perceive the potential of renewable energy and the implications of such a transition on the country's economy, energy security, social welfare, and environmental goals.

The research employs a qualitative approach, gathering data through semi-structured interviews with community members (4) and industry experts (14), including engineers, environmental specialists, and managers working across the energy, mining, and regulatory sectors. Thematic analysis was employed to identify recurring themes from the interview data. Key themes identified included the national energy status, processes of RE transition, opportunities and challenges associated with the transition and its social impacts.

Research findings reveal that, while renewable energy offers environmental sustainability and potential to reduce load shedding, several significant challenges need to be addressed. These include the high costs of renewable energy, potential job losses in coal-dependent regions, and the unreliability of solar and wind energy in providing a continuous power supply. Furthermore, participants highlighted the lack of political leadership and regulatory frameworks as major barriers to the successful implementation of renewable energy projects. The findings are based on the analysis of interview content, as highlighted by participants during the qualitative interviews.

The report concludes that South Africa's energy transition must be approached with careful planning, considering the socio-economic implications of moving away from fossil fuels. Recommendations include promoting an energy mix strategy, fostering government-led initiatives to build grid capacity for renewables, increasing public awareness of career opportunities in the renewable energy sector, and establishing policies that attract foreign and local investments.

The report suggests that a gradual, well-executed transition, with clear strategies to mitigate job losses, ensuring energy security, and addressing social concerns, is essential for South Africa to achieve a just and sustainable energy future.

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ABBREVIATIONS AND SYMBOLS

Abbreviation/Symbol	Full Term/Meaning
AfDB	African Development Bank
CCS	Carbon Capture and Storage
CO ₂	Carbon Dioxide
COP	Conference of the Parties
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated Solar Power
DMRE	Department of Mineral Resources and Energy
EIA	Environmental Impact Assessment
Eskom	South African Electricity Supply Commission
EV	Electric Vehicle
EWSETA	Energy and Water Sector Education and Training Authority
GHG	Greenhouse Gases
GW	Gigawatt
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IPG	International Partners Group
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
IRP	Integrated Resource Plan
JET	Just Energy Transition
kWh	Kilowatt-hour
MHSC	Mine Health and Safety Council
MW	Megawatt

NDC	Nationally Determined Contribution
OECD	Organisation for Economic Co-operation and Development
PV	Photovoltaic (solar power technology)
PwC	PricewaterhouseCoopers
QCTO	Quality Council for Trades and Occupations
R&D	Research and Development
RE	Renewable Energy
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RSA	Republic of South Africa
SA	South Africa
SANEDI	South African National Energy Development Institute
SARS	South African Revenue Service
SDG	Sustainable Development Goals
Seriti Green	Renewable Energy Company under Seriti Resources
UDL	Uniformly Distributed Load
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar

CHAPTER ONE

1 INTRODUCTION

1.1 Research Background and Context

South Africa's coal mining industry plays a critical role in the country's economy, providing employment to thousands and contributing significantly to energy production. However, the environmental and social costs of this reliance on coal are becoming increasingly evident. South Africa is one of the world's largest carbon emitters, with 86% of its electricity generated from coal-fired power stations, making the country highly dependent on fossil fuels (Presidential Climate Commission, 2021). This heavy reliance on coal has led to high greenhouse gas (GHG) emissions, contributing significantly to climate change. In response, South Africa is under increasing pressure to transition from coal to renewable energy sources as part of its decarbonization efforts (United Nations, 2023).

The concept of a Just Energy Transition (JET) is gaining traction in South Africa, aiming to shift the country towards cleaner, more sustainable energy sources while addressing the social and economic challenges of this transition (DMRE, 2022a). A JET focuses not only on reducing carbon emissions but also on ensuring that the transition is inclusive and does not disproportionately impact vulnerable communities, such as those employed in coal mining (Eskom, 2023a). Globally, the transition from coal and other fossil fuels to renewable energy is seen as essential in mitigating climate change, which is causing rising global temperatures, extreme weather events, and environmental degradation (United Nations, 2023).

For South Africa, the energy transition is vital to achieving its climate goals, especially considering its commitment to the Paris Agreement, which seeks to limit global temperature rise to well below 2°C (The Paris Agreement, 2015). To meet these targets, carbon emissions need to be reduced by nearly half by 2030, with a goal of reaching net-zero emissions by 2050 (United Nations, 2016).

However, achieving these goals presents significant challenges, including economic dependency on coal, potential job losses in the coal mining sector, and the need for substantial investment in renewable energy infrastructure.

JET refers to the equitable shift from fossil fuels to renewable energy sources in a way that protects the socio-economic well-being of workers, communities, and industries reliant on the carbon-intensive fossil fuel economy (JET-IP, 2022a). This concept acknowledges the need for urgent climate action while recognizing that such transitions can have significant social and economic impacts on affected groups. JET is grounded in principles of fairness, justice, and inclusivity, ensuring that the burdens and benefits of the energy transition are shared equitably. This involves mitigating potential job losses in the fossil fuel sectors, protecting vulnerable communities, and creating new economic opportunities in the renewable energy sector (United Nations, 2023).

One of the foundational elements of a JET is addressing the adverse impacts of the energy transition, particularly for workers in coal mining, oil, and gas industries. The International Labour Organization (2015) emphasizes that a just transition should ensure that workers and communities are not left behind. This includes investing in reskilling programs to help workers transition into emerging industries, providing social protection for those displaced, and fostering economic diversification in regions heavily dependent on fossil fuels. Additionally, it encourages multi-stakeholder engagement—ensuring that the voices of labor unions, local communities, industry stakeholders, and governments are part of the decision-making process.

The concept of JET is intricately tied to the global commitment to climate change mitigation. The Paris Agreement (2015), a landmark international accord, requires signatory countries to limit global warming to below 2°C, and preferably 1.5°C, compared to pre-industrial levels. Achieving these targets necessitates a dramatic reduction in carbon emissions, primarily through the phasing out of coal, oil, and gas in favor of renewable energy. For fossil fuel-dependent countries like South Africa, this transition represents a significant challenge, not only for meeting emissions targets but also for safeguarding the livelihoods of communities reliant on coal industries (Winkler, 2022).

South Africa's reliance on coal extends beyond energy generation, with substantial employment in the coal mining sector and local economies tied to coal-rich regions, particularly in Mpumalanga (DMRE, 2022b).

Thus, the transition to renewable energy sources poses significant risks for these communities, potentially exacerbating unemployment, poverty, and economic inequality. The Just Transition Framework for South Africa (2022) highlights these risks, arguing that without appropriate planning and interventions, the energy transition could deepen existing social and economic disparities.

Despite these challenges, there are numerous benefits to transitioning to renewable energy. Renewable energy sources such as wind, solar, and biomass offer the potential to reduce the country's carbon footprint while meeting its energy demands in a more sustainable manner. Furthermore, renewable energy development can spur economic growth by creating new job opportunities in the green energy sector and reducing the country's dependence on imported fossil fuels (IRENA, 2021a).

JET presents numerous opportunities for South Africa, especially in the context of renewable energy growth. The country is endowed with abundant renewable energy resources, including some of the highest levels of solar radiation globally and significant wind energy potential. According to the International Renewable Energy Agency, the country could generate as much as 20 GW of electricity from renewable sources by 2030, creating new industries and jobs (IRENA, 2021b). In this context, a just transition is about balancing the protection of existing coal-dependent workers and communities with the expansion of renewable energy industries that offer future employment opportunities.

Several organizations have emphasized that the JET should not only focus on creating jobs but also on ensuring that these jobs are decent, secure, and inclusive. The World Bank (2021a) stresses that the transition to a low-carbon economy can only be successful if the quality of employment in renewable energy is as good, if not better, than jobs in fossil fuel sectors. This involves ensuring that new jobs provide adequate wages, benefits, and working conditions, particularly for workers transitioning from the coal sector.

Moreover, the transition should address broader social justice issues, including gender and racial equity. Research indicates that women, minorities, and marginalized groups are often underrepresented in the fossil fuel and renewable energy sectors.

The International Energy Agency (IEA) highlights that gender diversity remains a challenge in the energy industry globally, and this must be considered in JET policies to ensure an equitable distribution of opportunities (IEA, 2021a).

In the South African context, the government has committed to the principles of a JET through various frameworks. The Presidential Climate Commission (2021) and the Just Energy Transition Investment Plan (JET-IP) (2022b) outline South Africa's strategy for achieving a fair transition. These documents emphasize the need for investments in green energy infrastructure, worker retraining programs, and social protection schemes to ensure a smooth transition that benefits all South Africans. However, critics argue that the implementation of these plans has been slow, and more concrete actions are needed to accelerate the process (Raji, 2022a).

Given these challenges, this study will explore both the obstacles and opportunities of transitioning to renewable energy in South Africa, particularly within the coal mining industry. The research will also examine how a JET can be achieved, ensuring that the shift from coal to renewables is equitable and does not leave affected communities behind.

1.2 Problem Statement

Employment Loss

South Africa's energy sector, heavily dependent on coal, is facing a critical juncture as the country strives to transition to renewable energy (CSIR, 2021). While the transition promises environmental benefits and contributes to global efforts to combat climate change, it poses significant socio-economic challenges, particularly for the coal mining industry (Eskom, 2021).

In 2020, coal was South Africa's third-largest employer in the mining sector, with 89,548 people directly employed. By 2021, that figure rose to nearly 93,000, and there are fears that approximately 102,000 jobs could be at risk if Eskom, the national power utility, shut-down coal-fired power stations by 2050 to meet net-zero emissions targets (Raji, 2022a).

With an unemployment rate of 32.6% as of the second quarter of 2023, South Africa cannot afford to ignore the potential social fallout of this energy transition (Trading Economics, 2022).

Energy Deficit

South Africa plays a significant role in Africa's energy landscape due to its heavy reliance on coal, which contributes approximately 80% of the country's electricity generation (DMRE, 2022b). Unlike many other African nations facing severe electricity deficits, South Africa has one of the most developed power infrastructures on the continent. However, the country still grapples with energy challenges, including aging coal-fired power plants, frequent load shedding, and a growing demand for electricity that outstrips supply (Eskom, 2023a).

Lack of Alternative for Coal

While South Africa contributes a substantial portion of Africa's total generation capacity, it faces pressure to transition towards renewable energy, which requires significant financial investment (Government Gazette, 2019). The challenge remains whether South Africa, and the broader continent, can successfully implement a JET when coal remains the most cost-effective and widely available energy source, while renewable alternatives remain expensive and intermittently available (CSIR, 2021).

Climate Financing

Climate financing fairness also presents a major obstacle in South Africa's energy transition (AfDB, 2022a). Although the Paris Agreement provides a framework for financial and technical support for developing countries, the reality is that much of the support offered to South Africa for decarbonization comes in the form of loans rather than grants. Of the \$8.5 billion pledged by the International Partners Group to support South Africa's energy transition, only 2.7% is offered as grants, with the remaining 97% in loans (Patel, 2023a).

South Africa, already burdened by significant debt, has expressed concerns about the fairness of this financial arrangement, particularly when the African continent contributes only 1% to global carbon emissions but bears disproportionate climate-related impacts. There is an ongoing debate about the extent to which industrialized countries, responsible for the bulk of historical carbon emissions, should bear a larger share of the financial burden for climate adaptation and mitigation (Raji, 2022a).

Research Focus

Given these challenges, the central problem of this research is to assess whether South Africa can achieve a JET that balances the need for environmental sustainability with the socio-economic realities of its coal-dependent economy. The report will explore the perspectives of a selected group of mining industry participants on how South Africa can navigate the risks of job losses, ensure equitable climate financing, and address infrastructure deficiencies while transitioning to renewable energy.

1.3 Justification for Research

The transition to renewable energy in South Africa is crucial not only for meeting international climate goals but also for addressing the country's ongoing socio-economic challenges. The research explores how this transition can be managed effectively while considering economic stability, energy security, and socio-economic fairness.

1.3.1 Economic Impact and Job Losses

The decommissioning of Eskom's coal-fired power plants could put 102,000 jobs at risk, contributing to the already high unemployment rate of 32.6% in the second quarter of 2023 as referred to previously in chapter 1.2 (Trading Economics, 2022; Raji, 2022a). While job losses are a recognized concern in the energy transition, this research highlights the urgent need to address this issue through a JET. The study explores potential strategies for mitigating job losses and fostering employment in the renewable energy sector.

1.3.2 Renewable Energy Potential and Energy Access

South Africa has significant renewable energy potential, particularly in solar and wind power. However, the country's energy infrastructure remains inadequate, with a large portion of the population—particularly in rural areas—lacking access to electricity (AfDB, 2022b).

This research evaluates the feasibility of scaling up renewable energy systems to meet growing energy demand. The study focuses on whether renewable energy can effectively address energy infrastructure deficits and the associated high costs of expanding grid access, especially for rural communities.

1.3.3 Climate Change Commitments

As a signatory to the Paris Agreement, South Africa has committed to reducing carbon emissions and achieving net-zero by 2050 (United Nations, 2016). However, the country's reliance on coal for electricity generation makes this goal particularly challenging. This research investigates how South Africa can meet its climate commitments through a JET, ensuring a balance between environmental sustainability and socio-economic realities. The study also explores possible pathways to decarbonisation.

1.3.4 Fairness in Climate Financing

As the \$8.5 billion pledged by international partners to assist South Africa's transition comes largely in the form of loans, there are concerns about the country's ability to finance this transition without exacerbating its existing debt (Patel, 2023a). This research touches on the financial challenges of climate financing and advocates for more equitable funding mechanisms to support South Africa's decarbonisation commitment.

1.3.5 Sustainable Development Goals (SDGs)

Transitioning to renewable energy is essential for achieving multiple Sustainable Development Goals (SDGs), including SDG 7 (affordable and clean energy), SDG 8 (decent work and economic growth), and SDG 13 (climate action) (International Labour Organization, 2015). This research contributes to the broader discourse on how South Africa can align its energy transition with the SDGs.

While the research does not explore every aspect of the SDGs in detail, it emphasizes that the energy transition must ensure that vulnerable populations are not left behind, aligning with the principles of social equity and sustainable development.

1.3.6 Policy and Leadership Gaps

South Africa's transition to renewable energy has been hampered by a lack of clear policy direction, weak infrastructure, and limited technical expertise (Raji, 2022b). This research identifies key enablers for a successful energy transition and provides a basis for understanding the necessary political and technical frameworks for a JET.

1.3.7 Contribution to Existing Knowledge

While there is considerable literature on global energy transitions, there is limited research focused on South Africa's JET—a framework that accounts for both environmental and socio-economic impacts. This study contributes to the ongoing policy debates by providing some insights on how the country can transition to renewable energy while maintaining economic stability and promoting social equity.

1.4 Research Objectives

The research objectives for this study are designed to explore the implications of a JET in South Africa. The objectives are as follows:

- To examine the challenges faced by the coal mining industry in South Africa during the transition to renewable energy.
- To assess the potential benefits and opportunities of the JET for South Africa's economy and environment.
- To evaluate whether the JET is fair and inclusive for coal mining industry workers and communities.
- To recommend strategies to ensure a JET that balances environmental goals with socio-economic stability.

1.5 Research Questions

To achieve the research objectives, the following research questions have been derived:

- What are the key challenges faced by South Africa's coal mining industry in the shift towards renewable energy?
- What are the potential benefits and opportunities of the JET for South Africa's economy and environment?
- Is the JET fair and inclusive for workers and communities' dependent on the coal industry?
- What strategies can be implemented to ensure a JET that balances socio-economic stability with environmental sustainability?

These research objectives and questions aim to address both the challenges and opportunities presented by the JET, with a particular focus on the coal mining sector in South Africa.

1.6 Structure of the Research Report

This report is organized into five chapters:

- **Chapter 1: Introduction** – Provides the background and context of the research, including the problem statement, justification, and research objectives.
- **Chapter 2: Literature Review** – Discusses key concepts, theories, studies, debates, controversies, and ends with a summary of the literature reviewed.
- **Chapter 3: Research Methodology** – Explains the research design, data collection methods, validation process, and data analysis techniques in detail.
- **Chapter 4: Data Presentation and Analysis** – Presents the research findings and provides an in-depth analysis of the data.
- **Chapter 5: Conclusion and Recommendations** – Summarizes key findings, provides recommendations, and suggests areas for future research.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Introduction

The literature review provides a foundation for understanding the key concepts, theories, and prior research related to the study. This chapter explores the existing body of knowledge relevant to the research topic, highlighting critical debates, controversies, and gaps in the literature. It aims to contextualize the research problem, provide insights into previous studies, and assess how the current study can contribute to the field. By examining the theoretical frameworks and empirical evidence, this chapter establishes a basis for addressing the research objectives and formulating informed conclusions and recommendations.

2.2 South Africa's Energy Profile and Coal Dependency

South Africa's energy sector is characterized by a diverse mix of energy sources, though coal remains dominant. The country is one of the world's largest producers and consumers of coal, with coal-fired power generation accounting for approximately 86% of its electricity in 2021 (Presidential Climate Commission, 2022). While coal has historically been the backbone of the energy supply, South Africa also relies on nuclear, gas, crude oil, solar, and hydropower to meet its energy demands.

2.2.1 Coal Dependency and Challenges

South Africa is ranked as the 14th largest emitter of carbon dioxide globally, largely due to its heavy dependence on coal (World Bank, 2021a). The energy sector alone is responsible for over 40% of Africa's total greenhouse gas (GHG) emissions, with Eskom's aging fleet of coal-fired power stations being the largest contributors (Department of Environmental Affairs, 2022). While coal provides baseload electricity and supports a significant portion of employment, it also presents economic and environmental challenges, making the transition to cleaner energy sources a national priority (Just Transition Framework, 2022).

2.2.2 Nuclear Energy Contribution

Nuclear energy plays a crucial role in South Africa's energy mix, contributing approximately 5% of the country's total electricity generation (Eskom, 2023b). The Koeberg Nuclear Power Station, located near Cape Town, is Africa's only operational nuclear power plant and has been in operation since 1984. Nuclear power is considered a stable and low-carbon energy source, and plans are underway to expand South Africa's nuclear capacity as part of the Integrated Resource Plan (IRP) 2019 (DMRE, 2019a).

2.2.3 Natural Gas and Crude Oil

Natural gas contributes around 3% to South Africa's electricity generation. The country imports gas from Mozambique through the Sasol Gas Pipeline, which supplies industries and power plants. Gas is seen as a potential transition fuel, offering a lower-carbon alternative to coal while providing reliable energy (SANEDI, 2022).

South Africa also relies on crude oil, primarily for transportation and industrial applications. The country imports majority of its crude oil, refining it locally at facilities such as the Sapref and Engen refineries. Although not a major contributor to electricity generation, crude oil remains vital to the broader energy economy (Department of Energy, 2021).

2.2.4 Renewable Energy: Solar, Wind, and Hydropower

Renewable energy is gaining momentum in South Africa, with solar and wind energy playing an increasingly important role. The country has abundant renewable energy resources, particularly in solar and wind. The IRENA (2021a) estimates that South Africa has the potential to generate over 1,000 GW of solar power and 70 GW of wind energy.

Solar energy currently contributes about 4.3% of the national electricity mix, with utility-scale solar farms and rooftop photovoltaic (PV) installations growing rapidly (CSIR, 2022). The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) has facilitated private sector investment in solar projects, further boosting the sector's expansion (IEA, 2021b).

Hydropower, though less prominent, contributes approximately 2% to South Africa's electricity supply. The country operates several hydropower plants, including the Gariep and Vanderkloof dams. Additionally, South Africa imports hydroelectric power from the Cahora Bassa Dam in Mozambique through the Southern African Power Pool (SAPP) (Eskom , 2022).

2.2.5 Energy Security and Future Outlook

Despite its diverse energy mix, South Africa faces ongoing energy security challenges, including frequent load shedding caused by aging infrastructure and inadequate supply to meet demand. The transition to a cleaner energy system requires significant investment. The CSIR (2021) estimates that approximately \$50 billion will be needed over the next decade to develop renewable energy infrastructure and maintain energy security.

As a signatory to the Paris Agreement, South Africa aims to achieve net-zero carbon emissions by 2050 (United Nations, 2016). The IRP (2019) outlines a gradual reduction in coal's share of the energy mix while increasing investment in renewables, gas, and nuclear energy (DMRE, 2019a).

2.2.6 Conclusion

South Africa's energy profile reflects both challenges and opportunities. While coal remains the dominant energy source, nuclear, gas, crude oil, wind, solar, and hydropower play crucial roles in diversifying the energy mix while reducing its carbon footprint. The transition to renewable energy presents a pathway for reducing emissions and ensuring long-term energy security. However, significant investment and strategic policy interventions will be required to achieve a just and sustainable energy transition.

2.3 Socio-Economic Impacts of the Transition

2.3.1 Socio-Economic Impacts of the Transition

The transition from coal to renewable energy presents significant socio-economic challenges for coal-dependent communities in South Africa. The coal mining sector has historically played a crucial role in regional economies, particularly in Mpumalanga, which houses the majority of the country's coal-fired power stations and coal mines (International Labour Organization, 2015). As the country moves towards decarbonization, the closure of coal mines and power plants threatens livelihoods, municipal revenues, and overall economic stability in these regions (Minerals Council South Africa, 2020).

2.3.2 Job Losses and Economic Disruption

One of the most pressing concerns is large-scale job losses. The coal sector directly creates employment, with many more working in coal-related industries such as transport, equipment manufacturing, and electricity generation (Minerals Council South Africa, 2020). Mpumalanga is particularly vulnerable, as the province is heavily reliant on coal for employment and economic activity. The phasing out of coal could lead to job losses that will ripple across local economies, increasing poverty and exacerbating social inequality (Raji, 2022c).

Unemployment is already a critical issue in South Africa, with the national unemployment rate reaching 32.6% in 2023 (Trading Economics, 2022). A poorly managed transition could further strain an already fragile labor market, particularly in regions where alternative employment opportunities are scarce. Research by the CSIR (2021) suggests that while renewable energy can generate new jobs, these may not be created at the same scale or in the same locations as coal sector jobs, making it difficult for affected workers to transition smoothly.

2.3.3 Impact on Municipal Revenues and Public Services

Municipalities in coal-dependent areas rely heavily on revenue from coal mining companies and coal-fired power plants. Coal operations contribute to municipal finances through property taxes, business licenses, and service fees, which fund essential public services such as education, healthcare, and infrastructure maintenance. In Mpumalanga, coal-related activities contribute approximately 30–40% of municipal revenues, making the transition a significant financial risk for local governments (International Labour Organization, 2018). As coal mines and power stations shut down, municipalities could experience a decline in revenue, leading to potential cuts in public services, job losses in local government sectors, and reduced economic activity.

2.3.4 Reskilling and Workforce Transition

To mitigate these socio-economic challenges, South Africa's Just Transition Framework (2022) emphasizes the importance of reskilling and upskilling programs to prepare workers for employment in emerging industries. The renewable energy sector requires a different skill set compared to coal mining. Key skills include solar panel installation, wind turbine maintenance, battery storage system operation, and electrical grid integration. Without targeted training and investment in skills development, many former coal industry workers may struggle to find new employment opportunities (IRENA, 2021b).

Institutions such as the Energy and Water Sector Education and Training Authority (EWSSETA) and the Quality Council for Trades and Occupations (QCTO) have introduced training programs tailored for the renewable energy industry. These include courses in solar photovoltaic (PV) installation, wind energy technology, and energy efficiency. Expanding these programs and ensuring accessibility for coal workers will be crucial for an equitable transition (IRENA, 2021b).

2.3.5 Economic Diversification and Regional Development

Beyond reskilling, broader economic diversification strategies are essential to reduce dependence on coal and create sustainable employment opportunities in affected regions. The JET-IP proposes investment in alternative industries such as agriculture, tourism, and green manufacturing, including battery storage production and hydrogen energy development. Such initiatives can help revitalize coal-dependent regions, ensuring long-term economic resilience and stability (JET-IP, 2022b)

2.3.6 Conclusion

The socio-economic impacts of South Africa's transition from coal to renewable energy are significant, particularly for coal-dependent communities in Mpumalanga and other coal-rich areas. While the transition poses risks such as job losses and declining municipal revenues, it also presents opportunities for economic renewal through investment in renewable energy, reskilling programs, and economic diversification. A well-planned transition, supported by government policies and private sector investment, is essential to ensuring that no communities are left behind in South Africa's journey towards a sustainable energy future.

2.4 Renewable Energy Potential and Limitations in South Africa

South Africa's abundant sunshine, averaging between 2,500 and 3,000 hours annually, coupled with high solar radiation levels ranging from 4.5 to 6.5 kilowatt-hours per square meter per day, positions the country favorably for significant solar energy generation (DMRE, 2019b).

To estimate the potential solar power generation, consider a simplified calculation:

1. **Solar Radiation:** Assuming an average solar radiation of 5.5 kWh/m²/day.
2. **Land Area Utilization:** If 1% of South Africa's land area (approximately 1.22 million km²) is utilized for solar farms, this equates to 12,200 km² or 12.2 billion m².
3. **System Efficiency:** Assuming a PV system efficiency of 15%.

The daily energy generation can be calculated as:

Energy = Area × Solar Radiation × Efficiency

Energy = 12.2 billion m² × 5.5 kWh/m²/day × 0.15

Energy = 10.065 billion kWh/day

Annually, this amounts to approximately 3,673.725 billion kWh.

In comparison, coal remains the dominant source of electricity in South Africa, accounting for approximately 84.44% of total electricity production in 2022 (Statista, 2024). The total energy production from coal in 2021 was measured at 4.98 quadrillion British thermal units (Btu), equivalent to approximately 1,459 billion kWh (Statista, 2024).

These calculations illustrate that harnessing just 1% of South Africa's land area for solar energy could potentially generate more than double the current electricity produced from coal. This underscores the substantial opportunity for solar power to contribute to the nation's energy mix, reduce reliance on fossil fuels, and support environmental sustainability.

As of 2023, South Africa's installed renewable energy capacity stands at approximately 10,623 megawatts (MW), with solar and wind energy contributing significantly to this total. The IRENA (2021a) projects that South Africa has the potential to install up to 20 gigawatts (GW) of renewable energy capacity by 2030, primarily from solar PV and wind energy. This anticipated growth aligns with the government's IRP, which envisions renewables playing a central role in diversifying South Africa's energy mix and meeting its international climate commitments. The IRP outlines that by 2030, 33% of the country's energy generation should come from renewable energy sources, thereby reducing the heavy reliance on coal and contributing to decarbonization efforts (DMRE, 2019a).

2.4.1 Solar Power

South Africa's geographic location provides it with one of the highest solar energy potentials globally. With an annual solar irradiation level of approximately 2,200 kWh/m², the country is well-positioned for large-scale solar energy generation (South African Department of Energy, 2022). The rapid decline in solar PV costs has further accelerated solar adoption, with the price of PV modules dropping by approximately 89% between 2010 and 2020 (IRENA, 2020).

The REIPPPP has played a crucial role in facilitating private investment in solar projects. By the end of 2021, over 6,000 MW of solar and wind capacity had been procured through REIPPPP, significantly contributing to the decarbonization of South Africa's electricity grid (South African Department of Energy, 2022). Large-scale projects such as the Jasper Solar Power Project (96 MW) and De Aar Solar Power (85 MW) exemplify the successful integration of solar power into the national energy mix (DMRE, 2019b).

2.4.2 Wind Energy

Wind energy is another promising renewable resource, particularly in coastal regions. The average wind speed in South Africa's coastal areas ranges from 6 to 8 meters per second, making it ideal for wind power generation (World Bank, 2017). Significant investments in wind energy have led to the development of large wind farms, such as the Jeffrey's Bay Wind Farm (138 MW) and Cookhouse Wind Farm (140 MW). According to the Global Wind Energy Council (2021), South Africa has the potential to generate up to 15 GW of wind energy capacity by 2040, making it a leader in wind energy on the African continent. However, infrastructure challenges and grid constraints must be addressed to unlock the full potential of wind power (Global Wind Energy Council, 2021).

2.4.3 Hydropower and Its Limitations

Unlike solar and wind, hydropower potential in South Africa is relatively limited due to the country's semi-arid climate and lack of major river systems. While small-scale hydropower projects exist, large-scale hydropower contributes minimally to the national grid, with South Africa importing hydroelectric power from Mozambique and Zambia (Eskom, 2022).

Furthermore, climate change poses a significant threat to hydropower reliability. The Zambezi-Kariba Dam crisis serves as a critical example of this vulnerability. The Kariba Dam, a major hydroelectric power source for Zambia and Zimbabwe, has experienced declining water levels due to prolonged droughts, leading to power shortages and blackouts in the region (World Bank, 2023). Similar challenges could impact South Africa's reliance on imported hydropower, emphasizing the need to diversify the country's renewable energy mix.

2.4.4 Renewable Energy Limitations

Despite these vast potentials, several barriers hinder the full realization of renewable energy capacity in South Africa. The JET-IP (2022b) outlines key challenges, including infrastructure inadequacies, particularly in the transmission and distribution networks. For example, the lack of grid infrastructure in rural areas, where solar and wind resources are abundant, limits the capacity to feed renewable energy into the national grid. Upgrading and expanding grid infrastructure is essential to accommodate the intermittent nature of renewables like wind and solar.

High upfront costs also remain a significant hurdle. Although the costs of renewable technologies, particularly solar PV, have decreased significantly, the initial capital investment required for large-scale renewable energy projects is still high compared to coal, especially in a country with an established coal infrastructure. This financial barrier is exacerbated by the need for battery storage solutions to address the intermittent supply from renewables, adding to the overall cost. According to IRENA (2021a), the integration of renewable energy with storage systems could significantly increase initial project costs, which presents challenges for scaling renewable capacity at the pace required to meet national targets.

Additionally, technical and regulatory challenges continue to slow down the renewable energy rollout. The maturity of renewable energy technologies in the South African context is still evolving, and technical expertise, particularly in the operation and maintenance of renewable energy systems, is lacking. Furthermore, policy and regulatory uncertainties, especially concerning land use, environmental impact assessments, and power purchase agreements, have created delays in the implementation of new projects (Presidential Climate Commission, 2022).

Political resistance and vested interests in the coal sector also complicate the transition. South Africa's coal industry is deeply entrenched, not only economically but also politically (Naidoo, 2022). As coal remains a dominant source of energy, any shift to renewables threatens established business models and jobs. The coal sector employs a significant portion of the workforce, and powerful stakeholders within the industry have been resistant to the transition. This political inertia slows the pace at which renewable energy projects are approved and implemented (Raji, 2022b).

2.4.5 Conclusion

In conclusion, South Africa's renewable energy potential, particularly in solar and wind, presents a critical opportunity to transition toward a cleaner, more sustainable energy future. However, realizing this potential requires overcoming significant barriers, including infrastructure challenges, high upfront costs, technical maturity issues, and political resistance. Effective policy frameworks, strategic investment in grid infrastructure, and stakeholder collaboration will be key to unlocking the country's renewable energy capabilities and achieving its climate goals.

2.5 Financing the Just Energy Transition

Financing is a crucial element of South Africa's JET, as it involves not only the development of renewable energy infrastructure but also the economic restructuring of coal-dependent communities (DMRE, 2022b). The transition requires substantial financial investment to support the construction of renewable energy plants, upgrade grid infrastructure, and provide social protection for communities affected by the shift away from coal. Achieving a just transition also implies mobilizing resources for training programs, social safety nets, and economic diversification strategies for regions that are heavily reliant on fossil fuel industries (National Treasury, 2023).

As part of its commitment to the Paris Agreement, South Africa has set ambitious targets to reduce its carbon emissions by shifting to cleaner energy sources. To support these efforts, the International Partners Group (IPG)—which includes the United Kingdom, France, Germany, the United States, and the European Union—pledged \$8.5 billion in funding at the 2021 COP26 climate summit to help South Africa decarbonize its energy sector (Patel, 2023b).

This financial support is intended to aid South Africa in reducing its dependence on coal, which currently accounts for 86% of its electricity generation, and to facilitate a smoother transition to renewable energy.

The \$8.5 billion climate finance package pledged to South Africa comprises approximately 97% loans and only 2.7% grants. Given South Africa's total national debt of \$288.1 billion in 2022, accepting the full loan amount would increase the national debt by about 2.9% (Countryeconomy.com, 2022). This addition is significant, especially considering that South Africa's debt-to-GDP ratio was already 70.83% in 2022. Such an increase raises concerns about exacerbating the country's fiscal challenges and underscores the need for a balanced approach that includes a higher proportion of grants to mitigate the potential debt burden associated with the energy transition (Presidential Climate Commission, 2022).

In addition to international support, domestic financing is essential to driving South Africa's energy transition. The Development Bank of Southern Africa (DBSA) and other local financial institutions have a critical role to play in providing investment for renewable energy projects and infrastructure upgrades. The JET-IP (2022a) estimates that over R1.5 trillion (\$86 billion) will be required by 2050 to fully transition South Africa's energy sector, with funding needed for everything from renewable energy generation to skills development and social protection measures for coal workers. However, attracting this level of investment will require a stable regulatory environment, clear policy frameworks, and assurances of long-term returns for private investors.

Private sector participation is equally crucial for the financing of JET. Large energy corporations and financial institutions have started to invest in renewable energy, seeing it as a profitable long-term sector. For example, Eskom, South Africa's state-owned power utility, is seeking private investment to help fund its transition to renewables, with the decommissioning of aging coal plants and the development of solar, wind, and gas plants now central to its long-term strategy (Eskom, 2023a). Public-private partnerships (PPPs) are increasingly being viewed as a way to share financial risks while maximizing the efficiency of renewable energy deployment.

Beyond national and international financing, global debates around climate finance fairness have grown in importance. As the AfDB (2022b) notes, Africa contributes less than 4% of global emissions, yet it suffers disproportionately from the impacts of climate change. This has fuelled calls for the Global North, which is responsible for the majority of historical emissions, to bear a greater share of the financial responsibility for climate mitigation and adaptation efforts in developing countries like South Africa. South African policymakers have stressed the need for more equitable financing solutions, emphasizing that wealthier nations should increase grant-based support to help address the socio-economic challenges of the energy transition, rather than relying primarily on loan mechanisms that exacerbate debt burdens (AfDB, 2022b).

Additionally, climate bonds and green finance are emerging as viable instruments to raise capital for the JET. South Africa has already issued green bonds, which allow investors to support climate-resilient and low-carbon projects while receiving financial returns. The South African National Treasury has highlighted the potential for scaling up green finance initiatives through the development of a robust climate finance framework that aligns with international best practices (National Treasury, 2023). These mechanisms could serve as an important tool for mobilizing the significant capital needed to fund the transition, while also engaging international investors committed to sustainable development.

In conclusion, the financing of South Africa's JET will require a combination of international and domestic resources, including grants, concessional loans, private sector investments, and innovative financial instruments such as climate bonds. Given the scale of the financial requirements, international cooperation and equitable climate finance solutions will be key to ensuring that South Africa can successfully transition to a low-carbon economy while addressing the socio-economic needs of its coal-dependent regions.

2.6 The Policy and Regulatory Landscape

South Africa's policy and regulatory framework is critical in shaping its transition toward a low-carbon, renewable energy future. The cornerstone of the country's energy policy is the IRP, which outlines the national strategy for energy generation up to 2030. The plan envisions a gradual decommissioning of coal-fired power plants and an increase in renewable energy capacity, with a target of generating over 20% of the country's electricity from renewables by 2030 (DMRE, 2019a).

However, implementation of the IRP has faced delays and challenges. Critics argue that although the plan sets ambitious targets, it lacks the necessary enforcement mechanisms to ensure compliance. There is also concern that the plan is not being updated frequently enough to reflect the rapid technological advancements in the renewable energy sector. According to Tyler (2022), the IRP's update cycles are too slow to keep pace with the dynamic energy landscape, leading to outdated projections and potentially slowing down the energy transition.

The Just Transition Framework for South Africa (2022) outlines targeted reskilling and re-employment programs to support workers affected by the transition away from coal. These initiatives focus on equipping displaced workers with skills relevant to the renewable energy sector, infrastructure development, and other emerging industries. Key programs include technical training in solar PV installation, wind turbine maintenance, energy efficiency auditing, and battery storage systems, offered through the EWSETA and QCTO. Additionally, the framework promotes entrepreneurship support programs, encouraging former coal workers to start businesses in green energy, waste management, and sustainable agriculture. Furthermore, job placement initiatives and wage subsidies are planned to facilitate smoother transitions into new employment opportunities, ensuring that the shift to renewable energy is inclusive and minimizes socio-economic disruptions (Presidential Climate Commission, 2022).

Despite these policy frameworks, Raji (2022d) notes that political resistance from vested interests within the coal sector remains one of the most significant barriers to the country's energy transition.

South Africa's coal industry is deeply entrenched, not only as a major economic contributor but also as a key player in the country's political landscape. This creates a challenging environment for policymakers to push through reforms that might disrupt the status quo. Powerful lobby groups within the coal sector, including large mining companies and unions, have been resistant to change, fearing job losses and economic instability in coal-dependent regions like Mpumalanga (Raji, 2022d).

Additionally, Eskom's financial struggles further complicate the policy environment. As the country's state-owned power utility, Eskom is heavily reliant on coal and is responsible for a significant portion of South Africa's greenhouse gas emissions. The utility's aging infrastructure and mounting debt have made it difficult for Eskom to invest in renewable energy projects at the scale required to meet national targets. Burton (2023) points out that without significant reform and financial restructuring, Eskom's reliance on coal is likely to continue, posing a major obstacle to South Africa's energy transition.

Moreover, the Carbon Tax Act is another policy instrument that aims to drive decarbonisation by placing a price on carbon emissions. The tax applies to sectors such as mining, energy, and manufacturing, and is designed to encourage companies to reduce their carbon footprint by adopting cleaner technologies (Government Gazette, 2019). However, the effectiveness of the carbon tax has been limited by relatively low tax rates and widespread exemptions granted to key industries, particularly the coal sector. Winkler (2022) argues that the current carbon tax structure does not provide strong enough financial incentives for companies to shift away from carbon-intensive activities.

In addition to national policies, South Africa's energy transition is also influenced by international agreements, such as the Paris Agreement. As a signatory, South Africa has committed to reducing its carbon emissions and transitioning to a low-carbon economy (United Nations, 2016). However, there are concerns that the country is not moving fast enough to meet its climate targets. The Presidential Climate Commission (2022) has called for more aggressive policy measures and a stronger regulatory framework to accelerate the transition. This includes tightening emissions standards, increasing investments in renewable energy, and providing greater financial support for coal-reliant communities.

Furthermore, the success of the JET will depend on the effective coordination between national, provincial, and local governments. Currently, policy implementation often faces bottlenecks due to a lack of alignment between different levels of government. Naidoo (2022) argues that for the JET to be truly successful, there needs to be a clearer delineation of roles and responsibilities across all levels of government, as well as better communication and collaboration with the private sector and civil society.

Lastly, the policy landscape for renewable energy is also shaped by the REIPPPP, which has been instrumental in attracting private investment into the renewable energy sector. Since its inception, the REIPPPP has helped South Africa secure billions of dollars in private investment and bring substantial amounts of renewable energy online. However, bureaucratic delays and issues related to grid connectivity have slowed the expansion of the program in recent years (Eberhard & Naude, 2021). Streamlining regulatory processes and addressing these bottlenecks will be crucial for scaling up renewable energy capacity in the coming years.

In conclusion, while South Africa has made notable progress in establishing a policy framework for the JET, significant challenges remain in terms of political resistance, regulatory enforcement, and financial constraints. Stronger leadership, greater policy coherence, and enhanced regulatory mechanisms will be required to drive meaningful change and ensure a smooth and equitable transition to a sustainable energy future.

2.7 Alternative Perspective: The Case for Retaining Coal in South Africa's Energy Mix

While the global shift towards renewable energy is gaining momentum, some experts and industry stakeholders argue that coal should continue to play a central role in South Africa's energy system. Proponents of coal emphasize its reliability, economic importance, and the challenges associated with transitioning to renewable energy. This section presents key arguments supporting the retention of coal, critically analyzing the rationale behind these perspectives.

2.7.1 Energy Security and Baseload Power Reliability

One of the primary arguments for maintaining coal in South Africa's energy mix is its role in providing stable and reliable baseload power. Unlike renewable energy sources such as wind and solar, coal-fired power plants operate continuously, ensuring a steady supply of electricity. South Africa has experienced significant power shortages and load shedding due to an aging coal fleet and insufficient generating capacity. Some experts argue that immediately reducing coal reliance could exacerbate these issues, leading to even greater energy insecurity (Eskom, 2021).

According to the CSIR (2022), while renewable energy has the potential to meet demand, the intermittent nature of solar and wind power necessitates large-scale energy storage solutions or backup generation, both of which require additional investment. Opponents of a rapid coal phase-out argue that existing coal infrastructure should be modernized rather than abandoned to maintain grid stability (CSIR, 2022).

2.7.2 Economic and Employment Considerations

The coal industry is a significant employer in South Africa, particularly in provinces such as Mpumalanga, where entire communities depend on coal-related jobs. The Minerals Council South Africa (2020) reported that coal mining directly employed over 89,548 people, with many more jobs supported through coal transport, maintenance, and related industries. Critics of an accelerated transition to renewables argue that phasing out coal too quickly could lead to widespread unemployment and economic distress, especially in regions heavily dependent on coal mining (International Labour Organization, 2018).

Furthermore, coal revenues contribute substantially to the national and local economies. Municipalities in coal-rich areas rely on tax revenues, business licensing fees, and other economic benefits from the industry (International Labour Organization, 2018). A study by PwC (2021) estimated that coal mining and power generation contribute approximately R31 billion to South Africa's GDP annually. Rapidly dismantling this sector without adequate alternative industries in place could result in severe economic consequences, making a gradual transition more pragmatic (PwC, 2021).

2.7.3 Financial and Technical Challenges of Renewable Energy Expansion

While renewable energy presents a promising alternative, critics argue that transitioning entirely away from coal presents significant financial and technical challenges. The IRP (2019) outlines ambitious renewable energy targets but achieving them requires an estimated \$50 billion in investment over the next decade (CSIR, 2021). Given South Africa's existing fiscal constraints and high public debt levels, there are concerns about the affordability of such a transition (Presidential Climate Commission, 2022).

Additionally, South Africa's transmission infrastructure was designed for centralized coal-fired power plants. Shifting to a decentralized renewable energy system would require substantial upgrades to the national grid. According to Eskom (2021), integrating renewables at scale necessitates improvements in transmission networks, grid stabilization technologies, and the deployment of energy storage solutions. Proponents of coal argue that modernizing existing coal infrastructure may be a more cost-effective short-term solution than overhauling the entire energy grid.

2.7.4 Technological Advances in Clean Coal and Carbon Capture

Another key argument for retaining coal is the potential for technological advancements in clean coal and carbon capture and storage (CCS). These technologies aim to reduce the environmental impact of coal by capturing carbon dioxide emissions before they are released into the atmosphere. Some industry experts argue that rather than phasing out coal entirely, South Africa should invest in cleaner coal technologies to meet its climate commitments while maintaining energy security (IEA, 2021c).

According to the IEA (2021c), countries such as China and the United States are investing in advanced coal technologies, including ultra-supercritical power plants that operate at higher efficiency, reducing emissions. The South African government has also explored pilot projects for CCS, although large-scale implementation remains limited due to cost concerns (DMRE, 2020).

2.7.5 Geopolitical and Resource Independence Considerations

South Africa's coal reserves are among the largest in the world, providing a degree of energy independence that renewables currently cannot match. Transitioning to wind and solar energy would require importing significant amounts of technology, rare earth minerals, and components such as solar panels and batteries, primarily from countries like China and the United States (Tyler, 2022). Proponents of coal argue that maintaining domestic coal production helps protect national energy sovereignty and reduces reliance on foreign energy technologies (World Bank, 2021b).

Moreover, South Africa exports coal to international markets, generating substantial revenue. In 2021, coal exports accounted for 6% of the country's total exports, with key markets in India, China, and Europe (SARS, 2021). A complete shift away from coal could negatively impact trade balances and foreign exchange earnings, affecting overall economic stability.

2.7.6 Critical Analysis and Counterarguments

While these arguments highlight the challenges of an immediate coal phase-out, they must be weighed against the environmental and long-term economic benefits of transitioning to renewable energy. The financial burden of maintaining aging coal infrastructure, rising carbon taxes, and global pressure to reduce emissions may ultimately make coal less viable over time. Additionally, while CCS and clean coal technologies offer some potential, their large-scale deployment remains expensive and uncertain.

Nonetheless, a balanced approach that prioritizes gradual transition while investing in renewable energy, grid infrastructure, and workforce reskilling may be the most pragmatic solution. Policymakers must carefully consider these trade-offs to ensure an equitable and sustainable energy future for South Africa.

2.8 Conclusion

The literature on South Africa's energy transition reveals a complex interplay of opportunities and challenges as the country moves from a coal-dependent energy system to a greener, more sustainable energy mix. The shift to renewable energy, particularly solar and wind, holds significant promise for addressing environmental concerns, reducing carbon emissions, and enhancing long-term energy security. However, the transition also presents substantial socio-economic challenges, especially for communities and workers heavily reliant on coal industries.

Key factors influencing the success of this transition include the need for strategic policy interventions, such as effective reskilling programs, social protection measures, and ensuring equitable access to the new opportunities in renewable energy. Furthermore, financing mechanisms must be carefully structured to balance loans and grants, ensuring that the country does not incur unsustainable debt while pursuing its climate objectives. The Just Transition Framework plays a critical role in outlining how to manage the social and economic impacts of this transition, emphasizing inclusivity and community engagement.

In conclusion, while South Africa's JET presents promising opportunities for the future, its success will depend on navigating the socio-economic impacts on coal-dependent sectors, ensuring financial viability, and fostering collaboration among all stakeholders to create a sustainable and equitable energy future for all.

CHAPTER THREE

3 RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology adopted for this study. It describes the research design, population and sampling techniques, data collection process, data analysis methods, ethical considerations, and research limitations. The chosen methodology aligns with the study's objectives, which aimed to explore and analyse the qualitative aspects of a just energy transition: challenges and benefits in the South African coal mining industry. The qualitative method was selected to gain in-depth insights into the subject matter by engaging participants in an open-ended manner.

3.2 Research Design

A qualitative research design was employed in this study to explore the perceptions, experiences, and opinions of the participants regarding a just energy transition: challenges and benefits in the South African Coal Mining Industry. Qualitative research is particularly effective in understanding complex social phenomena and allows for the collection of rich, detailed data through direct interaction with participants (Creswell, 2014). An exploratory design was used to identify emerging patterns and themes without pre-existing hypotheses, as it facilitated an understanding of the subject in its natural setting.

3.3 Population and Sampling

The population for this study consisted of community members, professionals, and employees in the coal mining industry who have direct experience or knowledge related to a JET. A purposive sampling technique was employed to select participants capable of providing relevant information for the study.

This non-probability sampling method was appropriate given the qualitative nature of the research, as it enabled the intentional selection of individuals who were most likely to provide rich, in-depth data (Patton, 2015).

The sample size of 18 participants was deemed sufficient based on the principle of data saturation, which refers to the point at which no new themes or insights emerge from additional data collection. A sample size of 12 to 20 participants is generally adequate for achieving data saturation in qualitative studies (Guest, et al., 2006). This range justified the sample size for this research. See Appendix A for participants' demographics.

3.4 Data Collection Process

Data was collected through semi-structured interviews, which allowed for flexibility while ensuring that key topics were covered. The interviews were conducted through virtual platforms via Microsoft teams. Each interview lasted between 30 – 60 minutes, and all were recorded with participants' consent. The interview guide included open-ended questions that encouraged participants to share their experiences and perspectives on research topic. Secondary data was also gathered from relevant literature, reports, and official documents to provide context and support the primary findings (Silverman, 2016).

3.5 Data Analysis

The data collected through semi-structured interviews was transcribed verbatim and analysed using a combination of thematic analysis and framework analysis, both of which are well-suited for qualitative research exploring complex social phenomena such as the JET.

Thematic analysis, as outlined by Braun & Clarke (2006), was employed to identify recurring themes and patterns within the data.

This method involves a six-step process:

Familiarization with the data, where the researcher thoroughly read and re-read the transcribed interviews to immerse in the data;

Generating initial codes, where specific features of the data relevant to the research questions were systematically coded;

Searching for themes, where codes were grouped into broader categories or themes that reflected shared ideas across different interviews;

Reviewing themes, where the initial themes were refined to ensure they were coherent and distinct;

Defining and naming themes, where the themes were clearly articulated, ensuring that they were relevant to the research objectives; and

Producing the final report, where the findings were presented from direct quotes of participants to illustrate key points and answer research questions.

Additionally, framework analysis Ritchie & Spencer (1994) was utilized to further structure the thematic analysis process. This method helped systematically organize the data into pre-determined themes based on the research objectives, such as the socio-economic impacts of the energy transition, job losses in coal-dependent sectors, and policy recommendations for mitigating these impacts. Framework analysis is particularly effective in policy-oriented research, as it allows for the comparison of different perspectives across stakeholder groups, facilitating the development of clear recommendations (Ritchie & Spencer, 1994).

Both thematic and framework analyses provided an understanding of the participants' perceptions and experiences, ensuring that the analysis was both flexible in exploring emergent themes and structured enough to meet the research objectives.

3.6 Ethical Considerations

Ethical considerations were rigorously adhered to throughout the study to protect participants and ensure integrity. Prior to participation, all individuals were provided with an informed consent form outlining the study's purpose, their rights, and the voluntary nature of their participation.

Participants were assured of confidentiality and anonymity; pseudonyms were used in the data analysis and reporting phases to protect identities. The research also received ethical clearance from University of the Witwatersrand, ensuring compliance with ethical research standards. Moreover, the researcher remained sensitive to the potential power dynamics between interviewer and participant, ensuring that all questions were posed respectfully and that participants felt comfortable sharing their experiences (Orb, et al., 2001).

3.7 Research Limitations

While this study provided valuable insights, it was not without limitations. First, the sample size, though sufficient for a qualitative study, may limit the generalizability of the findings to a broader population. Secondly, the reliance on self-reported data in interviews can introduce bias, as participants may present themselves in a socially desirable manner or have recall inaccuracies. Additionally, the study was limited to Limpopo and Mpumalanga, which may mean that the findings reflect localized experiences and may not be applicable in other contexts. Finally, the study's timeframe and resources restricted the extent of data collection and analysis that could be conducted.

3.8 Conclusion

In conclusion, the research methodology adopted for this study was appropriate for achieving the research objectives. A qualitative approach enabled the researcher to gather in-depth data, and thematic analysis allowed for the identification of key themes. Ethical considerations were rigorously adhered to, and while the study had limitations, it provided a contribution to the understanding of a JET: challenges and opportunities in the coal mining industry in South Africa. Future research could benefit from a larger sample size and a comparative analysis across different regions to enhance the generalizability of the findings.

CHAPTER FOUR

4 Data Presentation and Analysis

4.1 Introduction

This section presents the findings from the data collected through interviews with participants in the energy, mining, regulatory sector and community members in coal-dependent regions. The analysis provides insight into the themes that emerged from the interviews, aligning with the study's objectives. The findings are supported by relevant quotes from participants and a detailed description of the data analysis process.

4.2 Characterization of Participants

The participants selected for this study included professionals working in various capacities within South Africa's energy, mining, and regulatory sectors and community members in coal-dependent regions (Mpumalanga). The sample consisted of three government regulators, two energy industry managers, eight mining sector representatives, one renewable energy consultant and four community members. These participants were chosen based on their involvement in energy transition projects or their roles in the above-mentioned industries. Participants had a minimum of 10 years of experience in their respective fields (excluding the professional who recently joined Seriti Green but has extensive experience in mining), which provided a strong basis for understanding the challenges and opportunities related to South Africa's energy transition. See participants demographics in Appendix A.

4.3 Data Collection and Analysis Methodology

The interviews were semi-structured, conducted virtually, and lasted between 45 and 60 minutes. The interview guide focused on five key areas: (1) South Africa's current energy status, (2) processes of renewable energy transition, (3) perceived benefits and opportunities of renewable energy, (4) challenges of renewable energy transition, and (5) proposed strategies for successful implementation.

All 18 interviews were audio-recorded with participants' consent and subsequently transcribed verbatim. See Appendix C with 5 selected transcripts representing participants from each industry (1-Eskom, 1-Mining Industry, 1- Renewable Energy Industry, 1- Regulatory Industry, 1-Community Member).

Thematic analysis was conducted following Braun & Clarke (2006) six-phase framework, which includes familiarization with the data, coding, generating themes, reviewing themes, defining themes, and reporting.

4.4 Thematic Analysis

4.4.1 Familiarization

In this initial stage, the researcher conducted a thorough review of the transcripts from the interviews with eighteen participants, each bringing insights into the JET in South Africa. Each interview was rich in detail, reflecting the participants' diverse backgrounds, roles within the energy sector, and their personal experiences related to energy generation and transition. As the researcher read through the transcripts, the focus was on understanding the main themes in their responses. Participants voiced their views on several critical aspects:

Current Energy Landscape: Many participants expressed concerns about South Africa's heavy reliance on coal as the primary energy source. They described the implications of this dependency, such as frequent power outages, energy insecurity, and the urgent need for diversification of the energy mix to include more renewable sources.

Perceptions of Renewable Energy: There was a general acknowledgment of the potential benefits and opportunities of transitioning to renewable energy. Participants highlighted how solar, wind, and other renewable technologies could not only help mitigate climate change but also enhance energy independence and security. However, there were varying degrees of optimism about the pace and feasibility of this transition.

Challenges and Concerns: The interviews revealed significant apprehensions about the socio-economic impacts of transitioning away from coal. Participants, particularly those with backgrounds in the coal industry, voiced concerns about job losses, the need for retraining programs, and the potential social upheaval in communities reliant on coal-based employment.

Policy and Governance: Insights into the role of government was a recurring theme. Participants called for stronger leadership, clear policies, and actionable frameworks to guide the transition process. They emphasized the necessity of involving all stakeholders, including communities affected by the transition, to ensure a just and equitable approach.

Long-term vision: Participants also reflected on their aspirations for South Africa's energy future, expressing a desire for a sustainable energy landscape that balances environmental, social, and economic considerations. They envisioned a future where renewable energy not only powered homes and businesses but also stimulated local economies through job creation and innovation.

This careful reading of the transcripts not only familiarized the researcher with the content but also allowed the researcher to appreciate the complexities and interconnections of the participants' insights. The participants' narratives provided a rich wall-hanging of perspectives on the JET, highlighting the urgent need for action and collaboration among all stakeholders involved in shaping South Africa's energy future. By engaging with their words and reflecting on their experiences, the researcher aimed to ensure that the thematic analysis would capture the essence of their views and the realities they face in the transition process.

4.4.2 Coding

In this coding process, the researcher analysed the transcripts from 18 participants to extract relevant information that aligns with the research questions. Each participant's responses were examined to identify key themes related to South Africa's just energy transition. The following table presents the coded responses, capturing the essence of their insights.

Table 1: Participants' transcript excerpts and codes

Participant	Transcript Excerpts	Codes
Participant 1	"South Africa's reliance on coal for energy is alarming; we need alternatives."	National Energy Status
	"A structured transition plan is crucial to minimize disruptions."	Processes of Renewable Energy Transition
	"Switching to renewable energy will help us meet global climate commitments."	Benefits and Opportunities in Renewable Energy Transition
	"Job security for coal workers is a major concern that must be addressed."	Challenges of Renewable Energy Transition
Participant 2	"Our energy crisis highlights the urgent need for change."	National Energy Status
	"Government incentives can accelerate the transition to renewables."	Processes of Renewable Energy Transition
	"Renewables can create jobs, especially in rural areas."	Benefits and Opportunities in Renewable Energy Transition
	"There will be resistance from those who fear losing their jobs."	Challenges of Renewable Energy Transition
Participant 3	"The energy landscape needs to diversify beyond coal."	National Energy Status
	"We need robust policies to guide the renewable energy shift."	Processes of Renewable Energy Transition
	"Investing in green technologies can stimulate economic growth."	Benefits and Opportunities in Renewable Energy Transition

	"Addressing socio-economic disparities will be critical."	Challenges of Renewable Energy Transition
Participant 4	"Eskom's struggles reflect our overdependence on coal."	National Energy Status
	"A gradual approach will help us manage economic impacts."	Processes of Renewable Energy Transition
	"We must harness our solar and wind potential for a sustainable future."	Benefits and Opportunities in Renewable Energy Transition
	"Retraining coal workers is essential to avoid social unrest."	Challenges of Renewable Energy Transition
Participant 5	"Transitioning away from coal will help mitigate climate change effects."	Benefits and Opportunities in Renewable Energy Transition
	"The role of government in facilitating this transition is vital."	Processes of Renewable Energy Transition
	"Communities need support during this change to prevent economic fallout."	Challenges of Renewable Energy Transition
Participant 6	"Energy independence is a goal we must strive for."	Benefits and Opportunities in Renewable Energy Transition
	"Investment in renewable infrastructure is long overdue."	Processes of Renewable Energy Transition
	"Concerns about reliability and intermittency of renewables need addressing."	Challenges of Renewable Energy Transition
Participant 7	"A sustainable energy future is not just possible; it's necessary."	Benefits and Opportunities in Renewable Energy Transition
	"Leadership from the government is crucial in this transition."	Processes of Renewable Energy Transition
	"Job losses in the coal sector could lead to economic hardship."	Challenges of Renewable Energy Transition
Participant 8	"Our energy supply must become more resilient and diverse."	National Energy Status

	"Policies must support innovation in renewable technologies."	Processes of Renewable Energy Transition
	"The transition can lead to new business opportunities."	Benefits and Opportunities in Renewable Energy Transition
	"Workers need assurance of new jobs in renewables."	Challenges of Renewable Energy Transition
Participant 9	"Coal is a major source of our energy, but it is also a major polluter."	National Energy Status
	"We need an actionable framework for a renewable transition."	Processes of Renewable Energy Transition
	"The benefits of renewables include cleaner air and job creation."	Benefits and Opportunities in Renewable Energy Transition
	"Transition planning must consider the socio-economic fabric."	Challenges of Renewable Energy Transition
Participant 10	"Our dependence on coal causes significant energy instability."	National Energy Status
	"A transition plan should involve stakeholders from all sectors."	Processes of Renewable Energy Transition
	"We can harness wind and solar energy to our advantage."	Benefits and Opportunities in Renewable Energy Transition
	"Without proper training, workers will struggle to adapt."	Challenges of Renewable Energy Transition
Participant 11	"The need for energy security makes this transition critical."	National Energy Status
	"Community engagement is essential for successful policy implementation."	Processes of Renewable Energy Transition
	"Investing in renewables could be a game changer for our economy."	Benefits and Opportunities in Renewable Energy Transition
	"The fear of job losses looms large in discussions around this transition."	Challenges of Renewable Energy Transition

Participant 12	"Renewables could stabilize our energy prices in the long run."	Benefits and Opportunities in Renewable Energy Transition
	"Government should incentivize the development of local renewable resources."	Processes of Renewable Energy Transition
	"The transition must prioritize the needs of vulnerable communities."	Challenges of Renewable Energy Transition
Participant 13	"Eskom's energy production model needs urgent reform."	National Energy Status
	"A clear roadmap for transition can help us navigate this process."	Processes of Renewable Energy Transition
	"The environmental benefits of switching to renewables are clear."	Benefits and Opportunities in Renewable Energy Transition
	"Investment in skills training is crucial for coal workers."	Challenges of Renewable Energy Transition
Participant 14	"The transition presents a unique opportunity for innovation."	Benefits and Opportunities in Renewable Energy Transition
	"We must learn from global best practices in energy transition."	Processes of Renewable Energy Transition
	"People are anxious about job security in the coal industry."	Challenges of Renewable Energy Transition
Participant 15	"Our energy crisis is a wake-up call to diversify."	National Energy Status
	"Collaboration between sectors will be key to our success."	Processes of Renewable Energy Transition
	"The transition must be inclusive and equitable."	Challenges of Renewable Energy Transition
Participant 16	"South Africa must invest in renewables to ensure energy security."	National Energy Status
	"There are exciting projects underway in solar and wind energy."	Processes of Renewable Energy Transition

	"We can emerge as a leader in renewable energy in Africa."	Benefits and Opportunities in Renewable Energy Transition
	"Addressing the socio-economic impact is crucial."	Challenges of Renewable Energy Transition
Participant 17	"Climate change impacts are exacerbated by our reliance on coal."	National Energy Status
	"We need a collaborative approach to manage the transition."	Processes of Renewable Energy Transition
	"The potential for job creation in renewables is significant."	Benefits and Opportunities in Renewable Energy Transition
	"We must provide support for those impacted by job losses."	Challenges of Renewable Energy Transition
Participant 18	"Renewable energy can help us achieve our climate goals."	Benefits and Opportunities in Renewable Energy Transition
	"The current energy framework is not sustainable."	National Energy Status
	"A transparent process for the transition is essential."	Processes of Renewable Energy Transition
	"Social equity must be at the heart of this transition."	Challenges of Renewable Energy Transition

This detailed coding reflects the participants' diverse perspectives, identifying key themes and sentiments regarding the just energy transition in South Africa. Each code encapsulates critical insights relevant to the research questions, facilitating an analysis of the responses.

4.4.3 Generating Themes

Following the coding of the interview transcripts, the researcher consolidated the identified codes into four dominant themes that encapsulate the participants' insights regarding the just energy transition in South Africa. Each theme emerged from a synthesis of the coded responses, representing a comprehensive understanding of the complex dynamics surrounding renewable energy transition in the country.

The four dominant themes identified were: (1) National energy status, (2) Processes of renewable energy transition, (3) Benefits and opportunities in RE transition, and (4) Challenges of RE transition.

Theme 1: National Energy Status

Participants provided significant insight into South Africa's current energy landscape, highlighting the concerns regarding the country's heavy reliance on fossil fuels, particularly coal as a primary energy source. One participant stated, *"South Africa's reliance on coal for energy is alarming; we need alternatives"* (P1). Six participants expressed concern over the feasibility of achieving net-zero carbon emissions by 2050, especially given the country's developing economy. One participant stated, *"The reality is that South Africa is not ready to completely phase out coal by 2050 without crippling the economy. Our energy system is still too dependent on it"* (P3). Another added, *"The global goals are admirable, but for us, there needs to be a more pragmatic approach. We cannot ignore the economic implications, especially when our GDP is so reliant on fossil fuels"* (P2).

Despite these concerns, four participants noted the potential for renewable energy, particularly in resource-rich areas like the Northern and Eastern Cape. *"There's so much untapped potential for solar and wind in regions like the Northern Cape, where we could see renewable projects really take off"* (P5).

The idea of an energy mix—combining fossil fuels and renewables—was supported by four participants, who emphasized that this approach would be more sustainable for South Africa's growing energy demand. *"I don't see how we can solely depend on renewables in the short term. The grid is already constrained, and a full shift could be disastrous. But a balanced mix could minimize emissions while keeping the lights on"* (P9).

Theme 2: Processes of Renewable Energy Transition

Participants stressed the importance of a gradual and well-planned transition to renewable energy. Four participants highlighted that moving too quickly could destabilize the energy grid and economy. One participant remarked, *"If we rush into this, we could end up with worse energy shortages than we currently experience with load shedding. We need a step-by-step approach, supported by solid policies"* (P4).

Government leadership was deemed crucial in ensuring a smooth transition. Participants believed that public confidence and investor interest could only grow if the government took the lead on renewable projects. One participant mentioned, *“Government incentives can accelerate the transition to renewables,”*(P2) highlighting the role of supportive policies in enabling this shift. Another participant mention, *“The government needs to take the lead. If they can prove renewable energy projects work and are viable, businesses will follow. But it’s hard to do that when policies are stuck in bureaucracy”* (P7).

Furthermore, the participants emphasized the importance of building internal capacity through skills development in the renewable energy sector. *“Upskilling the workforce is key. There’s a huge skills gap that we need to address if this transition is to succeed”* (P12). Participants also called for removing bureaucratic barriers that slow down policy implementation, with one participant noting, *“We need to cut the red tape. Right now, it’s too difficult for private businesses to invest in renewables because the policies are not clear or well-implemented”* (P10). Others pointed out that community engagement and stakeholder collaboration are essential to ensure a smooth transition, ensuring that the needs and concerns of affected communities are addressed.

Theme 3: Benefits and Opportunities in Renewable Energy Transition

This theme revealed several perceived benefits of transitioning to renewable energy which participants identified as crucial for the country's future. Many highlighted environmental sustainability, job creation, and energy independence as significant advantages. Participant 6 noted, *“Energy independence is a goal we must strive for,”* while Participant 3 remarked, *“Investing in green technologies can stimulate economic growth”*. Five participants pointed out that renewable energy could be a solution to South Africa's ongoing load shedding issues. One participant highlighted, *“If done correctly, renewables could eliminate load shedding.*

We’ve seen how solar and wind energy could generate enough to meet demand in certain areas” (P7). Participants also agreed that the transition to renewables would contribute significantly to environmental sustainability.

New career opportunities in the renewable energy sector were also emphasized by three participants. *“There’s a whole world of opportunities in renewables that many people don’t know about. We need to raise awareness so that people, especially the youth, can prepare for these new roles”* (P3).

Regarding financial opportunities, six participants discussed the influx of foreign investments and international loans. *“Foreign investment is already coming in, especially from international bodies like the World Bank. If we can scale up renewables, we’ll see even more investment”* (P6). Participants also mentioned projects led by Seriti Green, which are laying the groundwork for a sustainable renewable energy future. One participant commented, *“Seriti Green is already working on solar and wind projects, and they are setting a strong example for what can be achieved in this space”* (P13). This theme encapsulates a forward-looking perspective among participants, recognizing the potential for renewable energy to drive economic development and enhance environmental resilience.

Theme 4: Challenges of Renewable Energy Transition

Participants also expressed concerns regarding the challenges associated with the transition from coal to renewable energy. Key challenges identified included potential job losses in the coal industry, the need for retraining workers, poor government leadership, the high cost and reliability of renewable energy sources. Eleven participants highlighted job losses in coal-dependent regions, particularly in Mpumalanga and Limpopo, as one of the most significant challenges. *“The majority of jobs in these provinces rely on coal. If we move away from that without a clear plan for job creation in renewables, we’re going to face massive unemployment issues”* (P18). Participants expressed concern over the government’s failure to address how displaced workers would be supported during the transition.

Nine participants also cited the high cost of renewable energy as a major hurdle. *“Right now, renewables are too expensive for the average person, especially in rural areas. This transition could end up benefiting only the wealthy”* (P2). Many participants feared that the shift could widen the inequality gap, leaving low-income communities without access to affordable energy.

Political will and leadership were also seen as barriers, with participants calling for stronger government involvement. *“There’s still too much political pushback. If we’re serious about this transition, we need real leadership and commitment from our politicians”* (P12). Five participants raised concerns about the reliability of renewable energy, particularly solar and wind power, which are intermittent. One participant observed, *“Solar and wind can’t provide 24-hour power. Even with battery storage, it’s not enough for business continuity. This could lead to more disruptions”* (P11). This theme highlights the importance of addressing socio-economic issues and providing support for communities and workers who may be adversely affected by the transition.

Summary of Themes

The generation of these themes reveals a multifaceted understanding of the JET in South Africa. Each theme illustrates the participants' perspectives on the current energy landscape, the processes required for transitioning to renewable energy, the potential opportunities of this transition, and the challenges that must be navigated to achieve a just and equitable energy future. This thematic analysis serves as a foundation for further exploration of strategies and policies that can facilitate a successful energy transition in South Africa, ensuring that all stakeholders are considered and supported throughout the process.

4.4.4 Reviewing Themes

The process of reviewing themes involved a thorough examination of the identified themes to ensure they accurately encapsulated the participants' perspectives and responses during the interviews. This review aimed to confirm that the themes were representative, coherent, and reflective of the underlying data.

4.4.5 Observations

National Energy Status: The theme concerning National Energy Status demonstrated strong consistency across all interviews. Each participant articulated a shared concern about South Africa's dependency on coal for energy generation. For example, several participants highlighted the urgent need for diversification in energy sources due to the adverse implications of coal reliance, such as energy shortages and environmental degradation. This collective sentiment reinforces the theme's validity and underscores the critical nature of addressing the current energy landscape.

Processes of Renewable Energy Transition: The theme regarding the Processes of Renewable Energy Transition emphasized the necessity of a structured and gradual approach to transitioning to renewable energy sources. Participants consistently expressed that a gradual, phased and well-planned transition would mitigate potential economic shocks and allow for the integration of renewable technologies into the existing energy framework. This theme was validated by participant comments regarding the importance of government-led initiatives and clear policies to facilitate this process, indicating a well-supported understanding among participants.

Benefits and Opportunities in Renewable Energy Transition: The theme focused on the Benefits and Opportunities of Renewable Energy Transition was strongly supported by participants, who articulated numerous potential advantages. Many emphasized environmental sustainability, job creation, and energy independence as critical benefits. For instance, multiple participants highlighted how transitioning to renewable energy could stimulate economic growth and foster a cleaner environment, reinforcing the optimism and forward-thinking perspective prevalent in their responses. This theme's strength lies in its alignment with participants' aspirations for a sustainable future.

Challenges of Renewable Energy Transition: The theme addressing the Challenges of Renewable Energy Transition was equally well-supported, as participants recognized the complexities involved in moving away from coal. Common challenges cited included job losses, skills mismatches, costs and reliability of renewable energy, and the need for infrastructural improvements. The participants' acknowledgment of socio-economic issues, particularly concerning coal-dependent communities, indicated an understanding of the transition's implications. This theme's relevance is underscored by the participants' calls for comprehensive support systems to assist affected workers and communities during the transition.

Conclusion of Review

The review of these themes revealed a cohesive and understanding of the participants' insights regarding the JET in South Africa. Each theme accurately represents a distinct perspective shared during the interviews, ensuring that the thematic analysis reflects the complexities of the transition process.

By validating the themes through participant feedback and consensus, the researcher can confidently proceed to the next stage of analysis which is the theme definition stage.

4.4.6 Defining Themes

In this step, each of the identified themes was refined and explicitly defined to ensure clarity and depth in the analysis of the just energy transition in South Africa. The definitions provided here encapsulate the essence of each theme, reflecting the insights gathered from participant interviews.

National Energy Status: This theme offers an overview of South Africa's current energy landscape, marked by a significant reliance on coal as the primary energy source. It highlights the prevalent energy shortages and underscores the urgent need for a diversified energy mix. Participants consistently pointed out that the nation's dependence on coal not only poses risks to energy security but also hampers progress towards sustainable energy solutions. The theme serves to contextualize the challenges and opportunities inherent in South Africa's energy transition journey.

Processes of Renewable Energy Transition: The Processes of Renewable Energy Transition theme encompasses the critical steps and strategies necessary for a successful shift from traditional fossil fuels to renewable energy sources. It emphasizes the importance of strong government leadership, the establishment and implementation of coherent policies, and active stakeholder engagement. Participants stressed that a structured and gradual approach is essential to manage the transition effectively, avoid economic disruptions, and ensure that all voices are considered throughout the process. This theme captures the roadmap required for a well-coordinated transition.

Benefits and Opportunities in Renewable Energy Transition: This theme reflects the potential positive outcomes associated with the transition to renewable energy. Participants articulated a range of benefits, including significant environmental improvements, potential for economic growth, creation of new job opportunities, and enhanced energy independence.

The emphasis on these benefits highlights a forward-looking perspective among participants, who see the transition not just as a necessity, but as an opportunity for South Africa to innovate and thrive in a sustainable energy future. This theme encapsulates the optimistic view of what a shift to renewables could achieve.

Challenges of Renewable Energy Transition: The Challenges of Renewable Energy Transition theme addresses the barriers and obstacles that must be navigated during the shift from coal to renewable energy sources. Participants acknowledged several significant challenges, including the socio-economic impacts on communities reliant on coal jobs, the reliability of renewable energy resources, the skills gap that exist among the workforce, and the infrastructural requirements necessary to support new energy technologies. This theme reflects the complexities and realities of the transition, emphasizing the need for comprehensive strategies to mitigate adverse effects and ensure a just transition for all stakeholders involved.

Conclusion of Theme Definitions

The definitions provided for each theme are essential for understanding the broader implications of the JET in South Africa. By clearly defining and naming these themes, the analysis not only captures the perspectives of the participants but also lays the groundwork for discussing actionable strategies and policy recommendations moving forward. This clarity will aid in subsequent analyses and ensure that the findings can effectively inform future efforts in renewable energy development and implementation in South Africa.

4.5 Conclusions

Chapter 4 provided the analysis of the themes that emerged from interviews with participants regarding South Africa's JET. The data presentation and analysis offered insights into the challenges, opportunities, the fairness of the transition for coal-dependent communities and workers as well as the proposed strategies for a successful transition.

The first section addressed the challenges faced by the coal mining industry during the energy transition. Significant concerns included job losses in coal-dependent regions, the high costs of renewable energy technologies, political inertia, and the reliability of renewable energy sources. The analysis revealed that the lack of clear plans for retraining coal workers and facilitating their transition to renewable energy roles is a critical issue that needs to be addressed. Furthermore, participants stressed the importance of overcoming the financial and technical barriers to renewable energy adoption, especially for marginalized and rural communities.

The second section highlighted the benefits and opportunities associated with the transition to renewable energy. Participants recognized that renewable energy presents opportunities for environmental sustainability, economic growth, and energy independence. Despite the risks to coal workers, the renewable energy sector was seen as offering potential for job creation and foreign investment. Several participants also saw renewable energy as a path toward achieving South Africa's carbon reduction targets and enhancing the country's energy security.

In the third section, the analysis focused on whether the JET is fair and inclusive for coal industry workers and communities. The data showed that while the transition offers opportunities, significant concerns exist about fairness and inclusion. Participants emphasized the need for comprehensive retraining programs for coal workers, the risk of socio-economic disruptions in coal-dependent regions, and the perception of inequality in the distribution of renewable energy benefits. Moreover, the exclusion of key stakeholders from decision-making processes emerged as a recurring theme, highlighting the need for more inclusive policymaking that takes into account the voices of those most affected by the transition.

In summary, the data analysis revealed both the potential and the risks of South Africa's Just Energy Transition. While renewable energy offers significant environmental and economic benefits, careful attention must be paid to ensuring that the transition is fair, inclusive, and equitable for all stakeholders, particularly those in coal-dependent regions. Addressing these challenges through targeted retraining, community support, and inclusive policy development will be essential to ensuring a smooth and just transition.

Also, review of existing literature and thematic analysis of secondary data has provided further insights of South Africa's renewable energy transition. The key findings highlight the country's heavy reliance on fossil fuels and the importance of a gradual, well-managed transition to renewable energy. Existing studies consistently emphasize the need for government leadership, clear policy frameworks, and support for vulnerable communities to ensure a just transition.

The review underscores that renewable energy presents significant opportunities for South Africa, particularly in regions rich in solar and wind resources. However, the transition must be carefully managed to avoid economic disruptions, particularly in coal-dependent sectors. Investments in skills development, infrastructure, and public awareness are vital components for success.

In conclusion, while there are challenges ahead, South Africa's renewable energy transition has the potential to provide substantial environmental, economic, and social benefits. A phased, inclusive approach could help maximize these opportunities, ensuring that the benefits of the transition are shared across all sectors of society.

CHAPTER FIVE

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 Data Analysis Addressing the Research Objectives

The data gathered through interviews with 18 participants provided the insights into South Africa's energy landscape and the multifaceted processes and challenges associated with the country's transition to RE. Thematic analysis of the data has effectively addressed the research objectives, offering an understanding of the current energy context, the feasibility of renewable energy adoption, and the socio-economic implications of the JET.

Objective 1: Challenges Faced by the Coal Mining Industry During the Transition to Renewable Energy

The analysis revealed several critical challenges confronting the coal mining sector amid South Africa's transition to renewable energy:

Job Losses in Coal-Dependent Regions: A key concern, raised by 11 participants, is the potential for large-scale unemployment in regions like Mpumalanga and Limpopo, which are heavily reliant on coal-related industries. The absence of structured retraining programs was viewed as a serious threat to socio-economic stability. One participant stressed, *"Without a clear plan for transitioning coal workers to renewable energy jobs, we're going to face serious unemployment issues"* (P8).

High Cost of Renewable Energy Technologies: Nine participants cited the prohibitive upfront cost of renewable technologies as a barrier to equitable energy access, especially in rural and low-income communities. As noted by one participant, *"Renewables are still costly. The rural poor are already struggling with access to electricity, and this could widen the gap"* (P2).

Political Inertia and Weak Leadership: Five participants highlighted the lack of decisive government leadership and policy clarity as significant impediments to renewable energy adoption. *"Without stronger political will and policy implementation, South Africa's renewable energy goals will remain unrealized"* (P5), remarked one participant.

Intermittency and Reliability of Renewable Energy Sources: Concerns regarding the intermittent nature of solar and wind energy were raised by 7 participants, who stressed the need for grid stabilization through advanced storage technologies. *“If we don’t solve the reliability issues with solar and wind, we might face energy shortages”* (P3) emphasized one interviewee.

These challenges underscore the complexity of the energy transition and point to the need for a coordinated approach encompassing economic, technological, and political strategies.

Objective 2: Benefits and Opportunities of the Just Energy Transition

Despite the aforementioned challenges, participants also identified several key benefits and opportunities:

Environmental Sustainability: Ten participants recognized the role of renewable energy in reducing carbon emissions and aligning with global climate goals. One participant remarked, *“Moving to renewable energy could help South Africa meet its carbon reduction targets and reduce our environmental footprint”* (P3).

Economic Growth and Job Creation: Eight participants viewed the renewable energy sector as a catalyst for job creation and economic growth, particularly in regions with high solar and wind potential. Projects like Seriti Green and the repurposing of Komati Power Station were seen as positive steps. *“There are already projects like Seriti Green laying the groundwork for a renewable energy future. The challenge is scaling this up”* (P12).

Energy Independence: Six participants highlighted the potential of renewable energy to reduce dependence on imported fossil fuels, thereby enhancing national energy security. One participant noted, *“Renewable energy can lead to greater energy independence and reduce reliance on foreign energy sources”* (P4).

These opportunities reflect the potential for RE to contribute meaningfully to environmental, economic, and strategic national goals.

Objective 3: Fairness and Inclusivity of the Just Energy Transition for Coal Industry Workers and Communities

The analysis also examined whether the JET is fair and inclusive for those most affected—coal industry workers and communities:

Job Security and Retraining: Twelve participants voiced concerns over the lack of retraining and reskilling initiatives for coal workers. *“We’re concerned that there aren’t enough retraining programs in place to help coal workers transition to renewable energy jobs”* (P6) highlighted this apprehension.

Socio-Economic Impact on Coal Communities: Eleven participants emphasized the risk of economic destabilization in coal-reliant regions without targeted support. *“Coal communities depend on the industry for more than just jobs. The entire local economy is at risk if there isn’t a plan to help these areas transition”* (P9).

Perception of Inequality: Nine participants expressed that the benefits of the transition appear skewed towards urban, wealthier areas, leaving rural regions behind. *“It feels like the transition is leaving rural and coal-dependent areas behind”* (P7) noted one participant.

Stakeholder Inclusion in Policy Development: Ten participants indicated a lack of inclusion of coal workers and their communities in policy discussions. *“The government needs to involve coal workers and communities in these discussions. They’re the ones who will be most affected”* (P15).

Community-Driven Renewable Projects: Five participants suggested promoting community-owned renewable projects to ensure coal regions benefit economically and socially. *“If we can create renewable energy projects that are community-owned, we could make sure coal regions benefit from the transition too”* (P13).

Collectively, these findings indicate that the current JET framework lacks inclusivity and fairness, particularly for vulnerable groups, necessitating deliberate, community-centered interventions.

Objective 4: Strategies for a Successful Renewable Energy Transition

To achieve a successful and equitable transition, several strategic recommendations emerged from the data:

Gradual Transition: A phased approach was supported by 15 participants to avoid economic shocks and ensure energy reliability. *“A slow and steady approach is necessary to avoid economic shocks and ensure energy stability”* (P1) encapsulated this view.

Government Leadership and Policy Implementation: Ten participants emphasized the need for strong governmental action and clear policy frameworks. *“We need the government to take charge and create a clear, actionable framework”* (P6) was a commonly echoed sentiment.

Skills Development and Worker Retraining: Eight participants called for targeted training programs to help coal workers transition into renewable energy roles. *“Investing in training and education could mitigate the risk of job losses”* (P7) emphasized the importance of this measure.

Investment in Renewable Energy Technologies: Seven participants recommended investment in advanced storage and grid management technologies to address intermittency issues. *“If we can improve battery storage, we can significantly increase the reliability of solar and wind power”* (P11) emphasized the technical priority.

These strategies reflect a comprehensive approach to a JET—balancing environmental sustainability with socio-economic equity and technological innovation.

5.1.2 Overall Conclusion

The findings of this study reveal a complex but navigable pathway toward a JET in South Africa. While there are significant challenges—particularly regarding job losses, political inertia, and perceived inequalities—there are also notable opportunities for environmental sustainability, economic development, and energy security. Achieving a fair and successful transition will require deliberate, inclusive planning and execution, driven by government leadership, stakeholder engagement, strategic investment, and targeted workforce development.

5.2 Recommendations

Based on the review of existing literature, thematic analysis of secondary data, and insights from publicly available sources, the following recommendations are proposed to guide the renewable energy transition in South Africa:

5.2.1 Gradual and Balanced Transition

A rapid shift from fossil fuels to renewable energy risks destabilizing the economy, particularly in coal-reliant regions. Research supports a gradual, balanced approach to energy transition, maintaining a diverse energy mix in the short-to-medium term. Coal and other fossil fuels should continue to play a role while the share of renewable energy in the national mix gradually increases. This phased approach will help protect jobs and mitigate economic shocks in coal-dependent sectors.

5.2.2 Government Leadership and Policy Development

Effective government leadership is essential for ensuring investment confidence and clear policy direction. Existing studies emphasize that the government should establish a comprehensive, actionable framework that includes clear timelines, investment incentives, and supportive regulations. This would help streamline renewable energy project approvals, reduce bureaucratic obstacles, and foster local and international investor confidence.

5.2.3 Skills Development and Job Creation Initiatives

The renewable energy transition presents both risks and opportunities for the labour market. Literature highlights the need for targeted skills development programs to prepare workers from coal-dependent industries for renewable energy jobs. Collaboration between the government, industries, and educational institutions is recommended to create training programs for solar, wind, and other renewable technologies. A focus on labour-intensive projects could also help address South Africa's unemployment challenges.

5.2.4 Investment in Renewable Energy Technologies and Infrastructure

Continuous investment in renewable energy technologies, particularly in energy storage systems like batteries, is critical to address the intermittency of solar and wind power. Studies recommend a focus on research and development (R&D) to improve the efficiency and reliability of renewable energy sources. Furthermore, upgrading the national grid to accommodate decentralized renewable systems will be crucial for supporting a reliable and widespread energy transition.

5.2.5 Targeted Financial Support for Vulnerable Communities

To ensure an inclusive and equitable transition, the literature suggests financial support programs for rural and low-income communities. Government subsidies or incentives can make renewable energy technologies more affordable for these groups, preventing the transition from disproportionately benefiting wealthier populations and leaving vulnerable communities behind.

5.2.6 Stronger Public Awareness Campaigns

Raising public awareness about the benefits and opportunities of renewable energy is critical. Research suggests public education campaigns that emphasize job creation, environmental sustainability, and economic growth within the renewable sector. Such campaigns can also inform the public about government initiatives and support available for renewable energy projects, encouraging broader participation, particularly from rural and marginalized communities.

5.3 Limitations of the Research

While this study provides valuable insights into the challenges, benefits, and strategies related to South Africa's JET, several limitations should be considered:

Limited Stakeholder Representation: While the study included insights from secondary sources, it may not have captured the full spectrum of stakeholder perspectives, particularly from marginalized communities, labor unions and lower-level workers from coal-dependent sectors. These groups may face distinct challenges and could provide critical insights into how to make the JET more inclusive.

Time Frame: The rapid pace of developments in the energy sector, particularly regarding renewable energy technologies, means that some findings may be outdated in the near future. The renewable energy sector is evolving quickly, and research conducted at a later stage may provide different outcomes and recommendations.

Geographical Focus: This study primarily focused on the national transition in South Africa. However, the JET implications are regionally diverse. The challenges and opportunities faced by coal-dependent regions may vary widely. Further research could explore these regional dynamics more thoroughly to tailor solutions to local needs.

Complexity of Social and Economic Factors: The study attempted to address the socio-economic challenges of the energy transition, but the complexity of factors influencing this issue, such as political instability, international market trends, and public perceptions, may not have been fully explored.

5.4 Recommendations for Future Research

Given the limitations of the current study, the following areas are recommended for future research:

Primary Research on Stakeholder Experiences: Future studies could incorporate primary data through surveys, interviews, or focus groups with lower-level workers from coal-dependent sectors, more renewable energy employees, labor unions and policymakers. This would provide a more direct understanding of the lived experiences of individuals impacted by the transition.

Regional Studies: Further research should explore the regional dynamics of the JET in South Africa. The specific challenges faced by coal-reliant communities in different provinces may vary, and more localized studies could propose tailored policies and strategies to address these unique needs.

Impact of Technological Advancements: As renewable energy technologies continue to evolve, research should examine the long-term economic impact of innovations such as energy storage solutions, smart grids, and advanced solar and wind technologies. Understanding these innovations' potential will help in formulating more forward-thinking policies.

Social and Cultural Impacts: Future research could delve deeper into the social and cultural implications of the energy transition, particularly how the move from coal to renewable energy impacts local identities, social structures, and community cohesion. This could be vital for ensuring the success of transition policies.

Comparative Studies with Other Countries: Comparative studies between South Africa and other countries undergoing similar energy transitions would be beneficial. Analyzing international case studies could uncover best practices and lessons that South Africa can apply to its own renewable energy transition.

Longitudinal Studies on Labour Market Outcomes: As the renewable energy sector expands, longitudinal studies tracking the long-term impact on employment and skill development in both the renewable energy and coal industries would provide more robust data for decision-making. These studies could track how successfully displaced coal workers are transitioning to new energy sectors and whether retraining programs are effective.

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APPENDIX A: PARTICIPANTS DEMOGRAPHICS

Participants	Title	Industry	Experience	Gender
P1	Performance and Testing Manager	Eskom	23	M
P2	Senior Manager Strategy Development	Eskom	16	F
P3	Safety and Sustainability Manager	DMRE	14	F
P4	Environmental Protection Inspector	DMRE	11	M
P5	CEO	MHSC	24	M
P6	Engineering Manager	Thungela Resources	15	M
P7	Mining Manager	Thungela Resources	15	M
P8	Environmental Superintendent	Thungela Resources	11	F
P9	General Manager	Thungela Resources	13	M
P10	Engineering Manager	Seriti Resources	18 months (previous company 17 years)	M
P11	Mining Manager	Seriti Resources	16	M
P12	General Manager	Seriti Resources	20	M
P13	Energy Specialist	Seriti Green	1,5 in Seriti green & 11 in mining	F
P14	Geologist	Glencore	17	M
P15	Pensioner	Community member	40	M
P16	Community member	Community member		F
P17	Community member	Community member		F
P18	SME/Supplier	Community member		M

APPENDIX B: INTERVIEW QUESTIONS

My name is Diana Mamabolo and I'm doing research in partial fulfilment of my master's degree in mining engineering with the University of the Witwatersrand supervised by Professor Gordon Smith. The title of my research is (A JUST ENERGY TRANSITION: CHALLENGES AND BENEFITS IN THE SOUTH AFRICAN COAL MINING INDUSTRY) and I will be interviewing senior managers across from Seriti, Thungela, Glencore, Eskom, DMRE and community members. Note that the questions that I would like to ask are all linked to my research topic and I have received permission from the University of the Witwatersrand to conduct this interview. This is a structured interview. We are going to have a conversation and please feel free to express your knowledge in the topic. If you are not sure you are more than welcome to also ask questions for clarity. Note that the interview will be recorded so that I can transcribe and analyse the interview content later. With the content that I have shared with you. Do you agree to conduct this interview?

1. Gender:

Race:

Occupation:

Years of experience in the industry:

Years of experience in your current role:

2. I would like to understand from if you know what a just energy transition is?

3. What do you think are the benefits and opportunities (if any) of transitioning to renewable energy?

4. What challenges do you think would come with this just energy transition process?

5. What does a just energy transition mean for the people of South Africa, people in the coal mining /coal-fired power station industry and what community members living in coal mining dependent regions?

6. Do you think as the country we are ready for this transition? Do you know the country's current energy status?
7. What do you think is the right approach or strategy the country must take to ensure successful implementation of the just energy transition
8. How will socio-economic issues be addressed in the coal mining industry post the transition considering the vast group of old and uneducated skilled labour to close the gap?
9. Are there clean coal technologies implementations underway or currently going on that you know of?
10. What are the explicit (clear) and implicit (unspoken/private) reasoning why just energy transition is happening according to your views?
11. What policy and governance approaches could embed justice during just transition, especially in the coal mining industry and coal fired power stations?
12. Where do you think we will be as South Africa in 20 years from now? With regards to renewable energy?
13. What do you think the world needs to do to reduce the impact of carbon emissions and global warming?
14. Is there an important point of discussion that you would like to discuss regarding this topic?

APPENDIX C: MICROSOFT TEAMS INTERVIEWS TRANSCRIPTS

Interview Transcription - Participant 1_Eskom

Speaker 1: Okay, so it has started recording. Yes, there we go. I'm doing this research as a partial completion of my master's degree. I'm doing it with the University of the Witwatersrand, supervised by Gordon Smith. The title of my research is Energy Transition, looking at the challenges and the opportunities in the South African coal mining industry at large. The plan is to interview managers in different mines, community members and people from the regulatory industry like DMRE. I will not be disclosing your name or the company you work for. And all the questions that I will be asking will be linked to the research question. We will just be having a conversation about this, please feel free to express your knowledge in the topic.

Speaker 2: No worries, it's fine.

Speaker 1: All right. Gender and race?

Speaker 2: Male. Black.

Speaker 1: What is your occupation?

Speaker 2: I'm the Performance and Testing Manager here at Kriel.

Speaker 1: Okay. And then your years of experience in the industry?

Speaker 2: 23.

Speaker 1: Okay. Thank you for that. The first question I would like to understand if you know what the just energy transition is or what it means. What are we talking about when we say just energy transition?

Speaker 2: Yeah. I was doing my honours on the same thing. I did my honours on energy with UJ and we covered this just energy transition extensively. So I'm clued up. In short, it's just changing from the current burning of fuel to renewable energy in a manner that will be fair, especially for the people that are living in those areas or working in those areas where the fossil fuels are.

So they're looking into ensuring that that is done in a friendly manner, that it doesn't discriminate anyone and no one is left behind when the transition happens. I think that is it in short.

Speaker 1: Thank you for that. And then what do you think the benefits or opportunities could be if there are any in transitioning to renewable energy?

Speaker 2: Well, the biggest benefit will be the issue of the environment. Renewable energy means less pollution and a reduction in carbon emissions, which is important for fighting climate change. Then, if we handle it well, renewable energy could also lead to more stable and independent energy sources. We'd be less dependent on imported fuels, which I think would benefit our economy in the long run. We have signed a Paris agreement committing to combat the carbon emissions so switching to renewable energy will help us meet global climate commitments.

Speaker 1: Thank you so much for that. What challenges do you think, according to you, comes with this just energy transition process in your view?

Speaker 2: The biggest challenge for me, it will be the socio-economic impact of this thing. The jobs, people have made life of, I'll just use coal mining and Eskom in this area. People have made life around this industry. So for me, the biggest challenge will be the jobs. Job security for coal workers is a major concern that must be addressed. The skilling and re-skilling of people will also be another issue. Currently, they are looking into making Komati a hub or a training centre for this. Have you seen how big Komati is? For me, Komati is not going to be sufficient to actually be able to carry all of these guys to be re-skilling in the upskill. For me, the biggest challenge will be the sustainability of jobs. Yes, during construction, it's going to absorb a lot of people. In the end, it doesn't take much people as much as the mines or power stations would do. For me, those are the key issues.

Speaker 1: You touched base on the Komati being the hub. Is it being the hub in terms of re-skilling people, maybe bit by bit? What do you mean by that? Sorry? You just touched base on Komati, that the plan is to use it as a hub, right?

Speaker 2: Yes. What they've done with Komati is that they've closed it down and then they've opened Komati as a training centre for the renewable, mainly solar and wind. They are in partnership with, there's a school in Western Cape that does the renewable

energy training. So Komati or Eskom is in partnership with that. The issue being that they want to make it the biggest training centre in Africa on renewable energy. So the plans are underway now. I can share some of the information if you want, because I do have some of the information from that, of converting Komati into that training hub.

Speaker 1: I actually was not aware of that. Thank you. I appreciate the sharing of information just to also further my knowledge. According to you, what do you think is the right approach or strategy that we must take to make the energy transitioning a success?

Speaker 2: Okay. My take would be firstly to postpone the decommissioning plan. I think you will be aware that there is what you call the 2035 strategy that Eskom is embarking on of closing the power stations around this area. So for me it would be to postpone that, introduce the renewable energy while the fossil fuel energy is still on the picture. And then you see if this thing is going to work. Because you will know that a country like Germany, they were in full force with renewable energy. They are back now to coal after the Ukraine-Russian war because they were relying heavily on the natural gas from Russia. And then when they put sanctions on Russia, then Russia closed their tabs. Now they do not have anything to give them energy. So they had to actually go back to their coal-fired power stations. So Germany, they even went to an extent of closing their wind farm. Demolishing their wind farm and putting a new coal-fired power station. We do not want that for South Africa. So for me this transition is a good start. But the way that it's been done is that we are actually not focusing on the right areas. The right areas being firstly the base load. Who is going to give South Africa base load if we have to shut down power stations, if we have to shut down the mines. Because currently we've got only one power station that is an alternative. That is Koeberg for nuclear. The rest is coal-fired.

And then now with that, we have load-shedding issues as it is. You close the power stations, what will happen to the economy? But they need to introduce it in a manner that they start slowly. Not like the full force that they want to do. And they must give themselves enough time. This thing they should have started in 2003 when you read the white paper on renewables. It was a promulgation in 2003. So if they started then, we would be in a far more better position. Let's give ourselves 20, 30 years to try and transition. Because this net zero by 2050 that they are talking about, we will not realise.

And then also there is very little contribution that Africa as a whole is making on this greenhouse issue. They must start with big countries like China. I was reading an article that almost every month China is commissioning coal-fired power stations. So I mean the people that are the ones that are actually polluting the atmosphere more are the ones that do not care. They are focusing on the small areas. I honestly think a slow and steady approach is necessary to avoid economic shocks and ensure energy stability, especially for regions heavily reliant on coal. Secondly, strong government leadership is crucial for the success of this transition. We need clear policies that attract investment into renewable projects and create training programs for coal workers. Additionally, we need to invest in technologies that can address renewable energy's reliability, like battery storage.

Speaker 1: Okay.

Speaker 2: I actually read something like this. Where is the fairness in terms of having to all now contribute to this green energy? Because it can only be fair if you contribute according to the damage you contributed. Even this money that they're giving us is actually loans. It's not like money that we're going to say, oh, okay, great stuff. Thank you. It's money that we have to pay back.

Speaker 1: I understand. Interesting. Interesting one. Thanks for this. So what does this just energy transition mean for us, both as citizens of South Africa and as people in the coal industry?

Speaker 2: It means the loss of jobs. It means the loss of life. For me, there's more negatives to it. You know, there was one guy who I interviewed who said, I'd rather die of this bronchitis or whatever than die of hunger. Because this, what this will do to me is it will bring us hunger.

So he said, you know what, I'd rather die of the dirty air than to actually die of hunger. And it really touched me, this thing will bring them more misery than what we are trying to do.

Speaker 1: So the next question is that you think of the country, we are ready for this transition. Do you know the country's current energy status?

Speaker 2: No, we're not. South Africa's reliance on coal for energy is alarming; we need alternatives. Maybe if we could do it concurrently and still keep coal, while

introducing renewable energy. With that said, but let's not stop trying to implement it. Implement and still have the coal fired power station and see how it works. Because chances are it might not work. But at least we've got something to fall back on. The reality is that South Africa is not ready to completely phase out coal by 2050 without crippling the economy. Our energy system is still too dependent on it

Speaker 1: Yeah, I understand.

Speaker 1: So what is your perception of South African coal mining industry generally? Is there an alternative for us?

Speaker 2: My biggest perception with coal mining is that the owners, if I may put it like that, they are crazy people. Because in most of these mines, you'll find that the people that are working on the floor, the people that are really putting their lives at risk are not getting what is due to them. So that is just my perception with coal mining and mining in general. It's still in the white people's hands. Black people are still not, I will use the word free for lack of a better word, just not yet free. It's monopolized in a way.

Speaker 1: I'm losing you a bit. I think it's network or maybe the area where you are. Are you still driving? Siboniso? Siboniso, can you hear me? Hello? Hello. Siboniso? I think I missed you there. Hi, Siboniso. I think I lost you there. It's probably network because it sounds like you're driving.

Speaker 2: Yes, yes, yes. Yeah. Yes, yes.

Speaker 1: We are almost done. I'm not sure if it's possible for you to join maybe for an additional five minutes for the sake of recording.

Speaker 2: Okay, that's fine. I'll wait for you.

Speaker 1: How do you think socio-economic issues in the coal mining industry can be addressed post-transition, especially for older, less-educated workers?

Speaker 2: It's a tough one. For the older workforce, transitioning may be especially difficult. We need specific programs that target this group, maybe through collaboration with community organizations that understand the local dynamics. For those who are near retirement, perhaps an early retirement package would be fair, while younger workers could benefit from vocational training for new skills in renewable energy sectors.

Speaker 1: So, another question. Are the clean coal technologies implementations underway that is currently going on that you know about?

Speaker 2: Well, for the new station, yes. Kusile and Medupi. They are fitted with these FTGs for sulphur mainly.

Speaker 1: Okay.

Speaker 2: But there's also a study that RTNT, RTNT is our research department. They are doing to try and see like your carbon capture and all those things. So, there's a full study. Eskom is also going full force with it. Last week, there was a conference in Cape Town. And Eskom is playing a very big role in ensuring that there are things that are being done to actually minimize the carbon emissions. And put things on the existing stations. But the new power stations, yes, they are already fitted with some of these carbon capture technologies.

Speaker 1: Oh, interesting.

Speaker 2: But a station like Kriel where I work, there is nothing except for the minimizing of the emissions themselves. We were fitting in, what is this, transformers? I forgot the name. So, it's almost a billion rent project that you're putting in to reduce our emissions. At Kriel, we've already implemented in one of the units. So, we still are left with five units. We're just testing now if this technology is working. It has been tested in, I think, at Matla . So, there are things that we're doing to try and reduce the emissions. Some of the stations are now fitted with low burners. Kriel was supposed to be fitted, but because of the age, I mean, it's pointless. Yeah, because in the books, Kriel will be closed in 2030. So, that project was surely cancelled. So, there are things that Eskom is doing, especially their research. I can just try to get contacts for research or an opportunity about this thing. What is it that they are doing on their site? I'll get more information to give it to you. I'll just check who can I get that site, so that you can just get a holistic picture. Because they're looking at all the sites, unlike me looking at Kriel alone.

Speaker 1: Yes, yes.

Speaker 2: Because I think there could also be more motivation in terms of the concurrent energy mix, not a full force transition to say, even the current project, we actually doing something. Why can't we just prolong the process? Because it's not like

we are just carrying on with business as usual. You understand? So, maybe that could also bring a bit of motivation. Let's make it 40-60. Until we see progress. Because it's not like nothing has been done. I mean, money has been invested.

Speaker 1: What policies and governance approaches do you think could ensure justice in the transition, particularly in the coal industry?

Speaker 2: Policies should prioritize coal-dependent communities, maybe with funding specifically for worker retraining, community development projects, and incentives for businesses to hire transitioning workers. The government should also set guidelines for transparency so that the coal industry workers are aware of all stages of the transition.

Speaker 1: Looking forward, where do you see South Africa in 20 years concerning renewable energy?

Speaker 2: Hopefully, we'll be much more energy-independent and less reliant on coal. Ideally, we'd have a diverse, stable energy mix with most of our power coming from renewables. But this will only happen if we invest in the right technologies and take everyone along on this journey.

Speaker 1: All right. So this is more of a controversial question. What are the explicit? Explicit meaning the clear and the implicit meaning the unspoken or private reasoning why just transition is happening, according to your view.

Speaker 2: You want my honest opinion? Because, I mean, we can read on the internet about the reasons behind this. We know, according to science and the environmental implications, it's clear there. But according to private agendas, I mean, it's a personal opinion. In my view is that this transition must happen. But the manner that it is being done it is not just. So, for me, it really needs to happen. If you look at what is happening, I'm currently doing a report on climate change. The issue of what is happening, the extreme floods etc. So energy transition needs to happen but in manner that will be fair for everyone. Currently, it's not fair at all. The guys, we call them, the guys with money, are the ones that are dictating what needs to be done. Actually, they are the ones that are polluting more. And they want now the third world countries to actually start with this thing. Whilst in their country, it's not yet implemented. At the end, this thing must happen. But it must happen concurrently with

the fossil fuel. And also in a manner that will not put any person at a disadvantage. So, I'm pro-renewables, but I want it to happen in a manner that will be fair for everyone I believe people of power are pushing their own personal agendas behind this.

Speaker 1: Is there anything else you think we should discuss or any final points you'd like to add on this topic?

Speaker 2: I can say if we're serious about a just transition, we need action, not just talk. Policies are only useful if they're put into practice. And for the communities relying on coal, we need solutions that are practical and not just promises.

Interview Transcription - Participant 9_Mining Industry

Speaker 1: I'm doing this research as a partial completion of my master's degree . I'm doing it with the University of the Witwatersrand, supervised by Gordon Smith. The title of my research is Energy Transition, looking at the challenges and the opportunities in the South African coal mining industry at large. So the plan is to interview managers around Seriti, Thungela, Glencore, community members and people from the regulatory industry like DMRE. So yes, I will not be disclosing your name or the company you work for. And all the questions that I will be asking will be linked to the research question. And we'll just be having a conversation about this, please feel free to express your knowledge in the topic.

Speaker 2: Sure.

Speaker 1: Gender and race?

Speaker 2: Male, Black.

Speaker 1: Occupation.

Speaker 2: General manager.

Speaker 1: Okay, and the years of experience in the industry?

Speaker 2: 13.

Speaker 1: So sir, we'll just go straight to it. Just to ask, what do you know about the Just Energy Transition?

Speaker 2: I think it's just a transition of moving away from fossil fuels into much more cleaner, renewable energy sources.

Speaker 1: Okay. And then, what do you think of the benefits or opportunities, if there's any, of this transition to renewable energy?

Speaker 2: I think the climate benefits and opportunities are real, or climate challenges are quite real. The benefits, obviously, in the face of it, it looks more like decarbonisation or slowing down the rate of global warming. Whether it can be reversed or not, I think that still needs to be proven. But the main benefits of renewables include cleaner air and possible job creation

Speaker 1: Okay. And the challenges of this energy transition process?

Speaker 2: The first obvious challenge, when it comes to any technological change, is leaving people behind. Leaving the less skilled people behind that work in the coal sector or in the fossil fuel sector. So that would be your power station employees, coal-fired power station employees, your coal mines, leaving those people behind and leaving those towns behind. Most of the economies in those towns are driven largely by fossil fuels production. Coal communities depend on the industry for more than just jobs. The entire local economy is at risk if there isn't a plan to help these areas transition. Two, there's a lot of research that talks about what do you do with, as an example, solar panels when they live beyond their time? Yeah. What do you do? How do you dispose those? That disposal is still not clarified. Some are they saying that disposal of solar panels are much similar, if not worse, than building coal-fired power plants, because no one has figured out how to renew them as yet. And the third challenge would talk about how do you fund it? For an emerging market or an emerging economy like South Africa, where you've got your current load, core base load, being heavily in debt, almost 40% of your GDP in debt. How do you fund this

transition in this economy? Are you going to pick up more debt to try and fund it? Or is there different options? If you're going to pick up more debt to go and fund it, what does it do now to your emerging economy? Because you also don't want your debt to GDP to continuously spiral out of control. The global goals are admirable, but for us, there needs to be a more pragmatic approach. We cannot ignore the economic implications, especially when our GDP is so reliant on fossil fuels. Transition planning must consider the socio-economic fabric.

Speaker 1: Yeah, definitely. And we're already not in a best of places.

Speaker 2: Exactly, exactly. And I guess once again, if you look at the contributors to carbon emissions, and you were to look at them throughout the entire world, Africa is one of the least, simply because of the rate of electrification in Africa. But if you look at what Europe has done, if you look at what USA has done, it's a bit of a shock because they build the economy based on coal and electricity. So they've contributed immensely as compared to our continent in terms of carbon emission. Africa is always on the lag, right? Now, you're placed in a position where you can see this is happening, but you have contributed less to the emissions but still need to contribute towards energy transition on the same level. The argument and the debate just don't sound right. But the reality is we are not yet geared up for it, which is why it has to be just, which is why it has to be careful. It has to be through, there has to be plans of how we are going to make sure that we don't end up sending people back into poverty.

Speaker 1: Yeah, very true. So this then leads me to my next question to say what is the right approach and strategy to ensure the success of this transition?

Speaker 2: So for me, for me, in the right approach, and I'm going to answer for the South African context and sphere, the first thing is people need access to electricity. And supply hasn't been secured. As a start, it's only the privileged that can afford different sources of energy, like solar, only the rich benefit from that. And the social dilemma is how do you get those that cannot afford to be on the same wavelength and platform through an affordable means? That means one, for every power station that you're shutting down, you need to have an equivalent in load, if not more replacement in terms of renewable energies and bringing them on board. Two, I'd say open the

doors of competition. Instead of having a monopoly of Eskom, consider getting private players to contribute into this process. So it doesn't necessarily have to be the balance of Eskom and the country. It can be shared amongst other private players that have got the resources and the funds to be able to do it just so that South Africa cannot necessarily get into debt. So what that could mean is Eskom can still be the main distributor, but it should have a framework to be able to purchase from, from different sources of energy mixes, bringing them to Eskom and redistribute because fundamentally they own pretty much almost the entire grid in the country. And that would require a policy shift from government. I think that's where the country should start. We need an actionable framework for a renewable transition. I'd start with allowing private players to be able to sell to the main distributor and the main distributor to be able to resell back to increase the base load and match the energy demand while considering the underprivileged.

Speaker 1: Yeah, yeah. Okay. Noted. Noted. It's a mouthful. So now, sir, Do you think as a country we are ready for this transition? What's your take on the energy status of this country?

Speaker 2: Listen, we can argue that coal is a major source of our energy, but it is also a major polluter. I believe the country is ready for this. Look, there's two things to that question. One, are we ready to implement? Yes, we are. However, I don't see how we can solely depend on renewables in the short term. The grid is already constrained, and a full shift could be disastrous. But a balanced mix could minimize emissions while keeping the lights On. Do we have the right policy framework to implement? No, we don't. Like I said, we need an actionable framework for a renewable transition. Do we have the right will to implement? I'm not sure. But 2050 is not far. That's 27 years from now. A lot can happen in 27 years. If the country wants to implement and is willing to open up the doors of partnership, I think there'll be a lot of influx in terms of investment, either foreign direct investment or local investment that can be put into this place. The potential is there. You've got companies like Sibanye planning to build a 600 megawatt hour plant in the next five years. That's almost an equivalent of a substation. You've got African Rainbow Power, it's the best company partnering with ABSA to be able to bring about 600 megawatts of grid capacity. So once again, that's an equivalent of a commodity power station. All you need is 10 to 15 projects that are delivering an

average of 600 megawatts and you're already at 10-gigawatt. 10 gigawatt hour is debated to be enough to sort of curb the likes of load shedding if we were to be there. So I think capacity is there. Government might not have the full resources, but if it opens the laws of competitiveness, South Africa will definitely accelerate its way into that. So it's always about opening doors of partnership and competitiveness to push the implementation and then just to have the right policy framework in place.

Speaker 1: What policy and governance approaches could ensure justice during this transition? Speaker 2: I think we need a gradual approach. We can't just shut down coal mines overnight—it would be disastrous for the economy. We need a balanced mix of energy sources for the time being. And during this time, policies should prioritize coal-dependent communities maybe with funding specifically for worker retraining, community development projects, and incentives for businesses to hire transitioning workers. The government should also set guidelines for transparency so that the coal industry workers are aware of all stages of the transition. A structured transition plan is crucial to minimize disruptions.

Speaker 1: Noted. So sir, are there any clinical technologies, implementations that you know about that are underway as we speak?

Speaker 2: Maybe, I don't know, through Eskom I'm sure. I think the topic still needs to be researched quite at large. People talk about carbon capture. Carbon capture technology, that is technology that a few companies are trialling. But I think what's probably a biggest hamper is the moment people mention a fossil fuel, everybody gets up in arms. Instead of, we've got fossil fuels, what can we do to be able to capture this carbon and redirect it for better use? So that process, I think, still requires a lot of research and a lot of funding. R&D is required to perfect and improve the technology. R&D referring to? Research and development. But yeah, if you read on carbon capture, there's people that claim that they've got the technology to capture CO₂ and store it underground, use it for doing things like building materials, blah, blah, blah, blah. Just like any technology, in its infant stages, it might not seem viable. I mean, if you spoke about an electric car 20 years ago, would you get a buy-in? Because the pressures in the world was not in that framework yet, the technologies were not necessarily pushed. Whereas now, if you talk about most developed countries, they're

pushing it. Most businesses are pushing for fossil fuel-free cars or petroleum-free cars. So I think the technology is there. It's got potential. It just needs more refined research and probably a lot of funding.

Speaker 1: Okay. So my next question is more controversial than anything else. We obviously know about the reasons behind this transition, but are there maybe unspoken or private reasoning behind this energy transition, or is it strictly explicit and clear the reasoning behind this whole transition thing?

Speaker 2: There's always agendas in anything that you're going to implement. There is someone who's already advancing the development of clean energy transition that's looking for business for their country or for their company.

will always be there. But I think the reality is, the process is getting Africa more and more indebted, it's a well-known issue. It's a real cause for concern because if all these technologies are going to be funded by first world countries through loans, then it poses the question that are we doing this because it's the right thing to do. The funding structure should be different and not necessarily free, but not in stringent loans. It should be the world collaborating to doing the right thing as opposed to doing the right thing means you are going to be in even more debt that's going to take you another century or decades to get out of. So that would always be a nagging factor that you've got a country that has money, you've got a country that has the technology, you've got a country that says, hey, you need to transition and part of your transition process is unfortunately getting into more debt so that you can buy the technology from us who already have the technology. And in that process, you are empowering us and disempowering some of your people. I think that scepticism is always been there, particularly given the fact that more developed countries have ripped Africa apart for years, for centuries. That's the unfortunate part. So there, then we're speaking of really injustice to our continent or our country generally.

Speaker 1: Where do you see the country in 20 years from now? Do you see the whole transition happening successfully?

Speaker 2: So the energy mix will change. That's for sure. There will be a lot more contributors to our energy mix. Though the percentage of your coal energy mix might decrease with an increase in other energy mixes, being in nuclear, being in renewables or whatever you call it. The reality of it is the rate of growth in energy generation is not equivalent to the rate of growth in energy needs or requirements. So as a result, coal will still contribute a lot more. The tonnage profile for coal burnt, I see it increasing, even though the actual contribution to the energy mix might be less. And I guess what matters for small towns like Witbank is the tonnage profile. The tonnage profile goes up. It means they're selling. It means they're producing. It means they've got jobs. But so what? If coal is no longer contributing 90% of the energy mix, it's now contributing 50%. But that 50% has got no direct impact on them or their livelihoods.

Speaker 1: Yeah. Okay. So this really puts me almost to the end of our interview, to say, is there maybe another important point of discussion that you'd like me to look at as a way to build this research according to your knowledge.

Speaker 2: Is there an alternative? Is there an alternative use of coal? If you can use it into petroleum, maybe you might not have time for it, but it's something to think about or to mention as an exclusion for your research. If you can use it into energy generation, is there an alternative use of coal? Can you use it to build a road? Can you use it to build a house? I'm just throwing ideas. We can't change the fact that we have a lot of coal. I mean, we are endowed with a lot of this coal, this fossil fuel resource. So to build our GDP, can we use it for something else?

Speaker 1: That's actually something good to look at. You're right. That's it. I'm noting that down. I'll definitely look at that. This brings us to the end of our conversation. Five minutes earlier

Speaker 2: All the best with your research, Dee. Thank you so much.

Speaker 1: Thank you so much. It was quite informative. And hopefully you don't mind me sending maybe a WhatsApp or two, just to confirm a few things.

Speaker 2: I'm just a phone call away. Yeah.

Speaker 1: No, thank you. I appreciate it, man.

Interview Transcription - Participant 4_Regulatory Industry (DMRE)

Speaker 1: I am doing this research as partial completion of my master's degree with the University of the Witwatersrand, supervised by Gordon Smith. The title of my research is Just Energy Transition, looking at the challenges and the opportunities in the South African coal mining industry at large. I will not be disclosing your name or the company you work for. All the questions that I will be asking will be linked to the research question. And we'll just be having a conversation about this, please feel free to express your knowledge in the topic. Can we start?

Speaker 2: Yes

Speaker 1: Gender, race?

Speaker 2: Female. Black

Speaker 1: Occupation.

Speaker 2: I'm an Environmental Protection Inspector.

Speaker 1: Years of experience?

Speaker 2: 11 years now.

Speaker 1: So I'd like to understand from you if you know what just energy transition is.

Speaker 2: So just energy transition focuses on a transition of South Africa's energy sector. The current form of energy production or energy use, which is based on fossil fuels to cleaner and renewable energy source. That's what I call it.

Speaker 1: Thank you for that. Nice and brief. So on your side, do you think there's any benefits or opportunities in transitioning to renewable energy?

Speaker 2: Okay. So, maybe what we need to understand is that this concept of energy transition as a whole is not new in the history of human life. We've had this in the past, for example, where people change from using wood to coal and then in the 19th century and later on, say in the 20th century, from coal to starting to use oil and other forms of energy. So, if you look at it, then it's basically like a paradigm shift. If you look at it, you will realize that this energy transition thing is more like a paradigm shift. It's not a very simple and straightforward concept. So, yeah, but coming back to try and answer the question, in terms of benefits or opportunities, the obvious one would be pollution reduction, which is the main driver anyway, because I think the reason we're trying to transition is because of the climate change and the damage to the ozone layer. So, in addition to that, I think if we transition to renewable energy sources and as the name implies, renewable means that the energy sources will never be depleted. So, in the long run, besides installation of the mechanisms to try and concentrate that energy, but the energy itself will always be there. The sources will remain because they are natural and cannot be depleted. So, they will probably save us costs along the way. So should the transition be done right, renewable energy can lead to greater energy independence and reduce reliance on foreign energy sources. But then, in terms of coal, I think we still need to look at more research to repurpose coal-fired power stations. I think it can still be used. We'll get into that with your follow-up questions.

Speaker 1: Thank you for that, what do you think the challenges are in transitioning to renewable energy?

Speaker 2: Alternative energy sources that I know, for example, will include hydroelectric, nuclear power, solar energy, wind, and geothermal. But if you look at geothermal, hydroelectric, and nuclear, we have a challenge with the availability. The first two, geothermal and hydroelectric, we have limitations in South Africa in particular. Nuclear power is expensive, and it doesn't really give you the benefit. It really produces very little energy, considering the amount of money that you must pump into the system. And that leaves us with two alternative sources of renewable energy, which are solar and wind. But then, both of them as well, the initial stages will be expensive. I mean, if you look at a standard three-kilowatt solar panel system in South Africa, it

can cost you anything, on average, between R45,000 and R70,000. Depending on how much energy you consume, you'll probably need more of these panels.

And when you look at wind, you know, the 3.5-kilowatt wind turbine in South Africa, last year, around this time, it was estimated to be more than R100,000. We must harness our solar and wind potential for a sustainable future. So in summary, reliability, sustainability and costs of these renewables are the biggest challenges.

Speaker 1: Okay. All right. So, what do you think, personally, is the right approach or strategy to ensure the success of this energy transition.

Speaker 2: You know, this is very difficult because I don't think anybody is actually ready to stop using coal completely. Even the so-called developed countries, if you look at their energy sources, they still use coal where they have it, they didn't just leave their coal resources and reserves and switch to other. So, and the reason for that is because of it's available, it's still a relatively low-cost form of energy production compared to other resources. So, in our case in South Africa, we still have plenty of coal resources and reserves, and I think we must take our time depleting them while conducting research to minimise the effects of coal on the environment. A gradual approach will help us manage economic impacts, that's my take. If we rush into this, we could end up with worse energy shortages than we currently experience with load shedding. We need a step-by-step approach, supported by solid policies. So the fact that by 2050 there needs to be a net zero carbon emission, is an unfair mandate because if you look at the countries that have put this instruction, if I may call it that, forward, it's the so-called developed countries, and they did it because they don't have any other way. They've depleted their coal resources and reserves. How long did it take them to do that? Almost 200 years. So, it's very unfair to us that suddenly we must leave coal in our backyards and look for other things, and because they are always ahead of us with destruction of the environment, they will be the ones producing these new energy sources. They'll be the ones providing the services. So, they will forever benefit from us. So, I don't think we should listen to them. I don't think we should be rushed into that, because, I mean, for all these years they've been controlling our mineral resources. Africa is well endowed with all these natural resources, but we have never seen the benefits. Even now, when they are depleted,

we still have to rely on the Western countries for that. I don't think that is fair. So, I don't think we should be rushed. We must completely deplete our coal resources and reserves. The only thing we can do is to look at ways to minimise carbon emissions or pollution to the environment. But I don't think we must just leave the coal and try to move on to other ways of energy production. That doesn't make sense to me.

And just to add on that, even if you look at carbon emissions to the environment, the last time I checked, I don't know if the stats have been updated, but Africa as a continent had only contributed 4% of what is out there, and most of it was actually from South Africa. The rest of Africa hasn't really caused much damage. They haven't contributed much to the contamination of the atmosphere and the damage of the ozone or air pollution. So, we cannot be punished by other people for their own mistakes. It's not fair.

Speaker 1: So, what does it mean for us, the people who are in the fossil fuel industry, people who are employed by these coal-fired power stations?

Speaker 2: I'm not sure what it means, but the obvious thing is, if it continues, I mean, if you look at the mines, the mines are labour intensive and they employ a broad spectrum of skills from unskilled to highly skilled people. So, if you transition to these new renewable energy sources, it means, for example, you must get rid of these workers because you will need very few people. I mean, you know, for example, even in the mines where the systems are mainly reliant on technology, you don't need a lot of people. You have like a control room looking at the whole process. So, obviously, if you look at the same concept, if you transition to automated systems or renewable energy systems, you will have to get rid of the people that are currently doing that kind of work. I don't believe it will be, you know, beneficial to the people in general. So, I don't know, but I don't see it happening anytime soon. I'm not, at least in the next decade or two, I don't see much happening. It will just be for some time.

Speaker 1: As a country, do you think we are ready for this transition? What is the current energy status of South Africa?

Speaker 2: No, we are not. And I'll tell you why. The problem lies with our politicians. And if you ask me, what we are going through now is some form of regression. Eskom's struggles reflect our overdependence on coal. The current infrastructure for power generation is in a worse condition than in the past two, three decades. And it is because we have not been taking the energy sector very seriously as a country. You know, all the scandals that have been associated. So, they see it as a meal ticket. So, they've been failing.

Look, in the previous government, very few people had access to electricity. And this new government, because it's claimed to be the government for all the people of South Africa, they made a promise that they will supply electricity to everybody. But now, if you want to do that, you cannot rely on the same sources. It means you must increase your capacity. But then they fail to do that. So, how do you then put strain on a pre-existing system? You don't even maintain it. So, we have actually regressed over the years. So, I don't know whether, I mean, there have been some conspiracy theories around that, but I won't tap into them. But there have been conspiracy theories that it was done deliberately so that there will be proof that Eskom is incapable and then it will be privatized. So, but that's maybe a conversation for another day or something to look into when you have time. But there's proof that nothing has been done let alone upgrade, but just to maintain the system that was already in place. We failed to do that. We have regressed. So, I don't think we are ready at all. We are far from that. We've had our infrastructure being vandalized. I've never heard of that in my whole life where railway lines will be stolen. And with this power load shedding stories, we are now making the situation worse because there are schedules in place. I've had many stories in many different places in South Africa where during that time of load shedding, that's when the cables are stolen. So, now when power is back, now we must go back to replacing these cables. You see, so it's not really helping. So, I don't think we are ready at all. We are far from it. Yeah. That's my view.

Speaker 1: How do you think socio-economic issues in the coal mining industry can be addressed post-transition, especially for older, less-educated workers?

Speaker 2: I think one solution could be providing early retirement packages or financial support for older workers who may not be able to retrain. For younger

workers, skills development and retraining are key. Retraining coal workers is essential to avoid social unrest. There should be programs focused on preparing them for jobs in renewables or other sectors. Partnerships with educational institutions could be useful here as well. We need a solid policy framework from the government that outlines clear goals, timelines, and support systems for affected workers. Investment in education and training programs for coal workers is essential, as well as financial incentives for renewable energy development.

Speaker 1: My next question is, do you know of any clean technology implementations that are underway, maybe, that are going on currently to reduce the emissions?

Speaker 2: Well, I've heard that in terms of clean coal technology, which is still using coal for power generation, but in a more environmentally friendly and hopefully economically viable ways. It includes processes that can be, I mean, there are two basic approaches or processes when it comes to this clean technology. One of them is combustion related and the other is gasification. And apparently, Eskom has some research program looking into these options. But I won't go into the details of that because I'm sure you will be able to conduct more research, but that's what I've heard. So, that should buy us time. But the question is, at what rate are we actually pursuing this? Are we slow? Are we going at the right pace? Because, you know, we have the tendency to delay, you know, look at the power stations. Let's take Medupi, for example. How long, you know, it came out late, much later than the time that was anticipated. So, I don't know with this research that has been conducted, whether it will give us the benefits sooner or later than expected. But knowing our country, it will probably be a talk for the next 10 years or so before this whole program gives us any benefits. Yeah, but that's the only thing I've heard. I don't know if there are others, but in terms of Eskom, that's what they are looking into, which makes sense because we have coal, we have ways to minimize the effect of carbon emission into the atmosphere.

Speaker 1: Okay. So, this next question is going to be a bit controversial. From your opinion, are there unspoken private or rather implicit reasoning behind it?

Speaker 2: You will tell me when I give you the answer, whether the answer is relevant to your question or not, but in terms of what is explicit, as I explained in your first question. Yeah, the reasons behind it, the real reasons. The one that you read about on the internet. We need to be environmentally friendly and all that. But at the same time, I think it comes back to the West or the so-called developed countries trying to exploit us as a continent, they know Africa, because if you look at the agenda that is driven, they say we must, you know, the concept of just, can we just remove this just, because there's nothing just about this energy. Yeah, let's just talk about energy transition, because when you say it's just, they really have to justify what is meant by that, because I don't see any justice in this transition. When we talk about this energy transition that has been pushed by the West, you look at what is brought in place. They are ahead because they had no alternatives. Out of resources, they must find the alternatives, which is what they have done. They come and sell that concept to us. And then when they sell it, we must pay for it. And when we're supposed to pay for it, we don't have money. What do they say? We can give you money. We can borrow. So that has been the story of Africa for all these years. Why do we borrow money from the West when we have everything? I mean, Africa is self-sufficient. So I think they're just pushing the agenda of keeping us indebted to them. You look at what happened. The president of South Africa borrowed money from the West. I don't know why we are a member of the G8 or the G20. We are not there. It's like a teenager being a member of a group consisting of the elderly citizens. These people have lived through their youth. They have done everything in life. And you come as a teenager and you join them, and yet you haven't lived your life fully. So what are you going to do? You'll obviously agree with what they say. So I feel like we have not had the opportunity as a continent and as a country to go through the stages that the West have gone through. And they are denying us that opportunity by making us jump the stages to where they are. So we always try to catch up with them. That is unacceptable. We don't have to depend on them. They actually depend on us. That's why they are coming with all these things so that we are always owing them. And then they can always tell us what to do because we owe them. Because you remember when you owe someone, they have to come over you. If you don't owe them, there's nothing they can do about it. So in my view, I think the hidden agenda is that they want to keep us indebted to them. And then one day they will come and tell us more what to do. And we will forever be indebted. Look, we may say there is no more colonialism. Yes, to some degree. But if

you look at how we do things, we are still controlled by them. The West is still controlling Africa in particular. So I think that is the issue here, because that money that was lent to South Africa, for example, what is it going to do? How do you loan money when you don't have a plan yet? That's where they will be looting the money. When the time comes, when there's an agenda to be followed, the money will not be there. Then we'll go and borrow more money. So it was premature. This was done prematurely.

Speaker 1: What policies and governance approaches do you think could ensure justice in the transition, particularly in the coal industry?

Speaker 2: The government needs to create policies that provide security for coal workers. This could be in the form of retraining grants, job placement programs, or financial assistance. There should also be strict monitoring of how companies implement these policies to make sure they're actually benefiting affected communities. Transparency and accountability are key here.

Speaker 1: where do you see South Africa in 20 years concerning renewable energy?

Speaker 2: Ideally, we'll have a much more balanced energy mix with a strong reliance on renewables. Solar and wind will hopefully make up a significant portion of our power generation. But that will require ongoing investment and a real commitment to building up our renewable infrastructure over the next couple of decades.

Speaker 1: Is there anything else you think we should discuss or any final points you'd like to add on this topic?

Speaker 2: Just that, for this transition to truly work, people need to feel involved and supported. It shouldn't feel like a burden but rather an opportunity for growth. The government, companies, and communities all need to work together to make this a success.

Interview Transcription - Participant 13_Renewable Energy Industry (Seriti Green)

Speaker 1: I'm doing my research as a partial completion of the master's, right? I'm doing it with the University of Witwatersrand, supervised by Prof Gordon Smith. The title of my research is a Just Energy Transition, Looking at challenges and opportunities in the South African coal mining industry. So the plan is to interview people in the mining industry, different mines. I've got people from Seriti that I've already spoken to Thungela a gentleman from Glencor that I spoke to this morning and a guy from Eskom and I'm still yet to actually have these conversations with someone from the DMRE so I have that mix of opinion and just to check how people are taking this and what's their perception around it. We're going to start with the interview what happens is that I won't be disclosing your name or the company you work for okay I'll just generally be asking about your occupation. You're a black female right? What's your occupation?

Speaker 2: I am an Energy Specialist

Speaker 1: How long have you been in the mining industry?

Speaker 2: About 12 years now (1.5 years at Seriti Green)

Speaker 1: Okay cool I think we can just jump straight to it this is more of a conversation really than anything formal so you must feel free to express your knowledge in the topic. What's your understanding around the just energy transition when people talk about it, high level.

Speaker 2: To me, a just energy transition is about moving toward renewable energy in a way that is fair to everyone, especially the workers and communities currently reliant on coal. It means making sure that people who may lose their jobs in coal mining have options and support in finding new work, and that no one is left behind as we move forward with renewables.

Speaker 1: So, tell me, what do you think are the benefits or opportunities of transitioning to renewable energy?

Speaker 2: Obviously, we read about it. We need to decarbonize. We need to reduce the carbon emissions. Working and living in the Mpumalanga region, we are surrounded by mines and power stations. We need cleaner air and a reduction in environmental negative impacts. Using renewables like solar and wind means cleaner air and less pollution, which benefits people's health. Economically, renewables could create new industries and jobs in South Africa, and we could attract foreign investment if we lead in renewables in Africa. I think renewables also have the potential to reduce our reliance on imported fuel, which helps our economy. Renewables could stabilize our energy prices in the long run. Seriti Green is already working on solar and wind projects, and they are setting a strong example for what can be achieved in this space.

Speaker 1: What are the challenges of transitioning to renewable energy?

Speaker 2: The negative impact is obviously there as there are a lot of people that are dependent on the coal power stations and the mines for survival. Mining contributes quite a big chunk of our GDP. And obviously the people who are employed by this sector will be negatively impacted. So now it's a thing of a give and take. The transition must prioritize the needs of vulnerable communities. So the plan says we're going to start reskilling and training but I do not think a lot of displacement will happen. People will lose their jobs. I do think people who are higher ups in the ranks will obviously probably be lucky because you have an engineering qualification. You'll probably be able to adapt, you know, whether you work at a coal mine or now you work at a solar plant you know it's almost similar but for people at the ground for your operators it's going to be quite a challenge.

Another challenge, coal is reliable, but renewables need more infrastructure, like battery storage, to be just as dependable. This transition requires a lot of funding, and there's always a question of where that money will come from.

Speaker 1: According to you, do you think there's a right approach or strategy to ensure the success of this energy transition?

Speaker 2: It's quite difficult. I mean, I don't think anybody has the right answers.

I certainly don't. And I think because a lot of the examples that we see from other countries are mostly developed countries. South Africa is one of those few countries that are developing and emerging on this transition so I don't think we fully and have the right references. I think my only grievance with this transition is the rate in which it needs to happen. For a target of 2050, I do think we are being a bit difficult or hard on ourselves. Also, I think we need more public participation, I don't think there's a lot of buy-in from South Africa as well you know which is obviously a bad thing because how are you embarking on a transition that will impact people's lives without even including them. So maybe if the government could have that inclusive approach and be lenient on the targets to say let's not press it too much to say 2050 we need net-zero carbon emissions because we are not a first world country. I'd say we need a balanced approach. A gradual transition is the best way forward. If we rush, it could lead to job losses and energy shortages. We should continue using coal for some time while we gradually introduce renewables and build up the necessary infrastructure. It's essential that this shift is planned, and that we provide support for coal workers in the form of training and new job opportunities.

Speaker 1: In your view, what does a just energy transition mean for people in the coal industry?

Speaker 2: For people in the coal industry, a just energy transition should mean they're abandoned. A lot of people in this sector have worked in coal their whole lives, and for many, it's the only skill they have. A just transition should provide options for these workers—whether it's training, jobs in renewables, or other types of support to help them and their families adjust. It should also consider the social impact on whole communities that are dependent on coal.

Speaker 1: Do you think South Africa is ready for this transition?

Speaker 2: To be honest, I don't think we're fully ready yet. We have started taking steps, but our infrastructure and policies need more development. There's also a lack of awareness about what this transition means for people on the ground. The government needs to take a stronger lead and bring more clarity to this process so everyone understands what's happening and what's needed.

Speaker 1: Where are we as a country in terms of our energy status?

Speaker 2: There is an enormous potential of solar energy in places like Mpumalanga and a lot of wind in places like Eastern and Western Cape. However, the question remains to say is it enough to close the energy gap, I doubt. Hence, I always advocate for an energy mix to at least balance the demand while we gradually perfect the energy transition idea. As it is, with the fossil-fuel, there is a gap. I anticipate the gap to widen should we transition without a proper plan. Renewable are limited and onboarding of them require massive capital considering the infrastructure requirement. Government should incentivize the development of local renewable resources. If we can create renewable energy projects that are community-owned, we could make sure coal regions benefit from the transition to. That's my take.

Speaker 1: How should we address socio-economic issues in the coal mining industry post-transition, particularly for older or less-educated workers?

Speaker 2: That's a big issue. For older workers, maybe offering early retirement options or financial assistance would help. For those who can't easily transition to a new job, we should provide skills training or even help them start businesses. The government and private sector could work together on this, offering programs specifically tailored to these workers so they don't fall through the cracks.

Speaker 1: Next question. Have you heard of any implementations that are underway to try clean coal energy implementation

Speaker 2: My previous mine wants to build a solar plant, a big solar plant and they aim to be using energy that they get from this solar plant to mine coal and for the rest that they produce to be sent back into the energy grid so I mean that's one example and I know. Other mines like Anglo Platinum are also looking at a hydrogen run machinery as well, you know, to reduce its reduction on diesel and electricity consumption. My current employer which I won't mention is a renewable energy entity that is busy developing, constructing, and operating large-scale renewable energy projects within South Africa and across the African continent. We are in a journey to unlock and harness this immense renewable energy potential for future generation to come. Also ESG, another fancy term that has come into the mix to help us manage our CO2 emissions, our electricity consumption, diesel consumption in order for us to have a reduced impact on the environment is coming with a lot of initiatives. Also I know Eskom has explored some clean coal technologies, like carbon capture, but I haven't seen much progress on that front. With Eskom facing so many issues, I think their focus has been on keeping the grid stable rather than developing cleaner coal. Right now, there's a lot more focus on moving towards renewables instead.

Speaker 1: The next question I'll be asking it's more of just a personal opinion than anything. Do you think there's unspoken or private reasoning behind this energy transition?

Speaker 2: Personally I think we're being bullied by the developed nations, I mean they were able to build their economy using carbon and coal for a very long time you know and then when we start wanting to climb onto the wagon. We are then told we need to stop mining coal almost immediately. Secondly because we do not have enough capital unfortunately, we find ourselves in a situation where we are bullied because I mean if you do not have enough money to say something then you unfortunately you have to follow what the rest of the world is doing. I mean just even looking at electrical vehicles and the fact that South Africa wants to have about a million of those on the road by the year 2030. It's also a pressure because, we are global exporter of cars.

And if the rest of the world stop making internal combustion vehicles, unfortunately, we're going to be left behind. So we are also now bullied to start making electrical vehicles. And then on a more South Africa, bringing it local, I do think probably politics play a part as well even looking at the state of Eskom at the moment. All the power plants just dying and failing I know that most of them are old generally but I do think there's probably some interference from higher powers to open up opportunities to independent power producers. So you'll find that the big owners of these independent power producers of renewables have more to gain from this transition hence it is being pushed like this. And I think it's probably not just about the just transition, but also who gets the benefits from providing us renewable energy. Yeah, tough times. It's all about the money in the bank.

Speaker 1: What policy and governance approaches could ensure justice during this transition?

Speaker 2: Policies that prioritize retraining programs and support for displaced workers would make a big difference. The government should also have policies in place that encourage companies to reinvest in coal-dependent communities. Transparency and accountability are important here too—people need to see that these policies are working and benefiting everyone, not just a select few.

Speaker 1: Where do you think you see us as South Africans in 20 years?

Speaker 2: I'd hope that by then, at least half of our energy would be coming from renewables. With the potential we have for solar and wind, I think South Africa could be a leader in renewable energy for the continent. We'd hopefully have developed better infrastructure and grid stability, so our energy supply is consistent, even with renewables as a primary source.

Speaker 1: So, looking at my research, is there maybe anything you would like to add?

Speaker 2: I'd just emphasize that for this transition to be truly "just," the human element has to be central. Too often, we talk about these big energy goals but forget about the individual workers and families who will feel the impact most. If we make this about people as much as it's about the planet, I think we'll have a better chance of succeeding.

Speaker 1: Yeah, I totally agree. Thank you so much for your time, I do appreciate it.

Speaker 2: Thank you and all the best.

Interview Transcription - Participant 15_Community Member (Pensioner)

Speaker 1: I am doing this research as partial completion of my master's degree with the University of the Witwatersrand, supervised by Gordon Smith. The title of my research is Just Energy Transition, looking at the challenges and the opportunities in the South African coal mining industry at large. I will not be disclosing your personal details. All the questions that I will be asking will be linked to the research question. And we'll just be having a conversation about this, so you can relax and share what you know?

Speaker 2: Okay

Speaker 1: Gender and race.

Speaker 2: Male, African.

Speaker 1: Occupation

Speaker 2: I am pensioner, worked at the mines for 22 years as a Shift boss.

Speaker 1: So what do you know about a Just Energy Transition?

Speaker 2: Not much I hear people talk about the need to move from coal and to renewable energy sources for the sake of the cleanliness of the environment.

Speaker 1: And what do you think are the potential benefits of transitioning to renewable energy?

Speaker 2: A clean, non-polluted environment help reduce pollution which is something that needs urgent attention. I cannot think of anything else.

Speaker 1: What challenges do you think we might face during this just energy transition process?

Speaker 2: The biggest challenge is what happens to workers in the coal industry, especially those in small towns where mining is the main source of jobs. What happens to the local clinics, schools and the municipality that is funded by those mines to keep the towns alive? Yes, I won't be affected as I am already on pension, but what happens to my kids who are currently employed by these mines? What happens to the small scale local businesses that supply services to these mines? We will end up with a dead town for the sake of saving the environment. Will the clean environment feed our families? I doubt. The transition must be inclusive and equitable.

Speaker 1: In your opinion, what is the best approach to take when transitioning from coal to renewable energy?

Speaker 2: I struggle to see or think of anything that will better this transition. Unless of course there are ways to minimise the environmental effects of mining and burning coal instead of completely shutting down mines and power-stations. We can't afford to just drop coal. We need a balance between old and new sources. We have to make sure that communities that rely on coal are still sustained.

Speaker 1: What does a just energy transition mean for South Africa, especially for people in coal mining or coal-fired power stations?

Speaker 2: For coal workers, it's a big, life-changing process. It means that their jobs are at risk, so it's essential that this transition includes programs to help them find new work. If it's done right, it could be an opportunity for workers to gain new skills and secure employment in emerging industries.

But for now, I have not seen or heard anything to try and consider the affected communities. For now, the transition means poverty for some of us.

Speaker 1: Do you think South Africa is ready for this transition?

Speaker 2: Not yet. There's also a lack of communication, clear policies and commitment from the government. We've seen some renewable projects start, but we do not even know it is the target market. Will those projects reduce the unemployment rate or at least match the current employment? We do not know.

Speaker 1: What do you think is required to ensure a successful energy transition in South Africa?

Speaker 2: First, we need strong government leadership. Policies should be in place to guide the transition, with clear goals and timelines. We need stakeholder involvement to understand the plans and way forward for a buy-in. Collaboration between sectors will be key to our success. Then we need investments in skills development for coal workers so they can transition into new roles.

Speaker 1: How do you think socio-economic issues in the coal mining industry can be addressed after the transition, especially for older, less-educated workers?

Speaker 2: This is crucial. For older workers, early retirement plans with financial support would help ease the transition. For others, it's essential to set up training programs that teach practical skills in other areas, like renewables or even unrelated fields like construction or agriculture. They need opportunities they can realistically step into.

Speaker 1: Are you aware of any clean coal technologies currently being implemented by Eskom?

Speaker 2: I am not sure my child, I would be lying to you.

Speaker 1: In your view, what are the explicit and implicit reasons behind pursuing a just energy transition in South Africa?

Speaker 2: Explicitly, it's about reducing emissions and aligning with global climate commitments. There's pressure to cut down on coal to meet international standards. There is nothing private about that.

Speaker 1: What policy and governance approaches do you think could ensure justice in the transition, especially in the coal industry?

Speaker 2: Policies should include financial support for affected workers, like grants for retraining or start-up funds for small businesses. Governance should be transparent, with regular updates to the public on progress. An independent body to monitor the transition could help make sure everyone is held accountable, especially companies involved in coal mining and renewable energy.

Speaker 1: Looking ahead, where do you think South Africa will be in 20 years in terms of renewable energy?

Speaker 2 I do not see any success in this renewable energy project alons. Coal is the cheapest source of energy and South Africa, and we are still struggling as country to keep the lights on. Maybe if we bring those renewables in conjunction with coal , we will at least keep up with the energy demands. Our energy crisis is a wake-up call to diversify. Maybe there something different will happen.

Speaker 1: Is there anything else you think we should discuss or any final points you'd like to add on this topic?

Speaker 2: I'd just add that communication is important. People need to understand why we're doing this and what's at stake if we don't. If the government and companies can be transparent and include communities in the process, it will help build trust and make the transition smoother for everyone.

Speaker 1: I hear you. Well noted and thank you for your time.

Speaker 2: Thank you and all the best

