The Impact of the Just Energy Transition on Job Creation in South Africa: A Case of the Wind Energy Sector

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ABSTRACT

South Africa's ratification of the Paris Agreement, an international accord established during the Conference of the Parties (COP21) in December 2015, underscores its dedication to confronting climate change and enacting measures to counteract human-induced global warming. Aligned with numerous other nations, South Africa is actively promoting a just energy transition that prioritises the Sustainable Development Goals (SDGs) established by the United Nations General Assembly on September 25, 2015. This transition entails a shift from reliance on carbon-intensive fuels like coal towards renewable energy sources.

Given South Africa's substantial coal reserves—ranking sixth globally coal mining and processing has historically played a central role in the nation's energy sector, industrialisation, and economy, contributing significantly to its GDP and providing employment for up to 150,000 individuals throughout the coal value chain. However, the imperative for an energy transition to mitigate climate change and fulfil the country's National Determined Contributions necessitates structural changes that will inevitably impact socio-economic dynamics. Notably, disruptions in the coal value chain will have profound repercussions on both direct and indirect employment and the communities and local economies reliant on the coal industry.

The Integrated Resource Plan (IRP) 2010-2030 outlines South Africa's energy trajectory of increasing renewable energy sources into the energy mix. This study focused on wind energy deployment, with a targeted capacity of 17,742 MW by 2030. It aims to identify critical considerations essential for facilitating a just energy transition that maximises job creation in South Africa. Applying a qualitative research methodology, semi-structured interviews were conducted to gather data, utilising a deductive approach based on predetermined themes derived from existing literature on factors influencing job creation.

Findings underscore the importance of addressing policy implementation gaps related to the socio-economic impact of the transition, establishing clear directives for skills development in the low-carbon economy, and prioritising local manufacturing and assembly of turbine components. Moreover, the study highlights wind energy deployment as a catalyst for fostering the development of a low-carbon ecosystem while advocating for exploring broader low-carbon value chains such as green hydrogen to enable new industries and employment opportunities. Finally, the study underscores the need for focused attention and investment in research and development of clean coal technologies, offering a potential avenue for sustainable coal utilisation devoid of adverse greenhouse gas emissions and environmental impacts.

Keywords: socio-economic impact, job creation, renewable energy, wind energy, just energy transition, climate change, value chain, manufacturing, policy, skills development

DECLARATION

I, Nomvula Zondi, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the Master of Science (Interdisciplinary Global Change Studies) degree at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Name: Nomvula Beryl Zondi Signature: NBZondi...

Signed at Boksburg

On the 12th October 2024

DEDICATION

This paper is dedicated to all those committed to the Just Energy Transition in South Africa and working on multiple pathways to ensure the transition is truly just and leaves no one behind.

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LIST OF ACRONYMS AND ABBREVIATIONS

CAPEX	Capital Expenditure
CCUS	Carbon Capture Utilisation and Storage
CSIR	Council of Science and Industrial Research
CSP	Concentrated Solar Power
CTL	Coal To Liquids
DMRE	Department of Mineral Resources & Energy
EPC	Engineering Procurement Construction
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IEA	International Energy Agency
IP	Intellectual Property
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
IRP	Integrated Resource Plan
LCA	Life Cycle Assessment
LCOE	Levelised Cost of Electricity
MEC	Minerals-Energy Complex
MW	Megawatts
NDP	National Development Plan
NERSA	National Energy Regulator of South Africa
OEM	Original Equipment Manufacturer
OPEX	Operational Expenditure
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
REFIT	Renewable Energy Feed-In Tariff
REIPPPP (or RIE4P)	Renewable Energy Independent Power Producer Procurement Programme
REN21	Renewable Energy Policy Network for the 21st Century
SANEDI	South African National Energy Development Institute
SAREM	South African Renewable Energy Masterplan
SAWEA	South African Wind Energy Association
SAWEP	South Africa Wind Energy Programme

SDGs	Sustainable Development Goals
SEZ	Special Economic Zone
Stats SA	Statistics South Africa
UN	United Nations
UNFCCC	United Nations Framework on Climate Change
WASA	Wind Atlas for South Africa

CHAPTER 1. INTRODUCTION

1.1. Introduction to the study

The introductory chapter outlines the research study's purpose and objectives, establishing the foundation by clearly articulating the research problem and questions the study aims to address. The study's significance is highlighted while also delineating its limitations. At the end of the chapter, explicit definitions of the pivotal terms and concepts central to the research aim and objectives and the assumptions applied.

1.2. Purpose of the study

South Africa holds an impressive suite of climate-related policies, including mechanisms for the decarbonisation of the economy with consideration for social and economic opportunities (Bohlmann et al., 2023). The accelerated deployment of renewable energy sources is essential for South Africa to shift from fossil fuels to low-carbon, environmentally friendly and sustainable energy sources. However, besides environmental sustainability challenges such as global warming and the collapse of ecosystems, South Africa is experiencing energy security and socio-economic challenges (Department of Environmental Affairs, 2012, 2018; National Research Council, 2012). The inclusion of renewables to the energy mix, as indicated in the 2019 Integrated Resource Plan (IRP) targets, is essential to mitigate against greenhouse gas emissions that arise from the processing of coal and improve energy security through a diversified energy mix (Department of Mineral Resources and Energy, 2019; Patel et al., 2020).

The dependence of the energy sector in South Africa on coal mining and processing is a meaningful conversation as the country considers decarbonisation plans to be a reliance on carbon-intensive sources such as coal, which continues unabated. The South African national government’s intended shutdown of coal-fired power generation has severe implications for the coal value chain, subsidiary sectoral growth dependent on the coal value chain, and communities in coal mining areas (Hermanus, 2022). The United Nations (UN) commitment through the Sustainable Development Goals (SDGs) to leave nobody behind gives impetus to a just transition of energy to renewable and cleaner energy that will not leave anybody behind (United Nations, 2015).

For South Africa, which is challenged by poverty, unemployment, and inequality (Pillay & Stiftung, 2000), there is a need to examine the impact of the transition from fossil fuels to more renewables on communities and the workforce (Bohlmann et al., 2023; Pillay & Stiftung, 2000; PWC, 2021). This qualitative research study identifies factors that must be considered to expedite wind energy deployment to enable maximum job creation, facilitating the Just Energy Transition in South Africa.

1.3. Context of the study

South Africa is amongst the top ten countries with the largest coal reserves (BP, 2021). At the end of 2020, South Africa had 9 893 million tons of coal, which amounts to a 0.9% share of the world's total coal reserve and a reserve-production rate of 40 (BP, 2021). Electricity in South Africa is primarily generated from coal, a fossil fuel resource available in abundance in the country. The state-owned power utility company Eskom generates, transmits, and supplies up to 90% of the national electricity demand (Eskom, 2020). Eskom generates up to 90% of its electricity primarily from coal-fired stations (Eskom, 2021b). The remaining power is generated from other energy sources such as Nuclear, Open Cycle Gas Turbines (OCGTs), hydro stations, pumped storage stations, and additional supply by independent power producers (IPPs) in the form of wind and solar photovoltaic (PV) power (Eskom, 2021b).

Energy availability, reliability and affordability are essential enablers and driving forces for any country's economic and industrial development. Nonetheless, the prominence of South Africa's energy sector is tempered by its status as the foremost source of national greenhouse gas (GHG) emissions. Emissions from electricity generation alone amount to 87% of the energy industry emissions in South Africa (Department of Forestry, 2022). The processing and use of fossil fuels such as coal for energy production negatively impacts the environment. High concentrations of greenhouse gas emissions have been scientifically investigated and proven to be the reason behind the witnessed rise in global temperatures since the mid-20th century (Intergov (IPCC, 2014). Climate change is a worldwide challenge that adversely impacts critical resources such as water, natural ecosystems, food supply security, human well-being and settlements along the coast and exerts changes in the climate system, which could be irreversible (Intergovernmental Panel on Climate Change (IPCC), 2014).

In addition to the significant carbon-intensive energy sector, South Africa is particularly sensitive to the aforementioned negative consequences of climate change, which has an imbalanced impact on the poor, particularly women and children (Department of Environmental Affairs, 2012). The International Energy Agency (IEA) stipulates that the negative environmental impacts attributed to the processing of fossil fuels to generate energy have given rise to a global mitigation measure to shift towards renewable energy sources (IPCC, 2014; World Energy Council, 2021). Renewable energy resources are harnessed from naturally abundant, sustainable energy sources to produce heat, electricity, liquid or gaseous fuels, or a combination thereof (Jain & Jain, 2017a). They also have a low carbon footprint and provide an alternative sustainable energy source (Department of Minerals and Energy, 2003).

South Africa is part of the global community addressing climate change challenges and applying mitigation actions against human-induced global warming. South Africa and the international community are confronted with achieving a *Just Energy Transition* that leaves no one behind, as adopted by the United Nations General Assembly on 25 September 2015 (United Nations, 2015). Achieving a just energy transition is a challenge that globally requires governments to transition their energy sources from fossil fuels to cleaner energy sources while ensuring economies and societies are more equitable and sustainable - leaving nobody behind. However, the impact of a just energy transition goes beyond reducing greenhouse gas emissions to the socio-economic effects currently being felt in South Africa's ongoing energy crisis (Bohlmann et al., 2023).

The literature on Just Energy Transition provides diverse and broad meanings to the concept of transition, with two primary approaches being more identifiable. The first approach to the just energy transition focuses on social dialogue and equitable outcomes for trade union members (Schulte et al., 2022). The principles of distributive justice, equitable allocation of burdens and benefits, procedural justice and transparency serve as the foundation for this approach. These are outlined in the International Labour Organization's (ILO) Guidelines for a Just Transition Towards Environmentally Sustainable Economies and Societies for All (International Labour Organisation (ILO), 2015). In contrast, the second approach to the just energy transition focuses on eradicating inequality and including marginalised stakeholders globally and nationally in greening economies and societies (Schulte et al., 2022).

For this study, the latter approach to a just energy transition will be adopted because, for South Africa, transitioning from coal to cleaner energy sources cannot be pursued without considering the country's socioeconomic challenges to ensure a Just Energy Transition that leaves no one behind. At the backdrop of South Africa's unique challenges, South Africa's National Development Plan (NDP) 2030 (South Africa National Planning Commission, 2012) details the country's vision and long-term plan for addressing challenges such as inequality, unemployment, poverty and access to reliable, efficient and environmentally sustainable energy at competitive rates.

One of the objectives of the NDP on climate change mitigation is that at least 20 000MW of renewable energy sources, such as wind and solar, should be incorporated into the energy mix by 2030 (National Planning Commission, 2011). In line with the 2030 National

Development Plan vision, the DMRE embarked on a journey to develop the Integrated Resource Plan 2010-2030 (IRP). The primary objective of the IRP (2010-2030) is to direct the expansion of electricity supply over a given period and to identify the required technological and financial investment that will allow the country to meet the forecasted demand at a minimum cost to the government (Department of Mineral Resources and Energy, 2019).

The promulgated IRP 2010-2030 does not only identify the power generation technology of choice to meet the country's projected demand growth up to 2030, but it also considers other South African government objectives such as (Department of Mineral Resources and Energy, 2019):

- affordable electricity, which considers the socio-economic challenges of the country and the need for energy equity improvement,
- reduced greenhouse gas emissions, which are primarily attributed to the energy industry,
- reduced water consumption due to water scarcity as a result of the possibility of recurring drought in the country (water-energy nexus),
- diversified electricity generation sources to improve reliability and environmental sustainability of electricity supply post the shutdown of coal power plants in the period beyond 2030-2050; and,
- localisation and regional development to address the country's socio-economic challenges.

The IRP outlines bold ambitions and targets to deploy 17 742 MW of wind energy into the energy mix by 2030. This will make wind energy 23% of the total energy mix in 2030, contributing more than other renewable energy sources such as nuclear, hydro, storage, solar PV (photovoltaic), and CSP (concentrated solar power), as illustrated in Figure 1.1. The projected 2030 plan is such that from the wind energy base case of 1 980 MW, a committed capacity of 1 362 MW between 2019-2021 will be added, and between 2022-2030, an annual additional capacity of 1 600 MW is planned (Department of Mineral Resources and Energy, 2019).

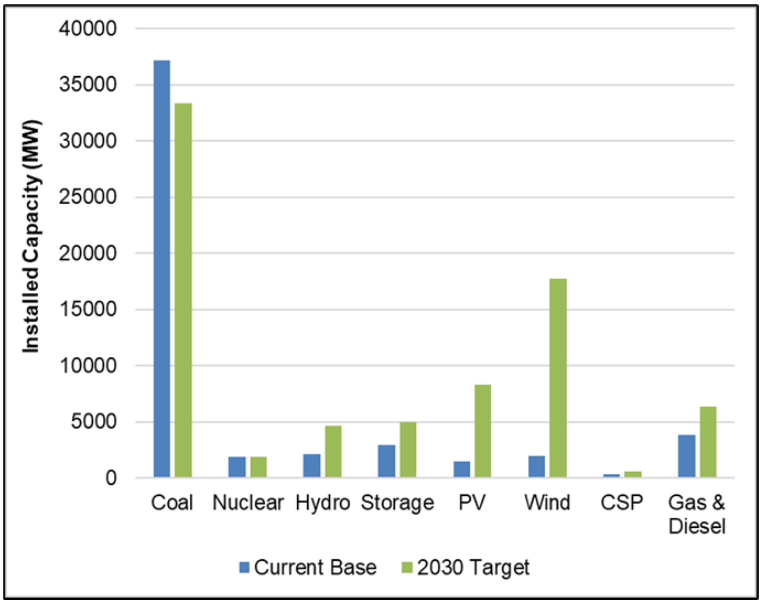

Figure 1. 1: IRP 2019 energy mix 2030 target

Source: author's illustration based on Department of Mineral Resources and Energy. (2019). *Integrated Resource Plan 2019*. Available online: http://www.energy.gov.za/IRP/2019/IRP-2019.pdf [accessed June 2023]

This study will focus on wind energy deployment and not the other forms of renewable energy outlined in Figure 1.1. Wind energy is the highest contributor to the 2030 energy mix. The wind energy value chain has multiple components which offer job creation opportunities along the manufacturing value chain (Department of Mineral Resources and Energy, 2022; Rivett-Carnac, 2022)

Several capacity development initiatives have taken place since the promulgation of the IRP 2010-2030. This research project will identify factors that must be considered to expedite wind energy deployment to enable maximum job creation, facilitating the Just Energy Transition in South Africa.

1.4. Research problem

As South Africa commits to transitioning from coal as the primary energy source and diversifying the energy mix by including renewables such as solar, wind and hydropower to attain energy security and environmental suitability as stipulated in the IRP, there are some employment impacts that the transition presents to the coal value chain workforce and associated communities (Montmasson-Clair, 2021). Except for some impressive work on workers' rights in the just energy transition (Schulte et al., 2022; Willis, 2021), there is limited clarity about the employment effect of the shift away from coal. How jobs will be created or have been created and how capabilities are sustainably developed on wind energy in terms of South Africa’s national development plan is unclear.

This study considers the progressive decommissioning of the predetermined coal plants as they reach their end of life and the extent to which this will result in the displacement of jobs and communities that have been historically established based on coal mining and processing (Patel et al., 2020). Coal mining and processing play a significant role in South Africa's economy because of the vast number of people the sector employs and its contribution to the country’s GDP (Hanto et al., 2022).

The coal mining sector contributes 2.3% towards the country’s GDP, with coal exports to other international countries accounting for 40-45% of the income (Hanto et al., 2022). The industry plays a significant role in coal supply for power generation and export markets. It is also essential for local industries such as coal-to-liquids (CTL), steel manufacturing and cement. The coal-to-liquids (CTL) industry, which Sasol operates, also employs many people in the Sasol Secunda, Mpumalanga operations facility. The energy transition away from coal creates some unprecedented challenges for South Africa, a developing country with a high unemployment rate of 40% in 2022 and economic inequality of 0.63, as represented by a Gini-Coefficient (Hanto et al., 2022). These include the likelihood of job losses and the loss of a crucial coal mining industry.

The coal value chain in South Africa is well established. It is linked to other associated industries, such as coal transportation, petrochemical production, steelmaking, and cement manufacturing plants, and it has an ecosystem that extends to small businesses in coal-rich areas. In contrast, policy around renewable energy adoption is still in the formative stages. It lacks clarity regarding their effectiveness in addressing the socio-economic effects of the impacted workforce and communities.

For the energy transition and the country’s decarbonisation journey to be just and sustainable, it needs to cater to the socio-economic needs of the citizens. South Africa has witnessed job losses due to decarbonisation in some regions (Hanto et al., 2022). The research aims to identify enabling factors critical in expediting wind energy deployment in a manner that enables maximum job creation and aids a Just Energy Transition in a country already grappling with poverty, unemployment, and inequality.

1.5. Research questions

Since a just energy transition calls on governments and all national stakeholders to ensure that the transition leaves nobody behind, this study aims to identify factors that must be considered to expedite wind energy deployment to enable maximum job creation in South

Africa. To address the requisite study aim, the study will address the following research questions, which will guide the research approach adopted:

RQ1 - What are the employment effects of South Africa's transition from coal to wind energy for electricity generation?

RQ2 - What are the factors that must be considered to promote an employment-led just energy transition?

RQ3 - What are the job creation opportunities that can be explored along the wind energy sector value chain?

RQ4 - What recommendations can be made on how to pursue an employment-led just energy transition without leaving anybody behind?

1.6. Significance of the study

While South Africa's energy sector, industrialisation and economy are still highly dependent on coal, the energy transition is irrevocably underway and necessary. The significance of this study is to determine whether South Africa is poised to implement an employment-led just energy transition as the country finds itself in a challenging position of needing to decarbonise its energy generation through a shift from fossil fuel energy sources to incorporating renewables in the energy mix.

The impetus to transition the energy source comes when South Africa faces worrying energy security challenges and escalating unemployment, which begs the question of how a just energy transition to renewable energy sources such as wind will alleviate unemployment, create jobs, and leave nobody behind.

The energy transition from coal to renewables creates some unprecedented challenges for South Africa, with an unemployment rate of 40% in 2022 and economic inequality of 0.63, as represented by a Gini-Coefficient (Hanto et al., 2022). Direct jobs across the coal value chain equates to around 150 000 permanent employees, with 80 000 jobs in coal mining, 12 000 in Eskom's power generation plants, 26 000 in Sasol's coal to liquids facility, 6000 for ArcelorMittal South Africa steel making, 7000 for cement production, and 2000 for small coal trucks (Montmasson-Clair, 2021; Patel et al., 2020).

The impact on the displaced fossil fuels-related jobs needs to be understood, including factors to maximise job creation. While being far from exhaustive, this study's significance will lie in its ability to present a catalytic basis to start the necessary conversation on employment-led wind energy – how it will ensure a just energy transition in an already precarious socio-economic environment wherein policies and legislation, advocacy and political will exist, but remain untested in their ability to create jobs, uplift communities, and leave nobody behind.

Managing the transition's effects on workers and local economic growth is crucial, especially in areas dependent on coal and impacted communities. There is a policy vacuum when analysing the effects of the coal transition on employment in South Africa (Montmasson-Clair, 2021).

This study aims to enhance the understanding of how transitioning to wind energy in South Africa could maximise job creation within the framework of the Just Energy Transition. The findings of this research will provide valuable learning and observations for various stakeholders, including policymakers, governmental bodies, financiers, entrepreneurs who would like to explore opportunities within the wind value chain, job seekers and project developers involved in deploying wind energy initiatives in South Africa. Specifically, the research outcomes will offer policymakers an assessment of the efficacy of current policies in addressing the socio-economic imperatives of South Africa's transition toward a low-carbon economy. Governmental agencies advocating for the Just Energy Transition will gain insights into critical factors, identified gaps, and potential opportunities crucial for optimising job creation through wind energy deployment. Additionally, financiers and project developers will benefit from analysing the socio-economic impacts of past wind energy projects in the country and understanding critical success factors and existing areas for improvement, which can inform their investment strategies.

1.7. Delimitations of the study

The study delimitations refer to the boundaries, exclusions, and inclusions that the researcher intentionally establishes and acknowledges within their study to narrow the scope and focus of the research (Simon & Goes, 2013). Research delimitations refer to those parameters influencing research within the researcher's control. In defining the study aim and research questions, the following study delimitations were adopted:

a) ***Wind Energy:*** Notwithstanding the similar factors of other renewable energy sources on job creation in South Africa's Just Energy Transition, this study will focus only on the wind energy value chain given the already progressive steps that have been taken in harnessing wind energy as a viable clean energy alternative to fossil fuel and the extent of research it has commanded in setting up the necessary infrastructure for power generation. This study will focus on onshore wind energy, which is deployed on land to harness naturally occurring wind energy from wind turbines operating together in wind farms to generate electricity. Offshore wind turbines, on the contrary, generate electricity from locations with relatively stronger winds, such as deep sea or shallow waters (S. Wang et al., 2018). Wind (onshore) energy constitutes the highest renewable energy share of the Integrated

Resource Plan 2030 energy mix. As such, its deployment is assumed to contribute more towards job creation.

b) ***South Africa*****:** The global imperative of the energy transition applies universally, but this study will examine its effects on job creation, specifically within the South African context. The study was not confined to any particular province since, according to SANEDI's 2020 Wind Atlas for South Africa, the wind energy sector is prevalent in specific geographic areas of South Africa.

c) ***Dismantling and disposal:*** The scope of this research study excludes potential job opportunities in the dismantling and disposal phase of the wind energy value chain. It must be noted that to calculate life cycle GHG emissions, the process-based life cycle assessment (LCA), which follows the principle of ISO 14044, the process boundary includes dismantling and disposal (S. Wang et al., 2018). The fleet of wind farms is only a few years old, and potential jobs from dismantling and disposal will be excluded from the evaluation.

1.8. Definition of terms

To establish the conceptual framework developed for this study, vital conceptual definitions are presented below:

Job Creation

Job creation refers to the process of economic activities that result in increased job opportunities (V. Smith, 2013). It can be direct or indirect.

- Direct jobs are generally defined as jobs related to core activities of wind energy farm deployment from development, manufacturing and fabrication, site establishment, construction and installation, and ultimately, operation and maintenance (Cameron & Van Der Zwaan, 2015).
- Indirect jobs are associated with the supply and support of the sector at a secondary level through processes such as the extraction and processing of input materials, marketing, administration, regulatory agencies, consultancy firms and technology research institutions (Cameron & Van Der Zwaan, 2015).

Just Energy Transition

A Just Transition refers to considering the needs of the workforce, residents in coal-rich communities and citizens who will suffer the direct impact of the energy transition (Glynn &

Błachowicz, 2020) by applying justice to ensure that the transition goals and the states' developmental goals are attained without compromising one for the other (Swilling et al., 2022).

Wind Energy

Wind energy is harnessed from naturally occurring wind on land (onshore) or at sea (offshore) (Department of Mineral Resources and Energy, 2001). Onshore wind energy is deployed on land by harnessing naturally occurring wind energy from wind turbines operating together in wind farms to generate electricity. Offshore wind turbines, on the contrary, generate electricity from locations with relatively stronger winds, such as deep sea or shallow waters (S. Wang et al., 2018).

Renewable Energy Value Chain

A renewable energy value chain refers to the project development and implementation process from project planning, procurement of engineering services, the manufacturing phase, transportation, construction and installation of equipment and components, grid connection, operations and maintenance (Larsen & Hansen, 2022; Morris et al., 2022; Rivett-Carnac, 2022).

Wind Farm Balance of Plant (BoP)

Balance of Plant refers to logistics such as transportation, installation, civil works and electrical, which is the scope that excludes assembling the wind turbine components (Rivett-Carnac, 2022)

1.9. Assumptions

Assumptions represent the foundational beliefs or premises that the researcher establishes and considers plausible within the context of the study (Simon & Goes, 2013). In this research study, the assumptions made are as follows:

- The 18 participants were purposively selected as experts in their area of speciality within the energy sector.
- The study respondents clearly understood the questions they were asked during the interviews and answered honestly and truthfully.
- The energy transition from fossil fuels to renewable energy will have an employment impact on South Africa's labour market with distinct factors from other regions worldwide.
- A qualitative study would allow for a deeper understanding of the factors that must be

considered to expedite wind energy deployment to enable maximum job creation, facilitating the Just Energy Transition in South Africa.

1.10. Structure of the report

Chapter 1 introduces the research issue, including the study's goals and objectives, the problem statement, the research questions, the research methodology, its limits, ethical concerns, and its importance, which will be outlined in this chapter.

Chapter 2 gives details of the literature review of relevant theoretical concepts addressing the research questions. The concepts covered are South Africa’s Just Energy Transition, an overview of the legislative, policy, and regulatory framework governing the energy transition in South Africa, and the deployment of wind energy and its associated value chain. The chapter concludes with a conceptual framework and propositions that are a set of expectations on factors that affect job creation and highlight the knowledge gaps the study will address.

Chapter 3 outlines the study's research philosophy, approach, and design. It also details the study population, data collection methods, and analysis techniques. The chapter concludes with a declaration of the study's limitations and the applied ethical considerations.

Chapter 4 presents the findings of the qualitative data collected. The findings are presented and reported in alignment with the research questions. The themes that emerge from the data about the research questions are also presented. The chapter concludes by comparing key research findings with the literature review in Chapter 2.

Chapter 5 outlines the interpretation of the results in Chapter 4 and discusses how the research findings compare with previous studies and the literature review in Chapter 2. The discussion of findings is structured in alignment with the research questions.

Chapter 6 summarises the key insights and conclusions from the research findings and links how the research aim and questions were addressed. Relevant literature is also revisited to contextualise the study's conclusions. The empirical findings form the basis of the conclusions drawn and the study's contribution to a more significant body of knowledge on factors that must be considered to expedite wind energy deployment to enable maximum job creation, facilitating the Just Energy Transition in South Africa. Finally, recommendations are proposed for further research and action.

CHAPTER 2. LITERATURE REVIEW

2.1. Introduction

This literature review establishes a foundational conceptual basis and insights for accomplishing the study's aim. This is achieved by examining substantial advancements documented in South Africa’s energy transition and the resulting implications on job creation. Aligned with the research aim and questions, the ensuing sections provide in-depth insights into critical facets such as the employment effects of the energy transition in South Africa, the renewable energy deployment policy legislative framework, the intricate connections between the energy transition and job creation, and strategies for pursuing the wind energy deployment in a manner that enables maximum job creation facilitating the Just Energy Transition in South Africa.

2.2. The background of South Africa’s coal-centered energy sector

South Africa has the world’s sixth-largest coal reserves, amounting to 30 billion tons of coal (BP, 2021). As a result, coal mining for in-country energy use and export markets has been central to the country's energy sector, industrialisation, and economy. Coal is the country’s primary energy resource, with Eskom, the state-owned power utility company, generating up to 85% of the country's power from coal-fired power stations (Eskom, 2021a).

According to the DMRE data, the coal consumption split in South Africa is 62% for Eskom utility power generation, 23% for the Sasol petrochemical industry, 8% for the general industry, 4% for the steel industry and the remaining 4 % for other marginal uses (Montmasson-Clair, 2021). Coal mining contributes 2.3% towards the country’s GDP, with coal exports to international markets accounting for 40-45% of the income (Hanto et al., 2022). For the 2020 fiscal year, the mining industry’s contribution to South Africa’s GDP was estimated to be 6.4%, with up to R173.7 billion in taxes collected towards government revenue (PWC, 2020). Sasol, the coal-to-liquids petrochemicals company, is also a significant player in the country’s economy, the country’s largest direct taxpayer, contributing up to 5% to South Africa’s GDP (Sasol, 2021)(Sasol, 2021). The coal value chain contributes to South Africa’s GDP, and the sector employs up to 150 000 people in total (Montmasson-Clair, 2021).

South Africa is confronted with the challenge of transitioning away from coal utilisation, primarily as a response to greenhouse gas emissions that exert detrimental impacts on the climate (Republic of South Africa, 2016). Climate change impacts water resources, natural ecosystems, food supply security, human well-being, and settlements along the coast

(Intergovernmental Panel on Climate Change (IPCC), 2014). In response to the risks of climate change for present and future generations, transitioning from fossil fuels to renewable energy sources is a pivotal mitigation measure. Renewable energy sources present an alternative, sustainable approach to energy provision without greenhouse gas emissions.

South Africa ranks amongst the top 14 emitters of greenhouse gases globally. It is the largest GHG emitter in Africa, with the power utility companies Eskom and Sasol contributing 53% of the country's emissions (Burkhardt, 2019). Governments worldwide have acknowledged the need to transition from fossil fuels to low-carbon energy sources. The Paris Agreement in 2016 is a significant milestone in a global collaborative effort to reduce GHG emissions.

The 21st Conference of the Parties, which is generally referred to as COP21 or the Paris Agreement, was conducted on 12 December 2015 in Paris. The parties to the UNFCCC, comprising more than 190 nations, agreed to collectively collaborate in climate change mitigation by accelerating investments required for transitioning to low-carbon technologies (Centre for Climate and Energy Solutions, 2021). As a signatory of the Paris Agreement, South Africa's commitment towards the Intended Nationally Determined Contribution (INDC) is transitioning from a business-as-usual emission profile to peaking in 2020-2025, a plateau in 2026-2035 and a declining GHG emissions trajectory from 2036 onwards (Republic of South Africa, 2016).

The global energy transition is not solely centred around climate justice and achieving a climate-resilient economy. Moreover, the UNFCCC has included a framework that considers the impacted workers and communities (Glynn & Błachowicz, 2020). As per the International Trade Union Confederation, a just transition ensures the future and sustenance of workers and their communities during the shift to a low-carbon economy (Bennett et al., 2019). This is achieved through collaborative discussions among affected stakeholders, including workers, unions, employers, government, and communities (X. Wang & Lo, 2021). To be considered just, the transition must ensure the provision of improved and respectable employment, skill development, training opportunities, and job security for the workforce affected by policies related to global warming and climate change (The Just Transition Centre, 2023).

The imperative for a just energy transition in the sense of consideration for the impacted workforce is critical for a developing country like South Africa, confronted with socio-economic challenges such as poverty and high levels of unemployment (Pillay & Friedrich-Ebert-Stiftung (South Africa), 2000).

The planned shutdown of coal power plants as they retire presents a need to assess and manage the transition's impacts, primarily on employment and job creation. The energy transition implies structural changes to the energy sector's value chain, leading to social disruption, specifically job losses (Willis, 2021).

This research study aims to identify factors that must be considered to expedite the deployment of wind energy, enabling maximum job creation and delivering a "just" energy transition in South Africa.

2.3. The employment impact of the energy transition in South Africa

This section outlines the background of the just transition concept and how it is applied in the South African context. The section concludes with details on the impact of the energy transition on employment in South Africa.

2.3.1. The "Just" Energy Transition

The phrase "just transition" has its roots in the 1990s labour union battles in North America to create a "superfund for workers" to save the employment of workers who would be impacted by environmental protection policies (PWC, 2021). The idea has developed into a paradigm for moving toward a low-carbon, climate-resilient economy over time to maximise the positive effects of addressing climate change while minimising negative consequences on workers and their communities (Smith, 2017).

A just transition refers to the pursuit and attainment of climate justice and developmental goals without compromising one for the other (Swilling et al., 2016). For South Africa to attain the state's development goals, the socio-political aspects and the configuration of interests must merge to form a sustainability paradigm. For the transition to be just, it must consider the needs of the impacted workforce, the associated communities, and citizens vulnerable to the effects of the low-carbon transition (Glynn & Błachowicz, 2020).

The International Trade Union Confederation (ITUC) spearheaded the formulation of the international labour movement's position on environmental concerns, including climate change (Malope, 2022). At the 2011 United Nations Climate Change Conference (UNCCC) in Durban, the ITUC made clear its main demands for sustainable development and a just transition, which, amongst other things, included consideration for decent jobs and social protection for those whose livelihoods, incomes, and employment are affected by climate change adaptation and mitigation measures (International Trade Union Confederation (ITUC), 2011).

The Congress of South African Trade Unions (COSATU) launched the Just Transition idea in South Africa in 2011. In August of that year, COSATU adopted a Policy Framework on Climate Change (COSATU, 2012). The state's capacity to combine investments in renewable energy with South Africa's sustainable development ambitions illustrates the country's early just transition efforts (Du Plooy, 2017). The just transition is essential in South Africa because of the significant focus on tackling unemployment, inequality, and poverty. As the country shifts to a lower-carbon economy, the transition must offer possibilities rather than cause undue losses to areas that depend on fossil fuels for employment. The President of South Africa articulated this commitment and ambition to attain a “just” energy transition in his statement to the UN Secretary-General’s Climate Summit in September 2019 (Presidency of the Republic of South Africa, 2019). President Cyril Ramaphosa emphasised that in facilitating an equitable transition, it becomes imperative to establish strategies encompassing workforce retraining and employment placement, social safety nets and livelihood establishment, incentivisation of emerging green industries, diversification of regions reliant on coal, and formulation of labour and social policies coinciding with the decommissioning of ageing coal-fired power facilities (Presidency of the Republic of South Africa, 2019).

There is still uncertainty about how jobs will be created despite the commitment to a just energy transition, expressed and reflected in several plans and policy frameworks in South Africa. This research aims to contribute to the body of knowledge by identifying the factors that must be considered to maximise job creation while facilitating a just energy transition as the country deploys more wind energy.

2.3.2. The impact of the Energy Transition on jobs in South Africa

Globally, two crises can be identified, the first being the ecological collapse due to human-induced climate change (Rockström et al., 2009). It is well known that we must decarbonise our energy supply internationally and reduce coal processing to mitigate GHG emissions. The second global crisis is widespread poverty, inequality, and discrimination worldwide (Pillay & Stiftung, 2000).

South Africa is experiencing ecological collapse and socio-economic challenges, with the second crisis at an even more alarming state. In 2022, South Africa’s unemployment rate of 29.8% ranked the highest in the world (Stats SA, 2023), and in 2021, South Africa was ranked the most economically unequal society in the world (Sguazzin, 2021). It is commonly claimed that supporting renewable energy is essential for climate change mitigation, energy security and job creation. Although the first two advantages are widely acknowledged, there is an ongoing debate and different views on how renewable energy affects employment (Jasmine Lambert & Pereira Silva, 2012). According to Willis (2021), there is a risk associated with the necessary action to address the first crisis: shifting from fossil fuels to clean energy sources—a transition that will disrupt society and create job losses—will worsen the second crisis. This is because shifting from fossil fuels to renewable energy sources implies structural change.

Introducing renewables and capping investments in coal power generation into the energy mix will be highly disruptive to the labour force. This is because the renewable energy sector would require a different set of resources and skillsets than what is currently in operation (International Labour Organisation (ILO), 1999). One of the impacts of the energy transition is an increased demand for investments in low-carbon technologies and the eminent cap on coal investments, which will both create and destroy jobs (International Labour Organisation (ILO), 2015).

Research examining how renewable energy affects employment may be generally divided into the following two categories:

- input-output (IO) methods are used to assess the impact of a specific sector activity on other interlinked sectors that form part of the same economic ecosystem. The IO methods can calculate an event or investment's direct, indirect and induced effects (Jasmine Lambert & Pereira Silva, 2012).
- analysis methods are generally utilised to assess regional studies and are limited to determining direct jobs only (Jasmine Lambert & Pereira Silva, 2012).

Both methods give a framework for quantifying job creation. However, with an increasing number of studies conducted concerning the impact of renewable energy deployment on job creation, there is no agreement on how to quantify job creation for the different renewable energy technologies (Jasmine Lambert & Pereira Silva, 2012; Tyler, 2018).

The undisputed element, though, is that disruption in the coal value chain will result in significant consequences for direct and indirect jobs associated with upstream and downstream coal activities, the towns and regions that are coal-rich and local economies that depend on the coal ecosystem (Montmasson-Clair, 2021). The threat to job security is due to the shortcomings of political programs and the disparity in expertise between those employed by the present coal-centric energy system and a future green energy system (International Labour Organisation (ILO), 2015). According to the ILO framework, other considerations essential to facilitate a just energy transition are job quality, employee skills and gender equality.

The decommissioning of Eskom's coal fired power station, as stipulated in the IRP, outlines the projected trajectory of decommissioning 5 200 MW by 2022, 11 000 MW by 2030 and 35 000 MW by 2050 (Department of Mineral Resources and Energy, 2019). Parallel to the decommissioning of the coal fired power station, renewables are to be incorporated into the energy mix with a total installed capacity of 17 742 MW for wind energy by 2030 (DMRE, 2019). This will significantly shift the energy mix in South Africa, as illustrated in Figure 1.2 and Figure 1.3 below. This shift will impact employment associated with the coal value chain and the communities in the coal-rich regions of the country (Montmasson-Clair, 2021).

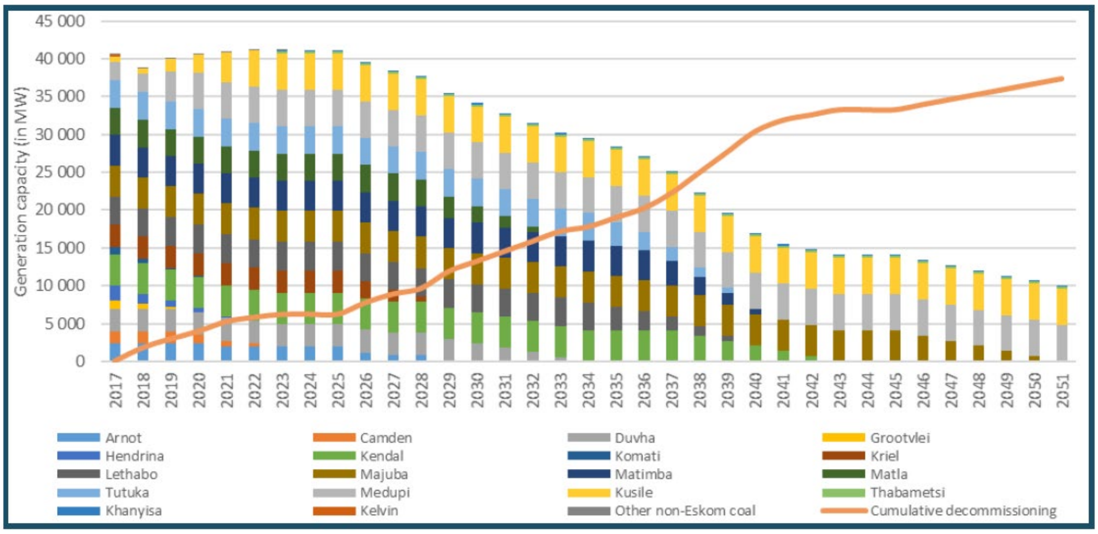

Figure 2. 1: South Africa's coal-based generation and scheduled decommissioning of coal fired power stations

Source: Montmasson-Clair, G. (2021). *Making sense of jobs in South Africa's just energy transition: Managing the impact of a coal transition on employment overview*.

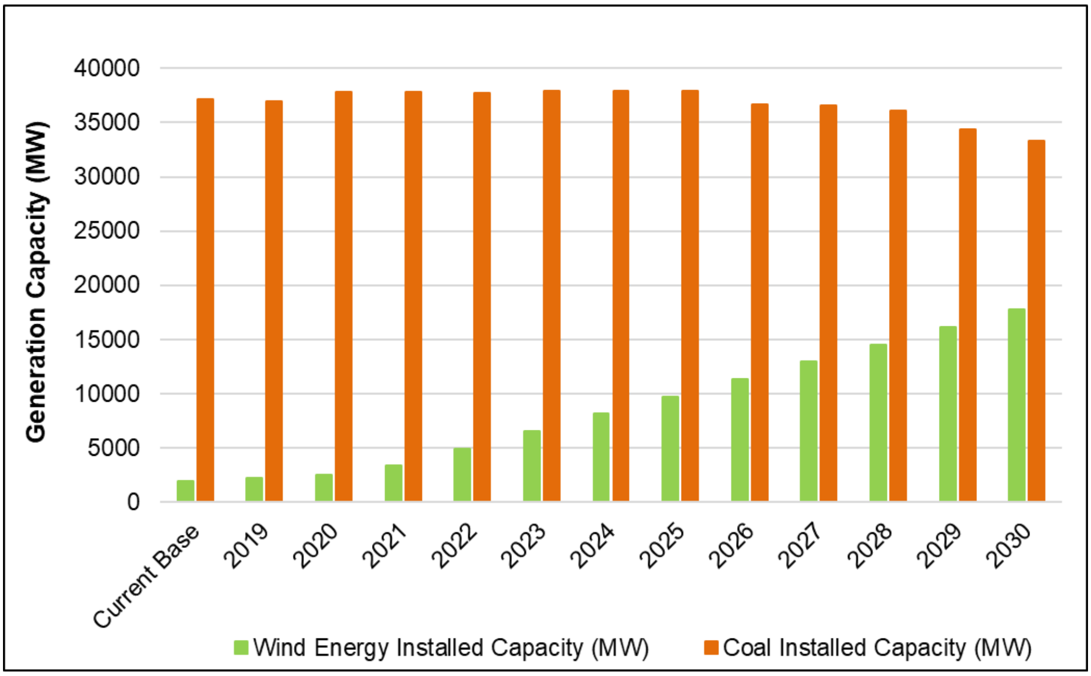

Figure 2. 2: South Africa's plan for coal-fired power stations decommissioning and deployment of wind energy

Source: Authors illustration based on IRP2019 Department of Mineral Resources and Energy. (2019). *Integrated Resource Plan 2019*. Available online: http://www.energy.gov.za/IRP/2019/IRP-2019.pdf [accessed June 2023]

Coal mining, electricity generation and coal-to-liquid petrochemical production are primarily concentrated in Mpumalanga province, which translates to maximum job losses in that province (Montmasson-Clair, 2021). Four towns in Mpumalanga were identified by a vulnerability study of the coal value chain as highly vulnerable to the impacts on the distributed coal value chain and potentially devastating consequences. An estimated total of up to 2.5 million people residing in Mpumalanga will likely lose their livelihoods when five coal-fired power plants and fifteen coal mines close by 2030 and four more plants and twenty-three mines by 2040, according to Eskom's decommissioning plan for its power stations as they retire (Ciaran, 2024). The identified municipalities are Govan Mbeki, eMalahleni, Steve Tshwete, and Msukaligwa. According to the vulnerability study, coal miners are the most susceptible workers in the value chain because of their limited mobility in the labour market, skill level, and limited financial means (Patel et al., 2020).

Direct jobs across the coal value chain equates to around 150 000 workers, with 80 000 jobs in coal mining, 12 000 in Eskom's power generation plants, 26 000 in Sasol's coal to liquids facility, 6000 for ArcelorMittal South Africa steel making, 7000 for cement production, and 2000 for small coal trucks (Montmasson-Clair, 2021; Patel et al., 2020). The employees in the coal value chain have a relatively high reliance on semi-skilled and low-skilled workers, which will be one of the critical considerations for reskilling and re-employment in the low-carbon economy (Hartley et al., 2019). Job losses for coal mining employees due to the planned coal-fired power plants are estimated to be up to 35 000 (Tyler, 2018). The main reason of the eminent threat to jobs at Eskom's older coal stations and impacted mines is not renewable energy, but rather the Eskom's own construction program for new coal power stations such as Medupi and Kusile, which is stranding the older power stations (Tyler, 2018).

One of the fundamental questions that must be addressed is whether alternative work prospects in the low-carbon economy will meet the International Labor Organization's (ILO) definition of a decent job. In 1999, the ILO launched the principles of decent work underpinned by the four pillars, as indicated in Table 2.1 below.

Table 2. 1: Decent work pillars and indicators
Source: International Labour Organisation (ILO). (1999). *Report of the Director-General: Decent work*.

PILLARS	INDICATORS
Job creation	Employment opportunities with fair remuneration
Basic human rights in the workplace	Safe and stable work environment without any discrimination
Social protection	Reasonable working hour
Social dialogue	Representation of workers through collective means

The primary goal of decent employment is to provide both men and women chances to attain productive and decent jobs in settings that respect human dignity, equality, freedom, and security (International Labour Organisation (ILO), 1999). The pillar relevant to this research study is employment creation, which refers to “adequate work opportunities, remuneration, and the embrace of safety at work and healthy working conditions” (Ghai, 2003). The energy transition to create sufficient work opportunities is of primary consideration, especially for the fossil fuels workforce, which is at risk.

Montmasson-Clair (2021) argues that the perceived trade-off between the coal jobs displaced by the transition and the renewable energy jobs created is a false conception. The large-scale renewable energy build-out envisioned by the Integrated Resource Plan (IRP) will provide lots of jobs, but it need not be the primary source of reemployment for coal workers (Montmasson-Clair, 2021). Some of the reasons why the displaced coal jobs do not have to be replaced with alternative energy jobs necessarily are as follows (Montmasson-Clair, 2021):

- The coal and renewable energy value chains are at different development levels, with the coal industry being far more developed in South Africa.
- There is no theoretical or empirical reason for the jobs at risk of being displaced within the coal value chain to be replaced or created in the renewables value chain. Instead, every opportunity to create jobs should be evaluated on its own merits.
- The jobs created through the deployment of renewables may or may not be located in the same region as the existing coal jobs.
- Similar to other employment opportunities, energy business jobs may require retraining and skills development, and they might include lead times that complicate planning.

There are conflicting views regarding the effect of the energy transition on net employment. One of the critical elements that lead to the complexity is the lack of agreement on the different metrics applied in the estimation of job numbers across the various energy value chains (Tyler, 2018). There are several ways to measure the number of jobs created with different ways to provide insights on whether the job is created during the construction phase, operations and maintenance phase and the associated power output of the facility (Jasmine Lambert & Pereira Silva, 2012). The other complexity is the assumptions applied to the different studies, primarily those that evaluate future projected employment impact based on modelled scenarios.

Job years are a measure used by the Independent Power Producer (IPP) Office to report on employment growth in the REIPPPP. A "job year" can be defined as the sum of the hours worked by several individuals in several short-term jobs equivalent to the full-time employment of one person over one year (Montmasson-Clair, 2021). The other job measure is full-time equivalents (FTE). FTEs are defined by the Expanded Public Works Program, which has a basis of 230 workdays a year, equating to one person working full-time for a year. Both metrics do not measure job security and adherence to the stipulations of decent jobs criteria, as indicated in Table 1.1 above.

A study conducted by Hartley et al. (2019) in collaboration with the Council of Science and Industrial Research (CSIR) concluded that South Africa has the potential to substantially enhance overall employment figures by augmenting the proportion of renewable energy sources. Projections suggest that by the year 2050, there could be an increment of over 150,000 fresh employment opportunities (+17%) within the energy sector, factoring in the potential job displacements in the coal industry (Hartley et al., 2019). Furthermore, by transforming the power sector, it is estimated that up to 1.6 million supplementary job opportunities could be generated across the economy by 2050 (Hartley et al., 2019). RES4Africa discovered a net gain in jobs in research on labour movement from coal-producing regions to industries that may use solar and wind power. It estimated the amount of employment-related to solar and wind power deployment between 2020 and 2030, with 862,000 direct, indirect, and induced jobs coming from solar and wind PV (PWC, 2021).

On the contrary, according to earlier research studies, the number of jobs lost in coal mining will surpass those in renewable energy, nuclear power, or gas (Caetano & Thurlow, 2015). The rise in jobs in the energy industry brought about by renewable energy sources cannot offset the loss of jobs associated with the transition. While specific renewable energy sources exhibit greater job-years per MW, their favourable effect on direct employment is overshadowed by the adverse impact on indirect employment (Caetano & Thurlow, 2015). The decline in low-skilled positions within the renewable energy sector predominantly drives this negative employment effect (Caetano & Thurlow, 2015).

It is also uncertain if the jobs generated by renewables would immediately help people adversely affected by the change (Hanto et al., 2021). Based on a study of actual data for an operational wind farm, the IPP was noted to have gaps in job creation since the jobs were temporary with limited investment in skills creation and employment numbers, which were inflated using the job-year employment metric (Malope, 2022).

For the studies assessed, it is not always clear whether the comparison was conducted against the entire coal value chain and not limited to power generation. It is noted that renewable energy job creation is more prevalent during the construction phase, but those jobs are for a limited period and are not permanent for the wind farm's life. The duration of the job is also a critical element for consideration, as jobs can be created for various durations, such as a day, month, year, or longer.

Reporting work in "person-years" is becoming standard practice internationally. Nevertheless, there is currently a lack of consistency in using this measure in South African research. In certain instances, high-level analysis based on person-years of employment is reported as just jobs (Tyler, 2018).

How employment data and research findings are displayed may provide the wrong sense of optimism. It is crucial to understand the distinction between gross and net employment impacts. Net effects include positive and negative effects on employment, whereas gross effects solely consider the positive influence on employment. Certain research makes it unclear whether the numbers being cited are gross or net (Jasmine Lambert & Pereira Silva, 2012).

It has been suggested that the following are the primary causes of the present uncertainty and annoyance over the job consequences of the South African transition to renewables for power generation:

- an absence of uniformity in employment metrics, job classification techniques, and power sector strategic plans (counterfactuals) (Malope, 2022; Tyler, 2018).
- an inability to recognise the topic's intrinsic complexity and the standardised analytical techniques needed to address it (Hartley et al., 2019; Tyler, 2018).

2.4. Wind Energy Deployment in South Africa

This section outlines South Africa's wind energy capability and deployment, driven through the Renewable Energy Independent Power Producer Procurement Programme (REIPPP). It discusses job creation mechanisms applied in the RIEPPPP, concludes with an overview of the wind energy value chain, and explores job creation opportunities.

2.4.1. Wind energy potential in South Africa

Wind energy has been used for thousands of years in the agricultural space when people utilised windmills to generate energy from wind to pump water and grind corn (Akinbami et al., 2021). Like solar energy, wind energy is a naturally occurring energy source that is free and will never run out. However, the magnitude of energy generated from the wind directly correlates to its speed, which depends on geographic area. The greater the wind speed and wind power density, the greater the energy that can be exploited to generate electric power on a large scale. South Africa is well endowed with wind and solar natural resources with an excellent potential for power generation (Jain & Jain, 2017a).

South Africa has developed several wind atlases to estimate the wind energy potential across the country. The first attempt was the Wind Atlas of 1995, which concluded that over seven terawatt-hours per year (TWh/year) of energy could be potentially generated in South Africa (Akinbami et al., 2021). In 2008, another wind atlas was developed, which addressed some of the shortcomings of the 1995 assessments, such as 4m/s, which was used as a benchmark for good wind potential. The evaluation concluded that the best regions in South Africa to harness wind power are the Western, Northern and Eastern Cape, with potential wind energy of 6 GW under modest model assumptions and 50 GW under optimistic assumptions (Akinbami et al., 2021).

The rollout of wind energy stations meant that by 2020, the Western, Northern and Eastern Cape provinces with nine wind measurement stations and KwaZulu-Natal and Free State provinces featuring five wind measurement stations provided the extent of the spatial distribution of wind energy sources for South Africa, with a further four wind measurements stations erected in the Northern Cape Province in the Northern Cape (South African National Energy Development Institute (SANEDI), 2020). As illustrated in Figure 2.3 below, Western and Eastern Cape coastal areas have good wind energy potential.

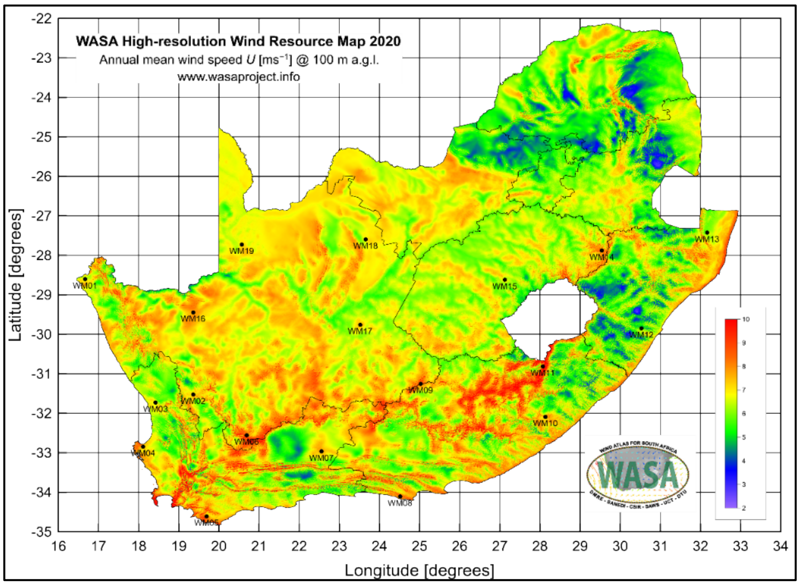

Figure 2. 3: WASA High Resolution Wind Resource Map

Source: South African National Energy Development Institute (SANEDI). (2020, December). *Wind Atlas for South Africa (WASA) SANEDI*. Available online: http://www.wasaproject.info/ [accessed July 2023].

Some modest achievements have been made in wind energy deployment and incorporation into the energy mix. According to GlobalData, wind power accounted for 5% of South Africa's total installed power generation capacity in 2021 (REN21, 2022).

Due to the depletion of inexpensive, readily accessible coal reserves and the backlog of expensive maintenance and repairs that need to be done on Eskom's ageing power station fleet, the cost of coal-fired power has increased by 300% in the past 20 years (PWC, 2021). Due to this, the cost of power for homes and companies has increased dramatically, which has a detrimental effect on the economy (Solidarity, 2022). Figure 2.4 shows the actual power cost in South Africa from 2011 to 2020. In the meantime, during the last ten years, there has been a significant decline in the price of solar and wind power (PWC, 2021). These days, the least expensive sources for power generation in South Africa are solar PV and wind.

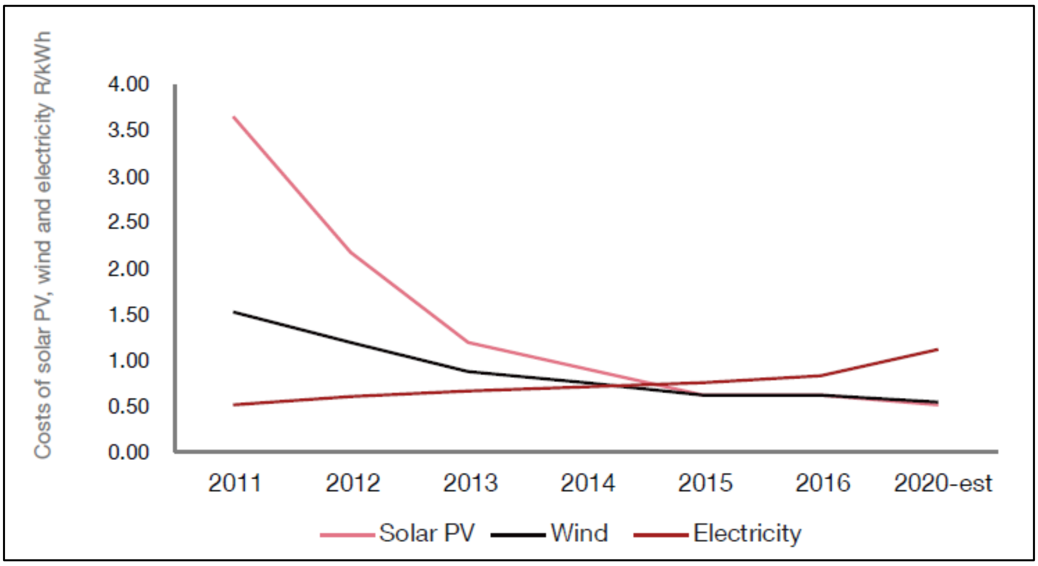

Figure 2. 4: The cost of wind energy over the years in comparison to solar and coal generation

Source: SAWEA. (2019). South African Wind Energy Association | About. Available online: https://sawea.org.za/about/ [accessed September 2023]

Due to the diminishing expense associated with renewable energy technology, renewable sources have emerged as a viable and competitive energy option. In response, policymakers have devised a strategy to seamlessly integrate renewable energy into South Africa's energy portfolio (Walwyn & Brent, 2015). This endeavour materialised in the form of the Renewable Energy Independent Power Producer Procurement Program (REIPPPP); a comprehensive initiative designed to facilitate the installation of 17.8 Gigawatts (GW) of renewable energy electricity generation capacity within the timeframe spanning 2012 to 2030 (Walwyn & Brent, 2015).

The South African Wind Energy Association (SAWEA) plays a pivotal role in promoting the development and growth of wind energy in South Africa (Jain & Jain, 2017b). SAWEA is a non-profit organisation which was established in 2007 to represent the interests of the wind energy industry and advocate for policies and initiatives that support wind power as a viable and sustainable energy source (Boadu & Otoo, 2024). One of such initiatives is the Integrated Resource Plan (IRP) whereby SAWEA was actively involved in the development and updating of the IRP, which outlines the country's energy mix and future energy needs (Schmid & Lumsden, 2023). SAWEA's advocacy has helped increase the allocation for renewable energy, including wind power in the energy mix. The association has promoted initiatives to boost local content in wind turbine manufacturing and create jobs within the sector, including endevours to encourage local suppliers and service providers to participate in wind energy projects (Mukonza & Nhamo, 2018).

2.4.2. REIPPPP and the socio-economic framework

The publication of the Integration Resource Plan (IRP) in 2010 was a crucial milestone in the demonstration of South Africa's government to transition and diversify the energy mix. To deliver on the Independent Power Producers Procurement Programme (IPPPP) mandate, the IPP office was formulated by the then Department of Energy in collaboration with the South African National Treasury and the Development Bank in November 2010. The mandate and primary purpose of the IPP programme is to secure electricity generated by private independent producers from renewable and non-renewable energy sources.

Apart from energy procurement, the IPPPP was formulated to drive other primary national developmental objectives, such as job creation and socio-economic upliftment and transformation through the broadening of economic ownership (IPP Office et al., 2020). The government introduced the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP or REI4P) in 2011 as a mechanism to procure renewable energy from private power producers. REIPPPP was conceived when the South African government changed Eskom's procurement of electricity from the private sector from the feed-in tariff approach to a competitive bidding mechanism (Eberhard et al., 2014)

The policy driver of the REIPPPP is the reduction of carbon emissions due to South Africa's power generation which is primarily from coal. Additionally, REIPPPP offers the opportunity to strengthen the economy through the creation of jobs and to alleviate the immediate shortage of electricity (South African Government, 2011; Walwyn & Brent, 2015). Two factors are used to evaluate the competitive bids in the programme: the price or tariff, which makes up 70% of the evaluation, and the economic development, which makes up 30%.

A multi-stage bidding procedure evaluates and selects bidders with the highest combined tariff and economic development scores. This process has two stages: the contractual phase, which involves putting out a call for bids, accepting them, and then having the IPP Office choose a few preferred bidders and signing the contract. The implementation phase, which includes project construction and the start of commercial operations, comes after the contractual phase. Following the start of operations, the IPP will generate and contribute a certain quantity of power to the national grid. In exchange, Eskom will pay the IPP by the terms of the Payment Procurement Agreement that were reached at the contractual stage of the bidding process.

Figure 2.3 below is an overview of the process for the procurement of IPPs.

Figure 2. 5: The process outlining the procurement of IPPs
Source: IPP Office. (2023). An overview of the Independent Power Producers Programme (IPPPP) As of 31 March 2023. Available online: https://www.ipp-projects.co.za/Publications [accessed 20 November 2023].

Over the years, the Department of Mineral Resources and Energy (DMRE) has formally invited interested parties to participate in different bid window submissions. Table 1.2 below gives the total number of wind farm projects under the different bid windows, their respective power generation capacity and project status.

Table 2. 2: Onshore wind projects over the various bid windows

Source: IPP Office. (2023). *IPP Projects Database*. Available online: https://www.ipp-projects.co.za/ProjectDatabase [accessed 20 November 2023].

Bid Window	Announcement Year	No of Projects	Total Capacity (MW)	Status
Bid Window 1	2011	8	639,3	100% Operational
Bid Window 2	2012	7	555,1	100% Operational
Bid Window 3	2013	7	785,3	100% Operational
Bid Window 4	2014	12	1362,8	100% Operational
Bid Window 5	2021	12	1604	50% under construction 50 % no financial close yet
Bid Window 6	2022	TBC	TBC	Bid submission date: 3 October 2022
Bid Window 7	2023	TBC	TBC	Bid submission date: 30 May 2024

To date, the total committed wind energy capacity is 5,225.4 MW, which is 29% of the 17,742 MW 2030 target outlined in the IRP (Department of Mineral Resources and Energy, 2019). This will make wind energy 23% of South Africa's total energy mix in 2030, the highest renewable energy contribution relative to solar PV, hydro, and concentrated solar power

(Department of Energy and Mineral Resources, 2011, 2022).

The South African Wind Atlas indicates excellent wind capacity in the Western, Eastern, and Northern Cape, so wind projects are generally deployed in those provinces. Figure 2.6 below shows the spread of operational wind farms in South Africa. The location of wind farms, as guided by the wind atlas, presents an unfavourable dynamic to the just energy transition since jobs created through the deployment of renewables are not located in the same region as the existing coal jobs, which are at risk of being displaced.

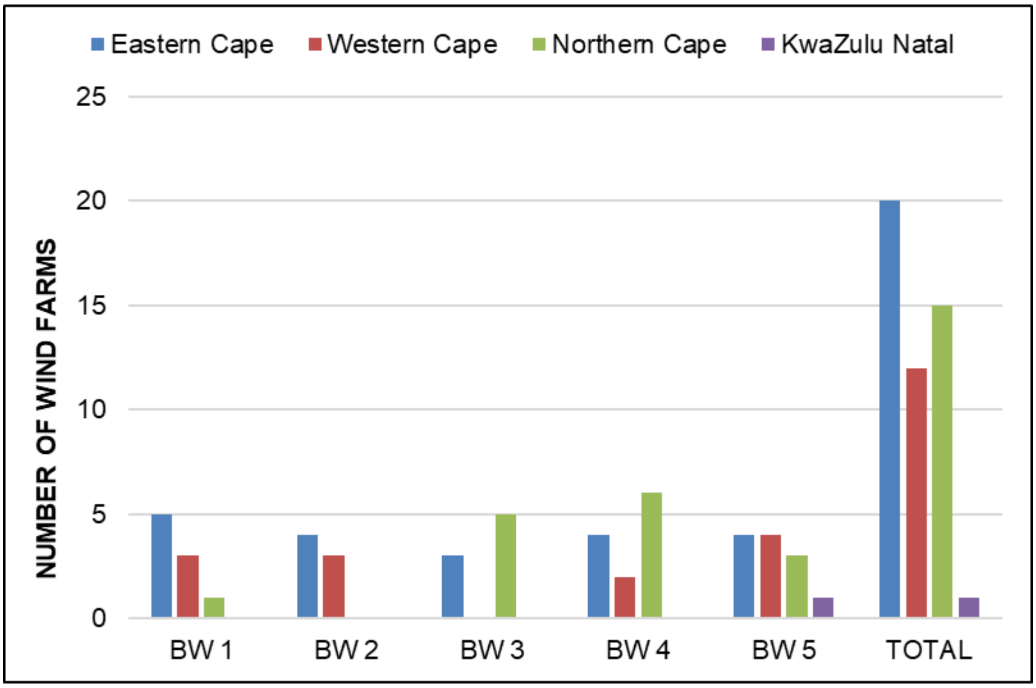

Figure 2. 6: Operational Wind Farms for Bid Windows 1-4 and Committed Wind Farm Projects for Bid Window 5 across the different Provinces in South Africa

Source: IPP Office. (2023). *IPP Projects Database*. Available online: https://www.ipp-projects.co.za/ProjectDatabase [accessed 20 November 2023]

The price of the first two bid windows was relatively high. However, REIPPPP recorded a striking price decrease over the subsequent bid windows. Since the launch of REIPPPP, wind energy rates have decreased by 59%, making wind energy more affordable than newly developed coal-based power plants (SAWEA, 2019).

The socio-economic aspect of the REIPPPP is also essential in the South African context of poverty, inequality, and extremely high unemployment rates. The economic development component of the bid evaluation process prioritises job creation and promotes local development in the host communities where the renewable energy projects are located

(Eberhard et al., 2014; Walwyn & Brent, 2015).

The IPP office's data indicates that REIPPPP is succeeding, with South Africa rated as the 12th most attractive investment for renewable energy globally. As of 31 March 2023, the total investment attracted into the country for renewable energy projects with confirmed financial agreements is R252.8 billion, with 73 738 job years of employment created (IPP Office, 2023). The figures indicated are for all renewable energy projects, including solar PV.

Social-economic and enterprise development are some of the performance indicators measured and reported by the IPP office, see Figure 2. 5 below. Enterprise development and the economic upliftment of local communities in the host communities where the renewable energy projects are located can positively contribute toward indirect jobs created. However, the IPP office tracks and measures the actual monetary contribution made towards socio-economic and enterprise development with R3 billion actual contribution realised as of 31 March 2023 (IPP Office, 2023). Employment opportunities for South African citizens during the construction and operational phases of the renewable energy project are measured in job years, the equivalent of a full-time employment opportunity for one person for one year (IPP Office, 2023).

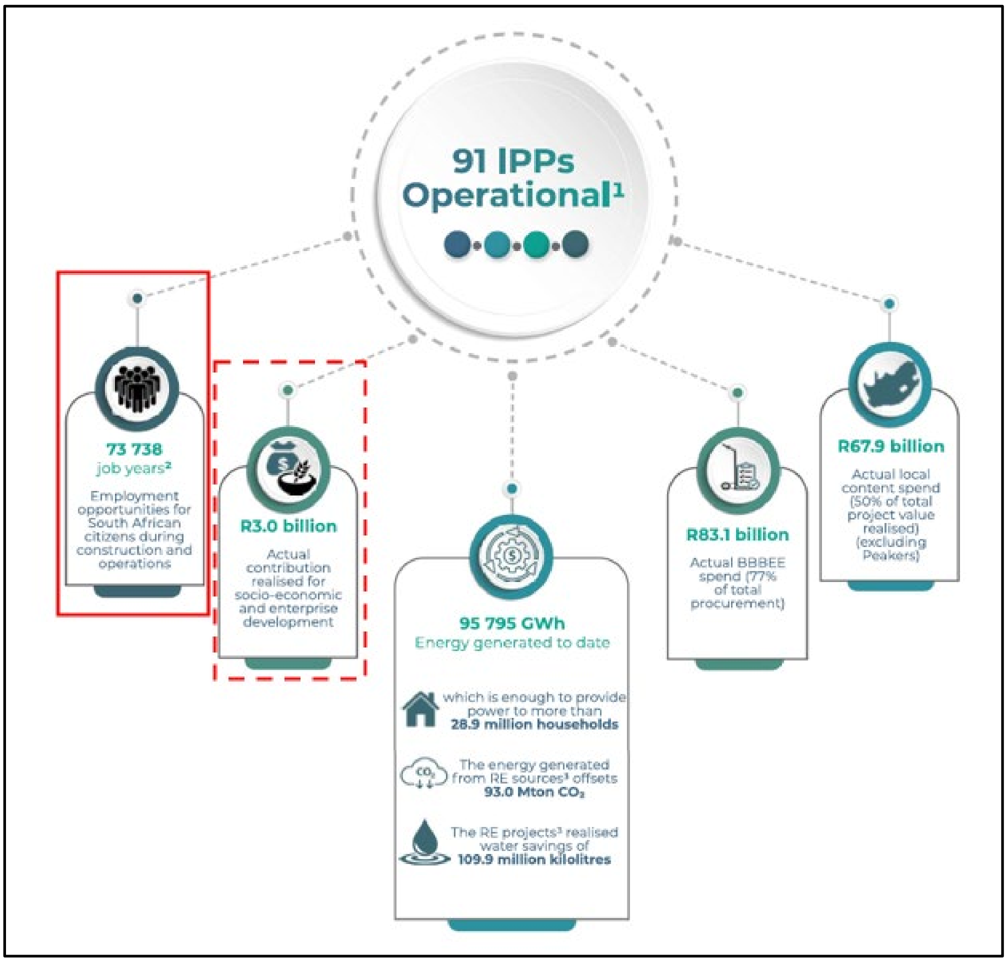

Figure 2. 7: The IPPP at a glance key achievements as of 31 March 2023

Source: IPP Office. (2023). *An overview of the Independent Power Producers Programme (IPPPP) As of 31 March 2023*. Available online: https://www.ipp-projects.co.za/Publications [accessed 20 November 2023]

As a means of addressing the socio-economic elements of the just energy transition, the REIPPPP is framed with 30% of the bid scored based on the project contribution towards aspects such as the following, amongst other things:

- the creation of jobs for South African citizens and local communities,
- promoting local content to stimulate a green economy and
- preferential procurement that is sourced from Broad-Based Black Economic Empowered (BBBEE) suppliers, Qualifying Small Enterprises (QSE), Exempted Micro Enterprises (EME) and women-owned businesses (IPP Office, 2023).

The South African government has identified the low-carbon economy as a primary employment enabler, with a projected contribution of up to 300 000 new direct jobs (PWC, 2021). Some researchers argue that more investigation is required to determine the precise number of jobs generated locally by the various renewable energy sources. The assessment of job creation in terms of "job years" is deceptive, and a standardised employment metric needs to be established (Malope, 2022; Tyler, 2018). Concerning the bidding procedure, bidders ought to approximate the quantity of genuine employment anticipated to be generated across various skill levels without influencing the scores on the scorecard (Malope, 2022).

In 2016, the REIPPPP faced challenges when the Eskom CEO at the time, Brian Molefe, indicated that the utility would not be signing the 20-year power purchase agreements (PPA) with independent power producers based on tariff negotiations (Miller, 2016). Eskom’s not signing PPAs devastated REIPPPP, and the uncertainty resulted in investors and wind turbine OEMs losing confidence in renewable energy development in South Africa (Miller, 2016).

Nelson Mandela Bay lost jobs because of the uncertainty surrounding South Africa's renewable energy industry due to Eskom’s refusal to sign PPAs. After failing to secure an equity investment partner, DCD Wind Towers, a manufacturer of wind turbine towers, shut down its production in the Coega Industrial Development Zone (IDZ) (Mhlathi, 2019). With no demand due to the wind farm development pause, DCD encountered cash flow difficulties. The manufacturing plant, which would contribute significantly to local manufacturing, had to retrench 110 employees and close down (Mhlathi, 2019).

Local manufacturing is an essential strategic component of job creation. Identifying enablers that will allow maximum job creation along the wind energy value chain is critical.

2.4.3. Job opportunities along the wind energy value chain

Wind technology development is still nascent in South Africa compared to the rest of the world. In 2019, the top ten global companies captured 85.5% of the installed wind capacity market (Department of Mineral Resources and Energy, 2022). The wind energy value chain is very competitive, and a few leading European, American, and Chinese manufacturers dominate it. In recent years, there has been an incremental shift in the manufacturing of wind turbines from Europe towards Chinese manufacturers, resulting in China having 66% of the market share in 2022 (Enerdata, 2024).

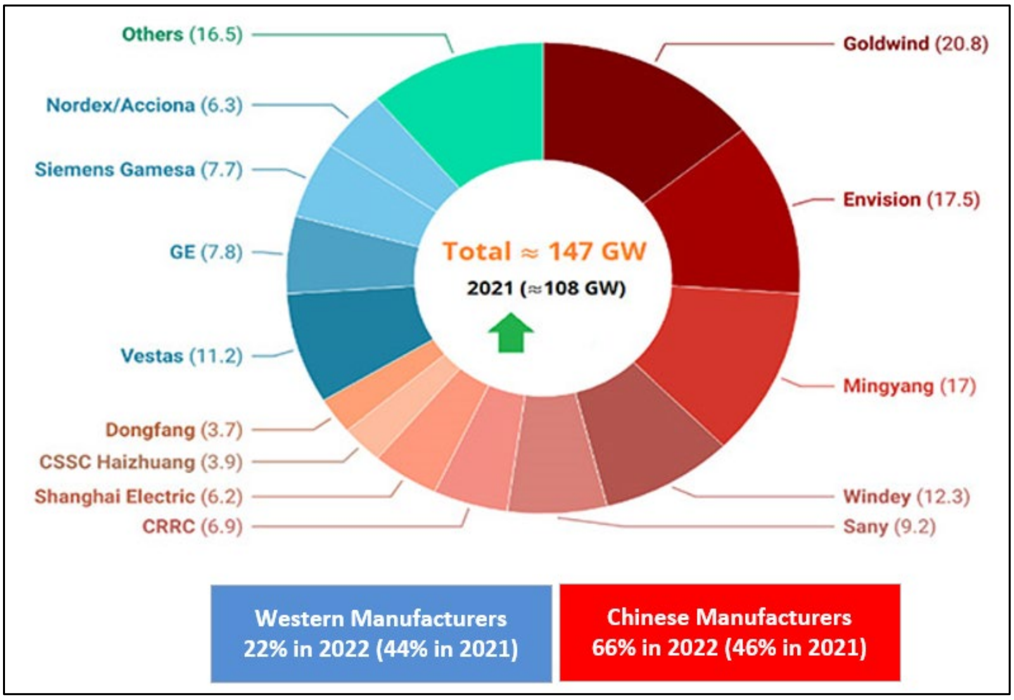

Figure 2. 8: Global Wind Turbine Manufacturers' Market Share by Take-in-Orders 2022 (GW)
Source: Enerdata. (2024). Wind Market Share. Available online: https://d1owejb4br3l12.cloudfront.net/publications/executive-briefing/wind-turbines-manufacturers-market-share.pdf [accessed 10 December 2023]

Europe and China are undoubtedly the two leading wind turbine manufacturing countries. China's competitiveness has been attributed to the Chinese government's ambitious wind energy targets coupled with policies that support the development of the domestic wind industry supply chain (Li et al., 2023). Some policy elements that have anchored China's wind industry include feed-in tariffs, local content stipulations, and industrial financial subsidies (Li et al., 2023). European wind turbine manufacturing, supported by a vast industrial ecosystem of suppliers and manufacturers, is a vital wind industry component. The ambitious energy target and policies of the European Commission have also played a significant role in bolstering the wind energy industry in that region (Enerdata, 2024). Most wind turbines currently in use in Europe were manufactured and assembled within the European markets (Enerdata, 2024).

South Africa needs to develop strategic localised manufacturing for the key components or assembly lines of imported components of the renewable energy value chain to achieve the projected job creation and GDP growth. The supply and installation of the wind turbine (tower, blades, nacelle and sub-components) make up to 64-85% of the value of an onshore wind project (Department of Mineral Resources and Energy, 2022). One of the objectives outlined in the SAREM is job creation through localised manufacturing of components associated with wind and solar PV power generation. A total of 36 500 direct jobs (19 586 from wind) and a GDP contribution of R420 billion can be attained through localising 70% of components and 90% of operations and maintenance of the rest of the wind and solar farm plants (Department of Mineral Resources and Energy, 2022).

Job opportunities for renewable energy deployment projects can be classified into three groups (Jasmine Lambert & Pereira Silva, 2012):

- *Technological development* opportunities are stable and require a speciality skill level. These opportunities will primarily apply to foreign internationals with wind technology skill sets, which are still in the development phase in South Africa.
- *Construction and installation* are temporary opportunities that can be explored by local skilled labour.
- *Operations and maintenance*, which are stable opportunities for semi-skilled locals.

To enable maximum job creation and address the high level of unemployment in South Africa, significant consideration must be given to job opportunities along the entire wind energy deployment, including opportunities upstream of the deployment phase of the project, as illustrated in Figure 2.9 below.

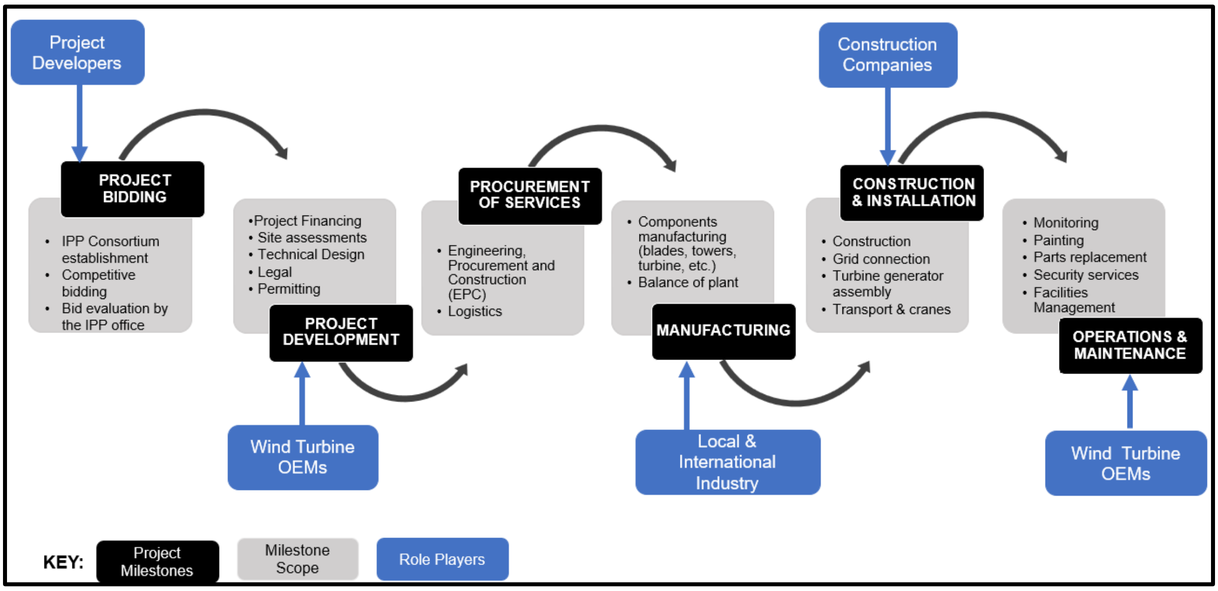

Figure 2. 9: Wind project value chain job opportunities

Source: Authors illustration

The scope of this research study excludes potential job opportunities in the dismantling and disposal phase of the wind energy value chain. It must be noted that to calculate life cycle GHG emissions, the process-based life cycle assessment (LCA), which follows the principle of ISO 14044, the process boundary includes dismantling and disposal (Wang et al., 2018).

Since renewable energy is still nascent in South Africa, with the fleet of wind farms only a few years old, job opportunities from dismantling and disposal will be excluded from the evaluation.

The wind turbine OEMs usually have at least a year's renewable contract to operate the facility on behalf of the IPP and take care of operations and maintenance (O&M) services such as crane operation, wind tower maintenance, parts replacement, lubrication, etc. (Morris et al., 2022). During that period, it is essential to note that the OEM world must provide operations personnel who would be foreign internationals.

The IPP office measures and monitors the number of jobs created from all the wind farms deployed through the RIEPPPP programme. Most publications on job creation in South Africa are future projections modelled based on some assumptions. Table 2.1 below indicates the projected number of jobs to be created during wind energy farm deployment's construction, operations, and maintenance phases.

Table 2. 3: Estimated jobs to be created through wind energy deployment between 2020 and 2030
Source: Schulte, L., Klindt, M. P., Robinson, B., Stephens, S., & Umney, C. (2022). *Wind Energy and the Just Transition: Political and Socio-Economic Pinch Points in Wind Turbine Manufacturing and Windfarm Communities in Europe and South Africa. London: The British Academy*.

Project Phase	Construction phase	Operation and maintenance
Direct jobs	179 000	5 000
Indirect jobs	198 000	5 000
Induced jobs	216 000	6 000
Sub-Total	594 000	15 000
Total	**609 000**	

The peak number of jobs are created during the construction phase, with less during the operation and maintenance phases (Hansen et al., 2022; Malope, 2022; Schulte et al., 2022; Simas & Pacca, 2014). According to a case study conducted on an operational wind farm in South Africa, Northern Cape Province, some but not all the requirements for "decent work" were met by the jobs created during the project's construction phase. However, pay and working conditions were typically better than those provided by other local firms; training opportunities were not a priority (Malope, 2022). Moreover, when the wind farms started producing electricity, only a few local people could be reintegrated for permanent employment. The organisation made false statements about the number of (short-term) employment opportunities created (Malope, 2022).

Most parts used in wind energy deployment are not currently made in South Africa but are imported (Rivett-Carnac, 2022; The Department of Mineral Resources and Energy, 2022; Willis, 2021). Local manufacturing of the components associated with wind energy deployment would lead to the creation of long-term jobs as well as new prospects for exporting to other countries (Malope, 2022). Historically, the growth of the manufacturing sector has been seen as a crucial component of the structural transformation that underpins industrialisation in developing countries (Larsen & Hansen, 2022). The manufacturing sector is often seen as a high-productivity area where job creation can be maximised, which is advantageous for both economic growth and the alleviation of poverty (Larsen & Hansen, 2022).

Wind farms typically consist of numerous wind turbines strategically located across a large expanse of land to harness wind energy for electricity generation efficiently. Each wind turbine within a wind farm comprises several key components, including rotor blades, a rotor hub, a nacelle (housing containing the generator, gearbox, and other mechanical components), and a tower. When the wind blows over the rotor blades, it causes them to rotate. There are three blades per wind turbine, which are 53 meters long, and the turbine is up to 152 m long (Malope, 2022). The rotational motion of the blades drives a generator housed within the nacelle, converting the wind's kinetic energy into electrical energy. The electricity generated by each turbine is then collected and transmitted through an electrical grid for distribution. Figure 2. 7 below provides an overview of the wind turbine components, how they link together, and the minerals and materials associated with their manufacturing value chain (Rivett-Carnac, 2022).

Most of the critical turbine components, such as the blades and nacelle with their auxiliary sub-components, are supplied to the turbine's Original Equipment Manufacturer (OEM), which is primarily European, American or Chinese, as indicated in Figure 2. 5 above (Department of Mineral Resources and Energy, 2022; Enerdata, 2024). The components are assembled in their country of origin and imported to South Africa. This is a missed opportunity for manufacturing jobs, and the South African government needs to focus on it.

The wind turbine OEMs do not only supply the equipment, but they also usually have at least a year's renewable contract to operate the facility on behalf of the IPP to take care of operations and maintenance (O&M) services such as crane operation, wind tower maintenance, parts replacement, lubrication, etc. (Morris et al., 2022). Lack of adequate domestic demand to support local production, rather than a lack of expertise, is the obstacle to local manufacturing of wind turbine components (Lewis & Wiser, 2007). As a developing country, South Africa is seemingly lagging in the highly developed and concentrated global wind sector due to rising levels of technological sophistication and top turbine makers' unwillingness to license their innovations (Baker, 2012).

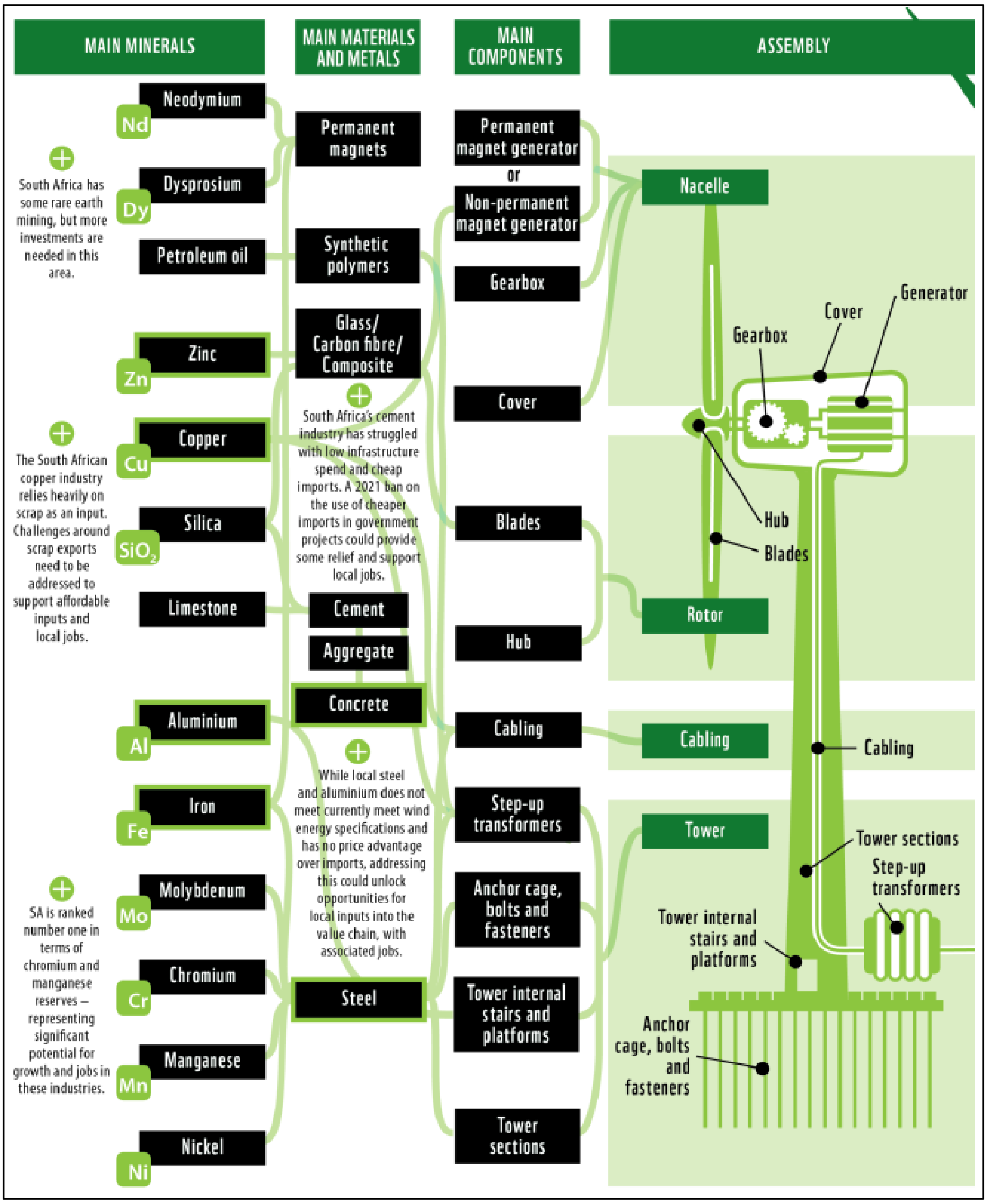

Figure 2. 10: Materials and manufacturing value chain for Wind Energy – Job creation opportunities for South Africa
Source: Rivett-Carnac, K. (2022). *Insights into the wind energy value chain in South Africa*

Local manufacturing and the enhancement of local content have been highlighted as a critical lever for job creation in several South African government policy documents (IPP Office et al., 2020; The Department of Mineral Resources and Energy, 2022. It is essential to identify areas within the wind value chain where South Africa has the capabilities to establish and develop local manufacturing. Table 2.4 gives an overview of the components and activities critical in the wind energy deployment process, the technology level, and the wind energy deployment status in the South African context.

Table 2. 4: Local manufacturing status for wind energy deployment in South Africa

Source: Morris, M., Robbins, G., Hansen, U., & Nygard, I. (2022). The wind energy global value chain localisation and industrial policy failure in South Africa. *Journal of International Business Policy*, *5*(4), 490–511.

Type of activity/product	Tech level	Status
Civils inputs (aggregate, cement, steel, pre-cast elements, some yellow goods (plant and equipment)	Low/medium tech	Established
Ancillary structures – fencing, building materials for temporary/permanent buildings	Low tech	Established
Grid integration – cables, distribution and power transformers, medium-voltage primary and secondary switchgear, mineral oil and bio-electra oil pole mount switchgear, pylons, indoor and outdoor ring main units	Low/medium tech	Established
Towers – steel towers	Low tech	Established
Towers – pre-cast concrete tower units	Low tech	Mostly disestablished
Tower internals – ladders, cabling, lighting	Low Tech	Established
Blades	Medium tech	None
Turbines – for the commercial grid wind energy sector	Medium tech	None
Nacelles panels	Low Tech	None
Assembly of nacelles & turbine elements	Medium tech	None

The local industry for manufacturing pre-cast concrete towers was destabilised due to the uncertainty in REIPPPP when Eskom did not sign the PPA, bringing renewable energy deployment to a halt. This resulted in devastating implications for local manufacturing of towers as DCD Wind Towers, a manufacturer of wind turbine towers, shut down due to cash flow challenges in that period (Mhlathi, 2019). Such facilities can be reestablished with appropriate policies to offer investors confidence in long-term renewable energy deployment in South Africa. Other potential areas for local manufacturing are nacelle panels and the assembly of the nacelle and turbine elements. Local manufacturing of the nacelle and turbine elements might be challenging due to intellectual property (Lewis & Wiser, 2007). However, local assembly is an avenue that can be explored to create jobs.

South Africa must also address the necessary skill level to operate and maintain the specialised equipment associated with wind farms' energy generation. Local citizens must be upskilled to fulfil the technical roles in the value chain and avoid being over-reliant on global skills (Marleny, 2023). There have been collaborative efforts by multiple government departments such as the DMRE and the Presidential Climate Commission Energy; renewable energy technology advocacy agencies for wind and solar; and the Water Sector Education and Training Authority (EWSETA) to help determine the correct skills demand profile and required development needs for the renewable energy industry (Marleny, 2023). The shortage of skills has been flagged as one of the main challenges across the wind energy sector (Hartley et al., 2019). One of the gaps noted in the wind energy sector is the lack of clarity on what needs to be studied, the required qualifications, and accreditations (Marleny, 2023).

EWSETA has launched renewable energy skills development initiatives to equip South African citizens with the skills required in the low-carbon economy. One such initiative is the Renewable Energy Specialisation Skills development programme, which was launched on 19 April (Energy & Water Sector Education Training Authority, 2023)

2.5. Renewable energy deployment Policy framework

Energy policymakers worldwide face the imperative task of formulating strategies and policies to navigate the intersecting imperatives of the energy trilemma: energy security, energy equity, and environmental sustainability. Determining priorities poses a multifaceted challenge that varies across nations, necessitating the development of energy policies tailored to individual contexts. These policies must account for each country's distinct circumstances, including its natural resource endowments, geographical characteristics, and prevailing socio-economic conditions.

The Trilemma Index, developed by the World Energy Council in collaboration with global consultancy Oliver Wyman and Marsh & McLennan Advantage, is one of the tools utilised in the energy sector for policymaking (World Energy Council, 2021). The World Energy Trilemma Index was established in 2010 and annually publishes a comparative ranking of 127 countries based on the country's energy system performance regarding the trilemma elements: energy security, energy equity, and environmental sustainability.

The trilemma index is a measurement derived from global and national data and provides insights regarding the countries' energy performance in relation to the energy trilemma elements. The ranking also highlights challenges and dimensions that could be off-balance, as well as opportunities and areas that require improvement to accelerate the attainment of energy transition goals. The index ranking can also be used to learn from leading performing countries and the practices contributing to their excellent performance. It can also inform policymakers of the focus areas requiring acceleration, energy leaders, and the financial sector to inform investment decision-making.

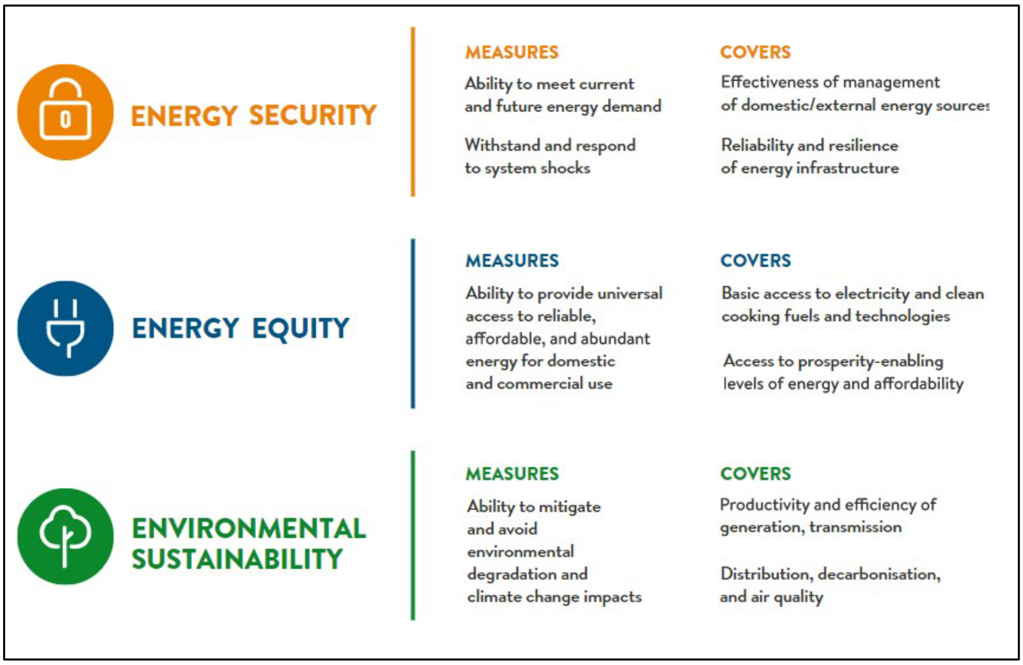

Figure 2. 11: Energy Trilemma Index Dimensions Source

Source: World Energy Council. (2021). *World Energy Trilemma Index*. Available online: www.worldenergy.org [accessed September 2023].

All energy trilemma dimensions in South Africa are significantly challenged and must be considered as the country develops renewable energy deployment-related policies. South Africa is a developing country with an energy system rooted in coal, which poses environmental challenges due to greenhouse gas emissions associated with fossil fuel processing. Energy equity is still challenging, with only 91.1% of South African households having electrical power availability and the population's balance using other energy sources such as paraffin, candles, firewood and coal (Statistics South Africa, 2016). Over time, the National Energy Regulator of South Africa (NERSA) has approved Eskom's price escalation above inflation, which has challenged the affordability of electricity for most of the population. From 2007 to 2022, electricity tariffs increased by an unbelievable 653%, whilst inflation over this period was just 129% (Solidarity, 2022).

In 2021, 127 countries were ranked into 101 positions, as some countries obtained identical scores. A rank of 1 is for the best country and 101 for the worst. South Africa's trilemma ranked 64 out of the 127 countries scored (World Energy Council, 2021). South Africa still largely depends on coal and oil imports and faces socio-economic challenges such as poverty, inequality, and high unemployment. European countries such as Sweden, Switzerland, and Denmark continue to show leadership in balancing the dimensions of the energy trilemma. Europe occupies eight of the top ten places in the 2021 Index of top performers as fossil fuel use continues declining (World Energy Council, 2021). Prominent determinants facilitating high performance in the trilemma index score encompass diversification and decarbonisation of the energy portfolio, alongside the implementation of robust energy policies aimed at optimising domestic resources while mitigating over-dependence on any singular energy source.

Over the years, a policy framework to enable the national energy mix has been developed and adopted. The foundational policy was the White Paper on Renewable Energy, adopted in 2003 to promote renewable energy technologies such as solar and wind (Department of Minerals and Energy, 2004). The policy document outlines a ten-year renewable energy target of how technologies could diversify the country's energy mix and secure cleaner energy. The White Paper on Renewable Energy of 2003 addresses the following policy objectives (Department of Minerals and Energy, 2004):

- Investment of national financial resources in renewable energy at an equitable level.
- Implement renewable energy technologies using public resources.
- Introduction of fiscal incentives to facilitate renewable energy development.
- Encourage a climate of investment to support the growth of the renewable energy industry.

To transition to a low-carbon (green) economy by adopting renewable energy sources, the South African government set a ten-year target of 1667 MW of renewable energy contribution into the 2013 energy mix (Department of Environmental Affairs, 2012). The target is 4% (1667 MW) of the 2013 estimated electricity demand of 41539 MW. The transition to a low-carbon economy also included establishing institutions to drive South Africa's decarbonisation programme.

In line with the objectives of the National Development Plan 2030 and the national commitment to transition to a low-carbon economy, the Integrated Resource Plan, which was enacted in May 2011, set an even greater target of 17 800 MW of renewable energy to be attained by 2030 in line with the aspired electricity generation mix (South Africa National Planning Commission, 2012). Within its 20-year timeframe (2010-2030), about 5000 MW were projected to be operational by 2019, with an additional 2000 MW expected by 2020 (Department of Energy and Mineral Resources, 2011).

Based on certain assumptions regarding electricity demand, existing Eskom power plant performance, costs and parameters of various energy technologies, and new and decommissioned plants, to name a few, the Draft IRP 2018 was published and approved by Cabinet for consultation (Department of Energy and Mineral Resources, 2011). The plan drastically increased wind energy to 11 442 MW total installed capacity, which is 15.1% of the installed capacity mix by 2030. The additional capacity of 1,332 MW (Ingula pumped storage), 1,588 MW (Medupi power station in the Limpopo Province), 800 MW (Kusile power station in the Mpumalanga Province) and 100 MW (Sere Wind Farm in the Western Cape Province) was also commissioned through the Eskom build programme; and 18, 000 MW of new generation being committed (Department of Mineral Resources and Energy, 2019).

The Draft IRP 2018 was updated to include the decommissioning plan of certain coal power stations, new additional installations for pumped storage, additional installed capacity for solar PV and wind to 8 288 MW and 17 742 MW, respectively and the reduction of planned gas/diesel installations. It is also intended that the Koeberg Nuclear Station, located in Western Cape province, South Africa, will reach its end of design life in 2024 and maintain nuclear power in the energy mix plans. These plans are already in place to extend Koeberg's design life and nuclear safety license for another 20 years. Following the updated assumptions, power system modelling, simulation analysis and policy choices. The Policy Adjusted IRP2019 Report was issued to provide adjusted capacity, demand projections, and performance (Department of Mineral Resources and Energy, 2019).

The IRP 2019 outlines a bold target of diversifying the energy mix by gradually increasing renewable energy sources from 11% to about 41% renewables by 2030**.** With the updated renewable energy target, several policies and initiatives have been adopted to implement the energy transition. Initiatives such as the Renewable Energy Independent Power Producer Programme (REIPPP) are mandated to secure renewable electricity from the private sector in a manner that supports broader national objectives of creating jobs and economic ownership by previously disadvantaged groups (Eberhard et al., 2014).

The competitive bidding process of the REIPPP has been formulated to incorporate the country's socio-economic needs through the economic development (ED) scorecard, which initially had 30% weighting on the bid, with 70% being the electricity tariff. The framework of the RIEPPP has resulted in significant job creation in South Africa, with 73 738 job years of employment created as of 31 March 2023 (IPP Office, 2023).

The objectives of the Energy Masterplan (SAREM) are to grow the country's economy, create jobs, build local capacity in the renewable energy value chain, and positively contribute towards the Just Energy Transition (Department of Mineral Resources and Energy, 2022). The projected number of direct jobs that can be created through localised renewable energy value chain manufacturing is 36,500 in total and 19,586 for wind energy in particular (Department of

Mineral Resources and Energy, 2022).

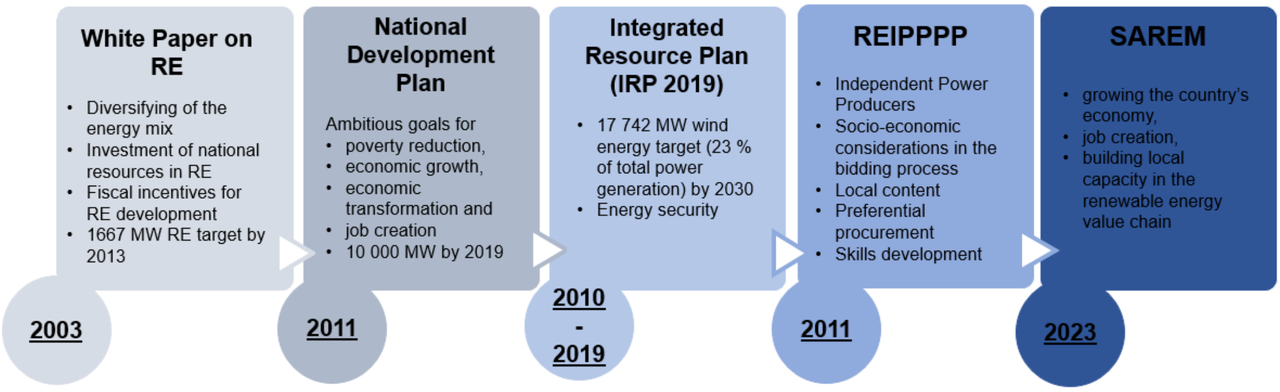

Figure 2. 12: Key renewable energy policy development milestones in South Africa
Source: Author's illustration

However, the extent to which the energy transition and its associated policies sufficiently address South Africa's unique socio-economic challenges and the foreseeable labour force disruptions remains unclear. Policies and legislation, advocacy and political will exist, but remain untested in their ability to create jobs, uplift communities, and leave nobody behind. South Africa's energy policies have been criticised for lacking a clear strategic plan for the just transition plan about job creation and plans for the affected and impacted coal workforce and communities (reference). The government at the local municipal level and social partners cannot promote local economic growth or provide other forms of assistance to impacted communities and coal workers without a plan. The plan lacks coherence, and it is also unclear who would convene and oversee which procedures to create and execute the numerous components of the plan (Malope, 2022).

In December 2020, President Cyril Ramaphosa established the Presidential Climate Commission (PCCC), a multi-stakeholder entity tasked with spearheading efforts to facilitate an equitable and fair transition towards a low-carbon economy resilient to climate change impacts. While the PCCC leads this initiative on a political level, it lacks the authority and the resources necessary for implementing a just transition at the grassroots level. Thus, all stakeholders are called upon to devise and execute measures to achieve a just transition across the nation.

2.6. Conceptual Framework

This section elucidates and synthesises prevailing theories that serve as the underpinnings and fundamental principles guiding the formation of a theoretical framework, aiding in addressing the research questions (Saunders et al., 2016). The research adopts a philosophical stance that underscores the significance of prioritising and maximising job creation amidst South Africa's transition from coal-based energy to increased wind energy deployment. The country's policy framework is structured to accommodate the distinct socio-economic complexities it faces and to advance the objectives of the Just Energy Transition. Among the pivotal factors under scrutiny in this study is the employment potential inherent in the wind energy value chain, with a particular emphasis on skills development and local manufacturing as pivotal levers for fostering job creation and the requirement for skills development and policy.

The Figure 2. 13 below visually demonstrates the dependencies and interlinkages of relevant concepts from the framework and how they apply to the wind energy value chain regarding potential sources for of job creation.

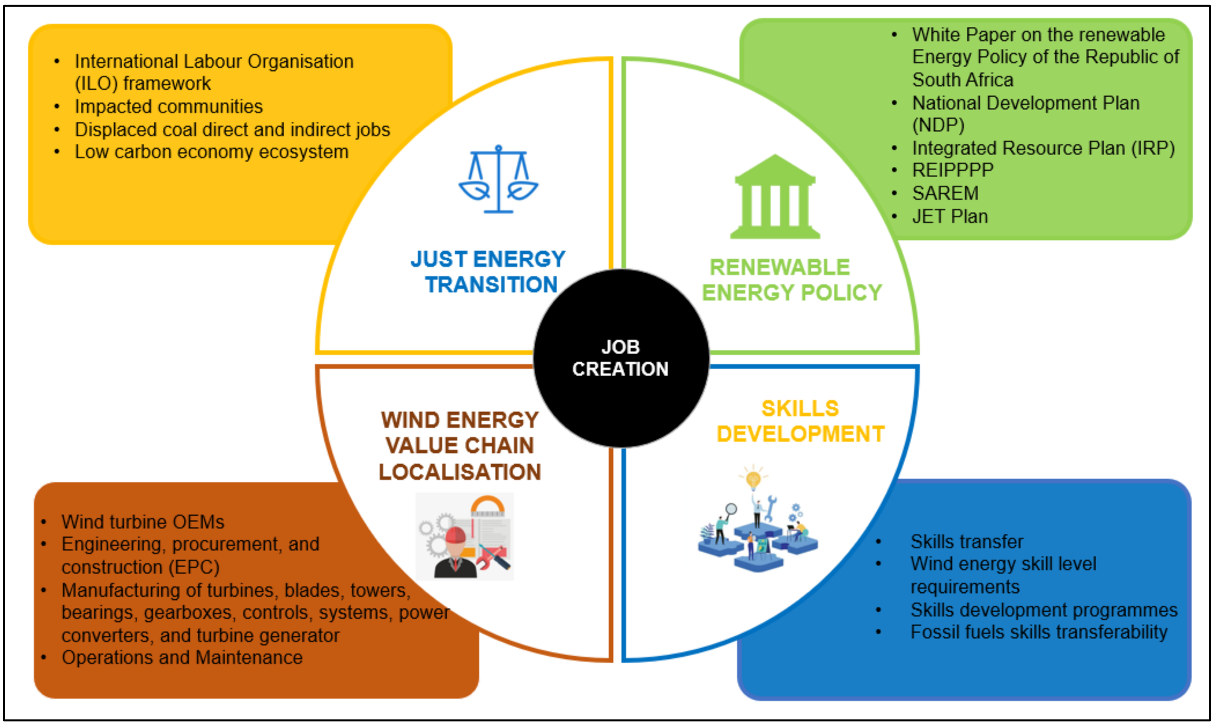

Figure 2. 13: Research study conceptual framework
Source: Author's own illustration

2.7. Conclusion of literature review

Numerous scholarly works delineate the profound ramifications of the energy transition, particularly highlighting the imminent upheaval it poses to communities reliant on coal and the workforce embedded within the coal value chain. Ensuring a just energy transition necessitates carefully considering the workforce affected, particularly in a developing nation such as South Africa, grappling with socio-economic adversities like poverty and pervasive unemployment. Despite the existence of policies, legislation, advocacy efforts, and political commitments, their efficacy in fostering job creation and community upliftment remains largely untested. A notable vacuum is discernible in the examination of how the energy transition from coal to renewables, such as wind energy, influences the employment dynamics in South Africa. Furthermore, there is a conspicuous gap in the precise strategic plan of employment opportunities within the renewable energy value chain and the requisite factors for optimising job creation in this sector. There remain knowledge gaps on how a Just Energy Transition would facilitate job creation in a society plagued by poverty, unemployment and inequality.

Table 2. 5: Consistency table outlining the research questions and propositions derived from the literature

RQ #	Research question	Prop #	Literature based proposition
RQ1	What are the employment effects of South Africa’s electricity generation transition from coal to wind energy?	P1	The energy transition is poised to disrupt the coal value chain, yielding notable ramifications for direct and indirect employment within the energy sector. The transition presents an employment risk for the workforce associated with the coal value chain, particularly in regions abundant in coal resources, such as Mpumalanga. The assessment of the net employment impact of this transition is characterised by conflicting perspectives and uncertainties attributed to inconsistencies observed in the diverse employment metrics utilised for reporting purposes.
RQ2	What are the factors that must be considered to promote an employment-led just energy transition?	P2	Factors to be considered in ensuring an employment-led just energy transition include addressing South Africa’s policy implementation gaps related to the transition's socio-economic impact, a clear directive on skills development for the low-carbon economy, and a focus on developing local manufacturing and assembly of turbine components.
RQ3	What are the job creation opportunities that can be explored along the wind energy sector value chain?	P3	The development of wind energy projects offers avenues for employment across various stages, encompassing project development, local manufacturing of certain components, construction, and

RQ #	Research question	Prop #	Literature based proposition
			operational activities. Each phase necessitates distinct skill sets and capabilities. It is imperative for South Africa to acknowledge these requirements and proactively identify strategies to optimise local job creation throughout the wind energy value chain.
RQ4	What recommendations can be made on how an employment-led just energy transition can be pursued without leaving anybody behind?	P4	Not applicable. The recommendations will allow for emerging themes in addition to the literature's predetermined categories.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction

Like the rest of the world, South Africa needs to transition from fossil fuels to employing more renewable energy sources as a mitigation measure against climate change. Great strides have been made in progressing the deployment of renewables such as wind energy in South Africa. Still, a knowledge gap remains in how to effectively combat the imminent negative socio-economic impact of South Africa's energy transition. This study aims to identify factors that must be considered to expedite wind energy deployment to enable maximum job creation, facilitating the Just Energy Transition in South Africa.

This Chapter outlines the methodological approach adopted to address the research aim and questions detailed in Chapter 1. The research methodology was designed to have a relationship between the research approach, data collection method, and data analysis techniques (Biggam, 2015). This chapter presents the research philosophy, approach and design that the study employs to address the research questions. It gives details of the study population, data collection methods, and data analysis techniques. The chapter concludes with a declaration of the study's limitations and the applied ethical considerations.

3.2. Research approach

A research approach is a researcher's overall strategy or study plan. It outlines the general framework and methodology used to gather, analyse, and interpret data (Sardana et al., 2023). The three most common research approaches are quantitative, qualitative, and mixed methods (Williams, 2007).

A qualitative research approach was adopted based on the study aim and the nature of the research questions, which is poised to explore and understand a complex phenomenon of job creation in the context of wind energy deployment in South Africa. Wind energy technology is still nascent and must be viewed through an explorative lens to fully comprehend its potential within the unique socio-economic context of South Africa. The qualitative research approach allowed for a better understanding of the subject matter by enabling a more collaborative and diverse range of inputs (Williams, 2007). By adopting a qualitative approach, it was possible to understand better all the employment factors associated with wind energy deployment in South Africa.

Creswell (2014) describes a qualitative data approach as systematically collecting data from a wide range of empirical material. According to Denzin and Lincoln (2011), this approach frees the study design from the constraints of structured questions, allowing it to explore the research topics flexibly. Employing the qualitative research methodology assisted in probing insights relevant to the study aim and questions from the unique perspectives and experiences of the study respondents (Hennink et al., 2023)

The flexibility of the qualitative research approach also enabled the study to probe further the required data to be collected to meet the desired objectives (Charli et al., 2022; Saunders et al., 2016).

A deductive approach was applied since the study started with a set of expectations on some factors that affect job creation, as illustrated in the conceptual framework in Figure 2. 9, to test them through data collection. The research study was confirmatory in nature and sought to confirm or disconfirm existing theories regarding factors impacting job creation as the country transitions to renewable energy sources (Petty et al., 2012).

3.3. Research design

This section outlines the overall plan, structure, and strategy that guided the research project from its philosophical conception to data analysis. The plan adopted was a logically structured process that systematically directed the research process to attain the study's primary and empirical evidence for subsequent analysis (Saunders et al., 2016).

The research onion model in Figure 3.1 was adopted to outline the different stages of the research process, associated elements of the research design, and the interrelationship between the study's theoretical perspective, research design, method of data collection, and data analysis (Saunders et al., 2016). This study's research design was informed by its research questions, as outlined in section 1.5 of this research report.

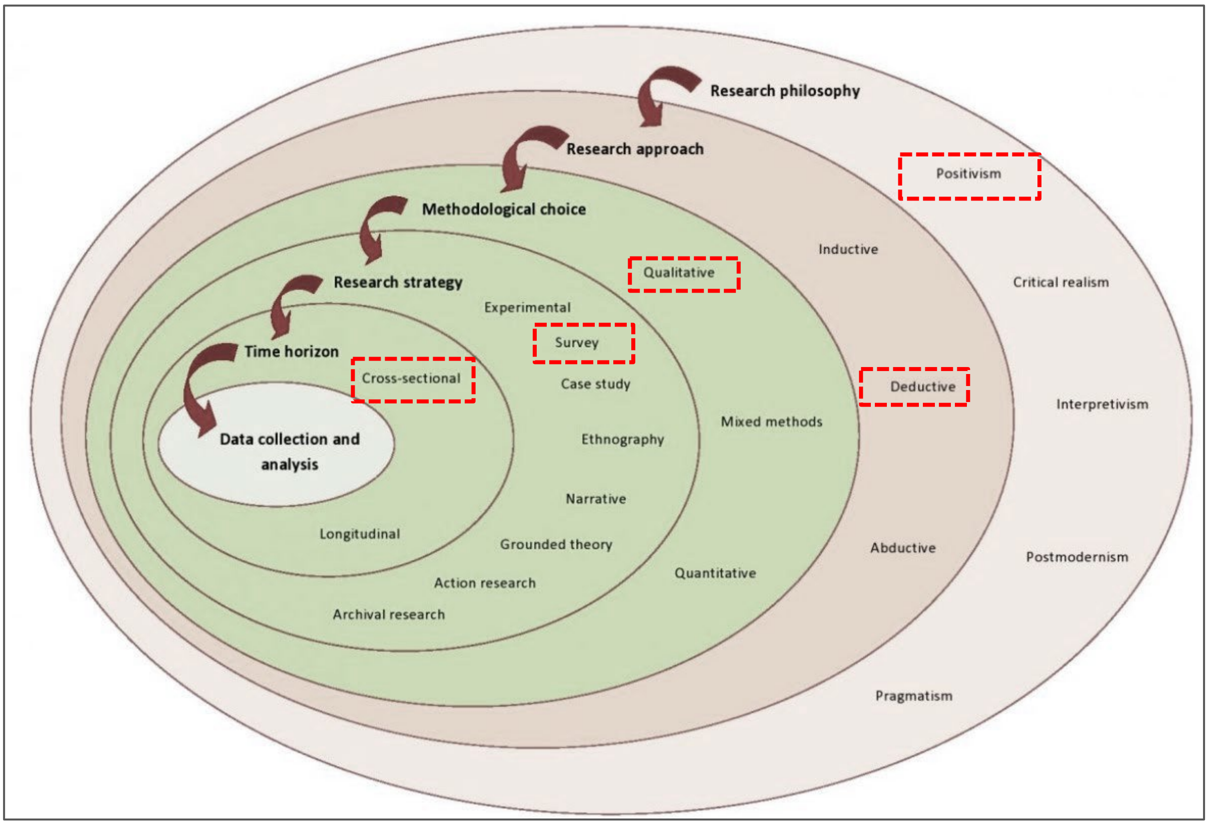

Figure 3. 1: Research Methodology Onion Model

Source: Saunders, M., Lewis, P., Thornhill, A., & Bristow, A. (2016). Research Methods for Business Students. *London: Pearson*.

In line with the research aim of identifying factors that must be considered to expedite wind energy deployment that enables maximum job creation, facilitating the Just Energy Transition in South Africa, the study adopted positivism as the research philosophy. The study involves an observable phenomenon: the need to maximise job creation as South Africa transitions to a low-carbon economy. Positivism emphasises the researcher's objectivity and the systematic study of observable phenomena (Saunders et al., 2016). Positivism applies the natural scientific principles to the social world in an independent way whereby data inform knowledge.

The research philosophy informed the deductive and qualitative methodological approach, further informing the data collection strategy. Surveys were the appropriate research strategy since they are effective in understanding the association between existing and new ideas regarding the research problem(Kothari, 2017). Cross-sectional research was applied since the data was collected from the respondents during the research study.

3.4. Data collection methods

Data collection involves collecting data required to respond to the research questions (Hennink et al., 2023; Kothari, 2017). Several research instruments can be used for data collection, such as interviews, which can be structured or semi-structured, focused groups, observations, and document analysis for qualitative studies (Hennink et al., 2023; Saunders et al., 2016). The study used primary and secondary data to address the research questions. Primary data was collected from semi-structured interviews conducted virtually, and secondary data was collected from open-source publications.

3.4.1. Semi-structured interviews

Building on the literature review, this study relied heavily on primary data collection in response to the research questions. The primary data collection involved semi-structured interviews with relevant stakeholders within the just energy transition ecosystem of South Africa and the wind energy value chain, as depicted in the following section that discusses the study population. Interviews can be structured, semi-structured or unstructured, and semi-structured interviews were utilised as they allow for structuring and guiding the interview based on the pre-determined areas of interest based on literature review findings (Petty et al., 2012). The researcher collected the primary data personally utilising semi-structured interviews in January 2024 following receipt of research ethical clearance from the University of the Witwatersrand.

The interviews were semi-structured, and the respondents from designated target groups were asked standard questions, guiding the conversation to focus on the pre-determined areas of interest the researcher wanted to explore. Semi-structured interviews allowed for flexibility in the collection of qualitative data, allowing for depth in participant responses and exploration of their insights, sentiments, and beliefs about the research questions (McGrath et al., 2019).

Interview dates and times were arranged once the respondents agreed to participate in the study and their consent to be interviewed was received in writing. The interviews were conducted virtually using Microsoft Teams to avoid excessive travelling and overcome geographic constraints. The interviews were about 30-45 minutes long, and the study participants were requested to consent to participate and allow recording of the interviews' audio for transcription into text. The relevant permission to record interviews and to use the information provided by study respondents in this study was managed within the parameters of the POPIA (Protection of Personal Information Act of 2021).

The applied data collection method enabled in-depth insights into factors that must be considered to expedite wind energy deployment in a manner that enables maximum job creation in South Africa. The open-ended questions and propping questions facilitated in-depth responses from the participants. The drawbacks that can be noted were the significant time investment required to conduct the interviews. The researcher also had to be cautious and guard against bias by ensuring that leading questions were not asked (Adams, 2015).

3.4.2. Document analysis

Secondary data comprises of published data that is easily accessible and attainable from research conducted by other researchers or institutions (Kumar, 2014). In this case, secondary data was collected from journal articles, policy documents, annual reports, media articles and statements, statistical data on job creation, regulations and prescriptions, and other documented information from the Department of Mineral Resources and Energy and related international agencies. The themes underpinning the analysed documents were derived from the conceptual framework depicted in Figure 2. 9, which encompasses the notion of the just energy transition and its repercussions on employment within the coal value chain, the prospects offered by the wind energy value chain, and the efficacy of the policy landscape in facilitating a just energy transition that leaves no one behind.

A systematic approach inspired by the study's conceptual framework was employed, directing the selection of literature genres to offer context, comprehension, and interpretation. Secondary data pertinent to the research questions is illustrated in Figure 3.2 below (Kumar, 2014):

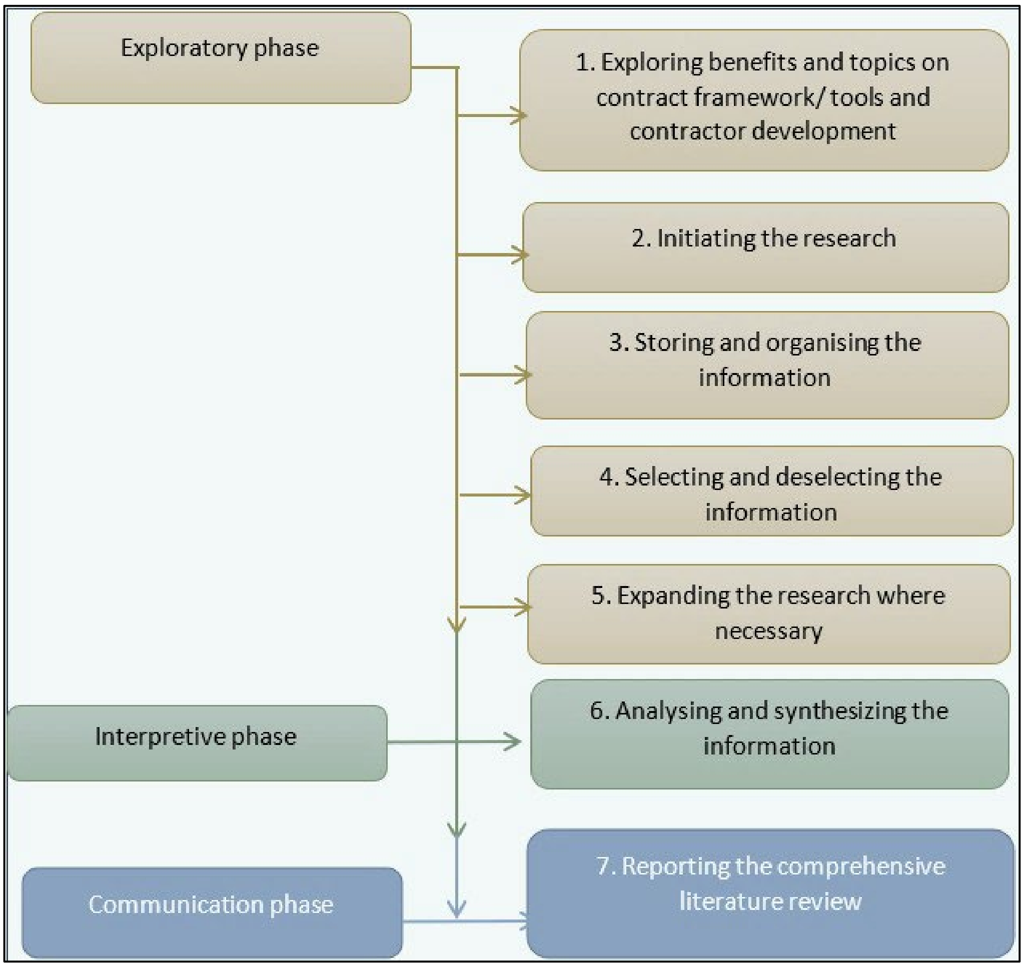

Figure 3. 2: Systematic Approach to Literature Review of Secondary Data

Source: Biggam, J. (2015). Succeeding with Your Master's Dissertation: A Step-by-Step Handbook. *London: McGraw-Hill Education*.

3.5. Study population and sample

3.5.1. Population

(Flick, 2011) describes a study's population as the collective of all possible research objects about which a statement is intended. For this study, the study population comprised a cross-sectional sample population reflective of relevant stakeholders within the just energy transition ecosystem of South Africa and the wind energy value chain, as depicted in Figure 3.3 below.

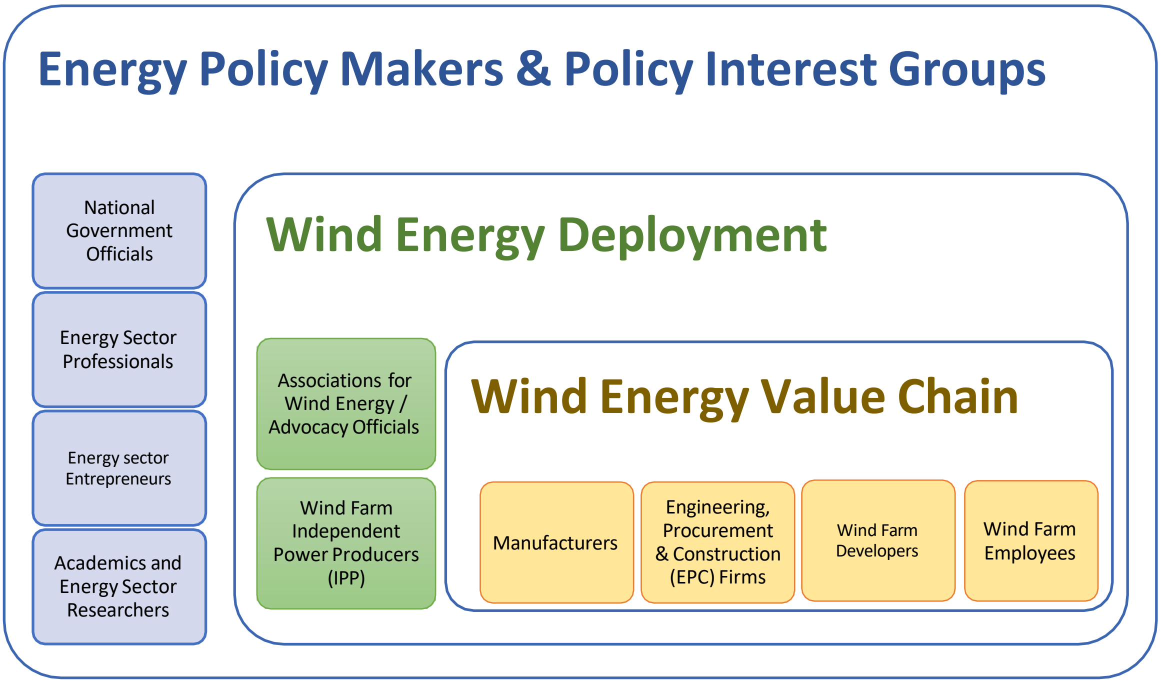

Figure 3. 3: Study Population
Source: Researcher's own illustration

The research study's population was the various stakeholders involved in the energy transition discourse and deployment of wind energy in South Africa, both from a policy point of view and those involved in the value chain of wind energy deployment in South Africa.

The definition of the population groups and their various roles and expertise that are aligned with the research aim and questions are outlined below:

a) Policymakers and policy interest groups

- *National government agencies and state-owned enterprise officials:* Respondents are responsible for setting, implementing, and tracking the policy objectives that govern the Just Energy transition, promoting industrial policy, and deploying renewable energy sources.
- *Energy sector professionals and Entrepreneurs:* Respondents are affected by the policy formulations of the transition to energy sources like wind.
- *Academics and energy researchers:* Respondents include economists, energy professionals, and policy practitioners who are members of policymakers and interest groups.

b) Wind Energy Value Chain & Deployment Stakeholders

- *Associations for Wind Energy / Advocacy Officials:* Respondents from government or public associations for wind energy advocacy.

- *Wind Farm Independent Power Producers (IPP):* Respondents are essential stakeholders in developing and procuring renewable energy.
- *Manufacturers:* Respondents are manufacturers of components utilised in developing wind farm projects.
- *Engineering, Procurement & Construction (EPC) Firms:* Respondents are responsible for designing and implementing wind farm projects.
- *Wind Farm Developers:* Respondents are wind project developers who have previously submitted bids for renewable energy contracts during any bid windows. A consortium of multiple stakeholders involved in wind farm deployments in South Africa, such as financiers, engineering, procurement and construction (EPC) firms, and international wind turbine original equipment manufacturers (OEM), are involved in the auction bidding process.
- *Wind Farm Employees:* Respondents are personnel involved in wind energy farms' operations, monitoring, and maintenance.

3.5.2. Sample and sampling method

The sampling method that the study adopted is purposive sampling, whereby the study participants were selected according to their relevance in obtaining key insights regarding job creation impact as the country transitions from fossil fuels and deploys more wind energy farms for power generation (Petty et al., 2012). Expert purposive sampling is a non-probability sampling method whereby the researcher identifies relevant participants for the research topic who have appropriate experience and expertise in the energy transition discourse and are willing to participate in the study (Andrade, 2021). Non-probability purposive sampling methods are used for data collection from the targeted population whose professional experiences align with the criteria required to answer the study's research questions (Saunders et al., 2016).

For this research study, expert sampling was adopted for data collection, and the researcher reached out to professional experts with diverse experience, as illustrated in Figure 3.*3*, to gain insights into the research questions. The recruitment process of the study participants from the targeted population is outlined in Figure 3.*3* was inclusive. The criterion for interviewees was that they should be stakeholders in the just energy transition discourse and wind energy deployment in South Africa and have at least five years' experience in their area of expertise.

The study envisaged that data would be collected from a sample of no more than 20 research respondents within the sampling frame depicted in Figure 3.*3*, possessing varying professional backgrounds and having a vested interest in the just energy transition from fossil fuels to wind energy in South Africa. The widely applied sample size is 15 to 50, with an average of 15 research respondents for qualitative research (Mason, 2010). However, 18 respondents were interviewed as saturation of the information received occurred (Mason, 2010). The respondents had a blend of policy formulation and wind value chain expertise. Ten of the respondents had strong experience in renewable energy policy, and the balance of eight respondents had more experience in the wind energy value chain. Some respondents had fulfilled several roles in renewable energy that gave them experience in policy formulation and implementation, wind energy value chain, and project development. 17 out of the 18 respondents had Master's degrees as their highest qualification level, with one respondent having a PhD.

The selected sample provided in-depth insights into addressing the research questions as the participants had experience in the various areas of the research study, as illustrated in Table 3.1.

Table 3. 1: Demographic profile of respondents

Respondent	Current Role / Position	Expertise	Total Years of Experience
Respondent 1	RE Product Developer	Project Development RE Financier	6
Respondent 2	Energy Specialist	RE Advocacy RIEPPPP	15
Respondent 3	Wind Farm Technical Support Engineer	Wind OEM Wind Farm O&M	10
Respondent 4	Chief Economist at DMRE	Policy Formulation JET Framework Climate Commission	7
Respondent 5	Enterprise Development in RE	RE Advisory RIEPPPP	6
Respondent 6	Independent Researcher	Policy Advisory Research	8
Respondent 7	Head RE Business Development	Wind OEM Wind Farm EPC REIPPPP	10
Respondent 8	Policy & Regulation Specialist	Policy Monitoring RE Advocacy Research	7
Respondent 9	Renewable Energy Product Developer	Wind OEM Wind Farm EPC REIPPPP	6
Respondent 10	ESD Specialist	Policy Monitoring	7

Respondent 11	VP Regulatory & Policy	Project Dev Policy Formulation REIPPPP	15
Respondent 12	Energy Sector Professional	Project Dev RE R&D	6
Respondent 13	Principal Specialist RE	Wind OEM Wind Farm EPC REIPPPP	9
Respondent 14	Head of Just Transition	Policy Formulation Strategy	10
Respondent 15	RE Project and Business Development	Wind OEM Wind Farm EPC REIPPPP	9
Respondent 16	Policy Advisory	Policy Formulation Strategy	10
Respondent 17	Grid Engineer	Wind OEM Wind Farm EPC	6
Respondent 18	Climate Change Policy	RE Advocacy Policy Monitoring	11
	Total number of respondents	**18**	

3.6. Study Research Instrument

In this study, semi-structured interviews served as the research instrument for data collection, ensuring that inquiries pertinent to the research aim and objectives were posed and deliberated upon with the interviewees (Castillo-Montoya, 2016). Interviews are characterised as dialogues involving one or multiple individuals posing focused questions, actively listening, and fostering rapport (King et al., 2018). The data collection approach was cross-sectional since all the interviews were conducted at a single time in January 2024; hence, the study insights collected are relevant to a particular point in time.

The research semi-structured interview guide comprised two sections. The first section was a questionnaire to capture general information on the study respondents' work experience and critical areas of expertise concerning the energy transition. The second section comprised a list of questions to examine the views of study respondents on their knowledge and insights into what the employment effects of the energy transition are likely to be, what factors need to be considered to promote an employment-led just energy transition, what are job creation opportunities that can be explored along the wind energy sector value chain, and finally, what recommendations can be made on how an employment-led just energy transition can be pursued without leaving anybody behind.

The guided interview questions were formulated to ensure they all linked to the study's research aim and questions. Although the questions were structured, they were open-ended, and the interview was flexible, allowing participants to zoom into details closer to their experience. The guide also had probing questions for clarity and to guide the discussion within the theoretical framework outlined in Chapter 2. See Appendix B for the interview guide.

The interview guide enabled the in-depth collection of research questions within the planned interview time. The open-ended questions and propping questions facilitated in-depth responses from the participants. However, the drawback was the significant time investment required to conduct the interviews. The researcher also had to be cautious and guard against bias by ensuring that the probing for further clarity did not steer the respondents in a specific direction (Adams, 2015).

3.7. Procedure for data collection

Participants of the research study that meets the criteria outlined in section 3.5 (study population) were identified from a LinkedIn search using the areas of expertise relevant to the study as a search criteria. Speakers of various webinars on the Just Energy Transition were also identified, as well as authors of certain publications in the public domain on the subjects relating to the research study objectives. Some of the study participants were accessed through referrals. The participants were approached in their private capacity and not as representatives of their respective organisations. This was done to eliminate the need to request permission from organisation gatekeepers and to obtain the experts' views without conflict of interest. The researcher approached the potential participants by first introducing herself and the study being undertaken via emails and LinkedIn messages.

The email requesting participation in the study was sent to the potential participants accompanied by the participation information sheet, which outlined the objectives of the research study, the intended study population and the eligibility criteria, what participation entails, the assurance that the interview data will be treated in a manner that protects the identity of the respondents, and the contact details of the researcher for any questions. See Appendix A for the Participation Information Sheet.

Once the willingness to participate was confirmed, an interview guide and the consent form were shared with the study participant, and the virtual interview was scheduled for 1 hour based on their preferred date and time. See Appendix B for the Participation Consent Form and Appendix C for the Interview Guide. All the interviews were conducted via the Microsoft Teams virtual platform to eliminate the need for excessive travelling. The functionality of recording and transcribing meetings on Microsoft Teams was utilised, and the participants were informed as soon as the interview recording started.

The process of setting up the interview was guided by the process framework, which can be summarised in the following steps (Raworth, 2019):

a) Introduction of the researcher and communication of the study's problem statement, objectives, purpose, and scope with the study participants.
b) Obtaining the participant's consent based on the discussed and agreed confidentiality and anonymity extent that can be provided.
c) Determine the interview location that will be convenient for the participant and align it with the researcher's availability.
d) Scheduling the interview date and time to meet the availability of the participant and honouring the interview.
e) Providing a translator where necessary (all the interviews were in English, which eliminated the need for a translator).
f) Recording the interview audio for future transcribing and analysis to minimise the need for excessive note-taking during the interview.

The research protocol was implemented to direct the interview. Using the interview guide, probing questions were asked to obtain in-depth insights from the study respondents. Once the semi-structured interview was conducted, the recording was transcribed to convert the audio into text data (Castillo-Montoya, 2016).

3.8. Data analysis and interpretation

The study used the thematic data analysis method, the most used method in qualitative data analysis, where patterns are studied using codes and themes derived from the data set (Petty et al., 2012). The advantage of thematic analysis is its relative simplicity and flexibility in using both primary and secondary data (Jenna, 2021). Deductive thematic analysis was applied, and a pre-determined set of theme categories was defined based on prior knowledge and existing theory covered in the literature review. Deductive thematic analysis helps examine how specific pre-existing concepts or theories manifest in the research data (Terry et al., 2017). It allows for a structured and theory-driven analysis, making drawing connections between the data and established theoretical perspectives easier. The pre-determined themes regarding factors that must be considered to expedite wind energy deployment in a manner that enables maximum job creation in South Africa are the renewable energy policy and regulatory framework, skills development, the wind energy value chain and the just energy transition framework as outlined in the conceptual framework in Figure 2. 13: Research study conceptual framework.

The initial step following data collection was to gain familiarity with the data by reading the interview transcripts several times to reflect and interrogate the data and obtain insights into the issues based on the participant's responses, experiences, perceptions, and thoughts (King et al., 2018). Pseudonyms were also used to preserve the confidentiality of the participants. The naming convention used was Respondent 1, 2, 3, etc. and any personally identifiable information was removed from the data. Every transcript was thoroughly verified, and audio recordings were carefully compared with the exact transcriptions. This step aimed to enhance the reliability of the data by confirming that research respondent responses were precisely and faithfully represented.

A computer-aided qualitative data analysis software program (CAQDAS) called Atlas.ti, which provides a range of features for organising, analysing, and visualising qualitative research data, was used. The raw data, in the form of transcripts, was uploaded to the program for analysis. The first step in data analysis was to read through each transcript, assign codes from the interview transcripts individually, and highlight all the respondents' quotations related to the research questions. Codes are labels assigned to text from interview transcripts used to summarise essential concepts, and themes are patterns derived from similarities and relationships identified from the data set (Terry et al., 2017). The coding process involved thoughtful reflection, enabling the identification of text segments and the assignment of labels to index them in relation to a particular theme (Nowell et al., 2017). Codes from the data set were then analysed for patterns and similarities for grouping according to the pre-determined themes (Terry et al., 2017). The analysis process was iterative and reflective, involving a continuous back and forth. While deductive thematic analysis generally starts with a predefined coding theme, the analysis was flexible. It allowed for the application of predetermined codes and themes to the raw data and the development of new codes and themes that were not initially considered but emerged from the data. The themes were then reviewed and evaluated for relevance to the research questions; some were merged, and others were eliminated.

Atlas.ti software is equipped with visualisation tools, such as networks and diagrams, to represent relationships and patterns identified in the data, such as code or theme frequencies and distribution across the data. This was used to aid the presentation of findings in a visually compelling manner. The research findings were interpreted within the context of the theoretical framework in Chapter 2, whereby patterns, relationships and insights informed a deeper understanding of the research questions.

3.9. Limitations of the study

Research limitations refer to the parameters and constraints that are out of the researcher's control but can potentially impact the study's outcome (Simon & Goes, 2013). One of the research constraints noted was the scale and extent of the study's data collection, given its focus on job creation in relation to wind energy deployment in South Africa. The limitation that the research methodology presented was time constraints in conducting multiple interviews across all the different stakeholders of wind energy deployment to get a wide spread of views and insights from which to draw conclusions. The research methodology incorporated a qualitative approach, which is time intensive as it requires considerable time for data collection and analysis. To overcome this limitation, participants were selected intentionally to ensure they had in-depth knowledge about the study subject. Another limitation was the willingness and availability of the study participants that were approached. Some approached potential participants who were unwilling to participate in the study, and others were unavailable during the required data collection period.

Finally, while the study would have benefited from long-term trend analysis and scenario-building, this was impossible because of the once-off data collection. The data collection approach was cross-sectional since all the interviews were conducted at a single point in time in January 2024; hence, the study insights collected are relevant to a particular point in time. Longitudinal studies require a longer time commitment, as data is collected at multiple points over an extended period (Petty et al., 2012).

3.10. Study trustworthiness

Trustworthiness in research refers to the concept of ensuring that the research data collection methodology results in findings that are accurate, dependable, and can be confidently used to make interpretations and conclusions (Nowell et al., 2017). Trustworthiness in this qualitative research study was demonstrated by applying protocols of credibility, transferability, dependability, and confirmability for data collection through semi-structured interviews (Lincoln & Guba, 1985; Nowell et al., 2017).

3.10.1. Credibility

In this research study, credibility was enhanced by adhering to the study protocol to maintain consistency in conducting the research. To bolster credibility, meticulous record-keeping was employed, and the participants' responses and insights were audio-recorded on Microsoft Teams and reviewed several times for accurate transcription. Throughout the interview phase, member checking was implemented, involving the restating of information by participants and accuracy validation through probing questions (Raworth, 2019). Sufficient time was invested for each interview to ensure the respondents were engaged, allowing for in-depth insights into the research questions (McGrath et al., 2019). During data analysis, codes and themes were used to group standard views from the study participants, ensuring that the diverse frames of reference were captured (Terry et al., 2017).

3.10.2. Transferability

Transferability refers to the extent to which the study findings can be applied or transferred to other cases (Tobin & Begley, 2004). The details of the study's conceptual framework in Figure 2. 9, the study participants and the criterion for the population are clearly outlined in Figure 3. *3*, which gives sufficient information to those who seek to transfer the findings to their enquiry to judge transferability (Nowell et al., 2017). Furthermore, the study interview guide questions give a detailed description of the guided questions that were used to answer the research questions.

3.10.3. Dependability

The dependability of the research study was established by ensuring that the research process is logical, traceable, and transparent documentation (Tobin & Begley, 2004). The research methodology was designed on a logical process, as outlined in Figure 3. *1*, to ensure that the methods applied are replicable and consistent (Saunders et al., 2016). The semi-structured interview guided questions and probes were formulated based on a thorough assessment of the literature, and the questions were tested through multiple interview dry runs to ensure that they were comprehended as intended, thus ensuring dependability. To further enhance dependability, the Microsoft Teams simultaneous recording and transcription functionality was utilised with the participants' consent (King et al., 2018). The transcripts were later meticulously checked for accuracy.

3.10.4. Confirmability

To fulfil the confirmability criteria, which emphasises transparency in data collection, interpretation, and findings, the research study was thoroughly documented, and a comprehensive record of the raw data and analysis method was utilised (Tobin & Begley, 2004). Atlas.ti, a computer-aided qualitative data analysis software program, enabled effective data management under one electronic platform and transparency in the data analysis with an unbiased view of how the conclusions and interpretations were reached.

3.11. Ethical considerations

This study complied with the University of the Witwatersrand's Research Ethics policy and Research Ethical Committee procedures on conducting ethical research. All research activities in this study were conducted under the auspices of the university's ethics clearance guidelines. Whenever research involves human participation, the core principles of honesty, objectivity, respect, confidentiality, consent, accountability, integrity, safety, transparency, protection, non-discrimination, and legality must be taken into account as both moral and legal obligations (Farrimond, 2017; Resnik, 2023). Such principles were applied during all the engagements with potential participants and the actual study respondents who were interviewed.

Appropriate ethical considerations that this study considered include providing a detailed information sheet to prospective study respondents on the project and allowing them the right to choose whether or not to voluntarily participate in the study. Seeking informed signed consent from study respondents before interviewing them was also an ethical consideration. The consent form guaranteed anonymity, free will, and protection from prejudice to all study respondents. It assured them of their rights and free will to withdraw from participating in the study at their discretion during the interviews should the need arise. Consent was obtained by discussing the context of the study, the requirements for participation, the measures in place to ensure the anonymity and confidentiality of the research participants, and the associated risks linked to participation (Ramabu, 2020). Beneficence and non-maleficence were applied to the research participants by intentionally maximising the study's positive benefits and identifying, assessing, and minimising potential risks for the participants (Pieper & Thomson, 2016). Participating in the study did not pose any emotional, physical or psychological harm to the participants (Brear & Gordon, 2021). The participants were informed that while the study's results might not directly benefit them, there could be indirect advantages in the broader just energy transition discourse if the study recommendations were implemented.

3.12. Consistency table

Table 3. 2: Consistency table - research questions, literature-based propositions, data collection and data analysis method

RQ #	Research question	Prop #	Literature based proposition	Data collection detail	Data analysis method
RQ1	What are the employment effects of South Africa's electricity generation transition from coal to wind energy?	P1	The energy transition is poised to disrupt the coal value chain, yielding notable ramifications for direct and indirect employment within the energy sector. The transition presents an employment risk for the workforce associated with the coal value chain, particularly in regions abundant in coal resources, such as Mpumalanga. The assessment of the net employment impact of this transition is characterised by conflicting perspectives and uncertainties attributed to inconsistencies observed in the diverse employment metrics utilised for reporting purposes.	Interview guide questions 2.1 and 2.2	Thematic analysis
RQ2	What are the factors that must be considered to promote an employment-led just energy transition?	P2	Factors to be considered in ensuring an employment-led just energy transition include addressing South Africa's policy implementation gaps related to the socio-economic impact of the transition, a clear directive on skills development for the low-carbon economy, and a focus on developing local manufacturing and assembly of turbine components.	Interview guide questions 3.1, 3.2 and 3.3	Thematic analysis

RQ #	Research question	Prop #	Literature based proposition	Data collection detail	Data analysis method
RQ3	What are the job creation opportunities that can be explored along the wind energy sector value chain?	P3	The development of wind energy projects offers avenues for employment across various stages, encompassing project development, local manufacturing of certain components, construction, and operational activities. Each phase necessitates distinct skill sets and capabilities. It is imperative for South Africa to acknowledge these requirements and proactively identify strategies to optimise local job creation throughout the wind energy value chain.	Interview guide questions 4.1, 4.2 and 4.3	Thematic analysis
RQ4	What recommendations can be made on how an employment-led just energy transition can be pursued without leaving anybody behind?	P4	Not applicable. The recommendations will allow for emerging themes in addition to the literature's predetermined categories.	Interview guide questions 5.1	Thematic analysis

CHAPTER 4. PRESENTATION OF FINDINGS

4.1. Introduction

Research findings obtained from the semi-structured interviews that we conducted virtually to address the research aim and questions outlined in Chapter 1 are presented without any interpretation or alteration in this chapter. The study findings were obtained from 18 respondents with more than five years of experience in the energy sector and expertise in just energy transition-related policy and the wind energy value chain. The raw data in the form of interview transcriptions was analysed using Atlas.ti, a computer-aided analysis software for qualitative data. The analysis method involved assigning codes to the data and grouping the codes according to the themes identified from the research theoretical framework in Chapter 2. The coding process allowed for the application of predetermined themes to the raw data and the development of new themes that were not initially considered but emerged from the data.

The study findings are structured and organised based on the group of themes that address the research aim of identifying factors that must be considered to expedite wind energy deployment in a manner that enables maximum job creation in South Africa. The sections are structured based on themes about each study research question, with an outline of the code distribution and quotations from the study respondents to substantiate and support each identified theme.

4.2. Findings about Research Question 1

RQ1: What are the employment effects of South Africa's transition from coal to wind energy for electricity generation?

The primary intent of this research question was to discern the prospective employment ramifications stemming from the energy transition within South Africa, where the prevailing energy landscape predominantly relies on coal-based resources. The study respondents were asked to give their insights regarding the possible net employment effects of the transition considering the shift from coal to renewable energy sources. The respondents were probed to share their deep insight on the threats and opportunities the transition presents for the impacted workforce and communities. Two themes identified from this research question's findings were the *displacement of coal value chain direct jobs* and the *negative impacts on economic ecosystem and indirect jobs in coal rich provinces.*

4.2.1. Theme 1.1: Displacement of coal value chain direct jobs

Most of the study respondents expressed that one of the significant threats of the transition is the loss of coal value chain jobs, which the renewable energy value chain might not accommodate. The workforce that will be affected the most is those based in coal-rich regions of the country, such as Mpumalanga. The responses received were assigned codes, and the distribution of codes under the theme of displacement of coal value chain direct jobs is summarised in Figure 4.1 below.

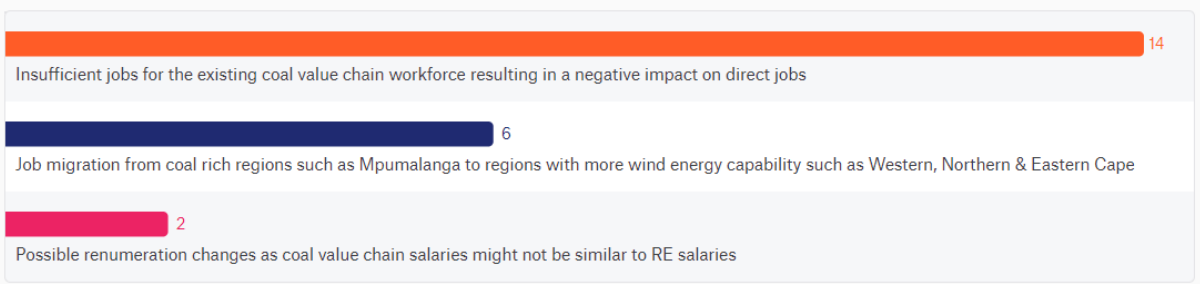

Figure 4. 1: The code distribution for Theme 1.1

Source: Author's illustration based on Atlas.ti data organising and visualising functionality

Most of the participants argued that the coal value chain employs a large number of people, which might not be accommodated in the wind energy value chain, which requires fewer people.

"…so I do think there's a risk that the net employment effect will be and such the renewables sector doesn't quite absorb all the labour that maybe is currently within the fossil fuel sector." (Respondent 1)

"It's a bit hard to try to match the existing workforce with what is to come in terms of the energy transition. Yeah, to be honest, it's going to have a negative impact or effect on employment in South Africa's labour force. Because when you look at the transition and the number of resources or the workforce that is required for the different energy sources..." (Respondent 12)

Several respondents alluded to the fact that the potential job losses will be due to a lack of focus on local manufacturing, with a policy framework focusing on job creation that is only considered late.

"When will manufacturing become a reality in South Africa is something that is not clear. Currently, more than 150,000 people are employed in the coal value chain, from mining to Sasol processing and then to power stations. 150,000 people that are employed already,

whether renewables are going to create those jobs because if you take a coal power plant and a wind farm, the employment disparities there are huge." (Respondent 4)

"Hmm, so I was saying that it's going to be hard to calculate the exact employment impact, except that it is going to be negative. And it's going to lead to job losses. And I say this because only now are we talking about the South African renewable Energy master plan, only now people are talking about localisation, manufacturing, job creation, this conversation should have happened in 2008 or 200…" (Respondent 2)

"…There's definitely still going to be a lot of the workforce that are unemployed based on this because we simply cannot absorb all of these people. We don't have the supply chain. We don't; we're not manufacturers of any of these components. So, we can't redeploy some of the labour forces to other value chain streams such as manufacturing and all…" (Respondent 18)

Another respondent highlighted that for certain skill levels within the coal value chain, there are no comparable roles to transition to, which will result in job losses.

"If, however, you are a coal miner, what are you going to transition to? And you can't just say, uh, but there are other minerals; you can do iron, or you can do platinum. Those industries already have their own miners, and they are packed. They've got thousands of miners, and they are getting retrenched. So if you were, for instance, a coal miner working in the A coal belt, and your mine was supplying Komati, and it shut down, and you were managed to find a job, let's say in the platinum mines, they're currently retrenching like crazy now as well. So your life is basically just spent moving from one area to the next, being retrenched; there's no job security in that aspect." (Respondent 9)

Other changes that will be brought about by the transition relate to the salary scales, which might be different between jobs in the coal value chain and jobs in the wind energy sector.

"And the other challenge as well is that once the next jobs are done, maybe there will be another challenge, which is compensation because mining jobs pay relatively well in South Africa. Uh, there's no guarantee that jobs in the clean energy forms will be commensurate in terms of compensation." (Respondent 14)

"But many of them probably won't because they became drill operators overtime on the job, getting guidance, doing courses, getting qualified, doing his thing. Where can that guy go and work for an equivalent salary in renewables? That just doesn't exist." (Respondent 5)

Coal mining and processing in South Africa are primarily based in Mpumalanga. However, wind projects are deployed in the Western, Northern, and Eastern Cape, which creates a dynamic job migration from coal-rich regions to regions with wind energy potential. Several respondents highlighted this effect.

"Northern Cape, Western Cape is actually, you know, become a hub, and businesses have started to, you know, emerging and all of those things, so it's more of it's that the jobs are shifting more than they are being lost, so to speak. So, like I said, I look at it in that sense that looks like, yes, as much as jobs are no longer here, but they are happening somewhere else." (Respondent 13)

"…but I think definitely the jobs are shifting to different places, and it's not such that somebody's coming and stealing your job. But I think if you look at it like I said, the Northern Cape, the Western Cape, parts of those remote towns are now bubbling, and they're energised in the way that they were not before. So there's definitely a job shift." (Respondent 17)

"…because there might be opportunities in the Cape and someone is in Mpumalanga, are they necessarily willing to move there and start a new life?" (Respondent 4)

Other respondents were of the view that jobs created by coal-powered power stations should not be compared to jobs in the renewables value chain since the two energy systems are vastly different.

"The renewable projects are not necessarily also going to be where you close your power station, so there's already an unfairness in comparing them. For instance, if I am closing Medupi and there are 2000 people in that value chain, they are all in Limpopo. They aren't wind farms and solar farms that are going to be in the area that those people can benefit." (Respondent 5)

"What we should be thinking about is we're moving from one economic and power paradigm to a new one. And what are the consequences of that and not because of it? They've just what are the consequences? The consequences are that when you close down the power station, there are people employed there who will need a plan after that, as well as their enterprises, businesses, and value chains that depend on that operation, for which we will need a plan after that. And then there is the potential, maybe, for a new economic activity when we close that down." (Respondent 17)

Another respondent highlighted that the real job impacts are not due to the transition but to the energy security challenges that South Africa is facing.

"So if we wanted to talk about jobs, I think the real job impacts are in the broader economy; the loss of jobs and the broader economy because of a lack of energy security because of the under-delivery of Eskom is probably far more pronounced than the kind of jobs that could be created in these small wind energy farms?" (Respondent 6)

4.2.2. Theme 1.2: Negative impacts on the economic ecosystem and indirect jobs in coal rich provinces

A few respondents also highlighted the impact of the transition on the economic ecosystems linked to the coal value chain in the communities in coal-rich regions of the country. The general sentiment was that the transition would impact the livelihoods of communities and business activities in these regions, as indicated in Figure 4.2 below.

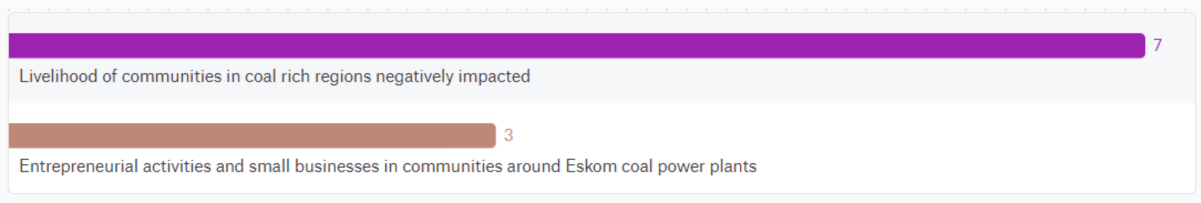

Figure 4. 2: Code distribution for Theme 1.2
Source: Author's illustration based on Atlas.ti data organising and visualising functionality

Most of the respondents alluded to the fact that communities have been established around coal mining and processing in South Africa, and the transition will impact their livelihoods and the indirect jobs created by entrepreneurial activities in those regions.

"…There's a whole lot of communities, you know, that is highly dependent on the power station as their form of income..." (Respondent 17)

"So I think also if you look at the impact in terms of the communities, it's a very negative impact because of the semi-migration that would need to happen if we want to reskill as the existing labour force and move to renewables." (Respondent 12)

"...a good example is the Komati power plant that recently shut down. Based on engagements afterwards, the people appreciated why it needed to be done and recognised the basis of the shutdown. What they were concerned about was that the new opportunities did not arise quickly enough by the time the old power plant was shut down. So it's that intervening period between the old technology being decommissioned and then the new opportunities arising." (Respondent 4)

4.2.3. Conclusion of research question 1 findings

The findings presented above indicate that the energy transition presents some employment risks to the current coal value chain workforce. The underlying factors resulting in the potential job losses have been highlighted as the disparity between the number of employment opportunities that the coal value chain presents and the significantly lower employment opportunities applicable to the wind farm. The transition was also noted to have a negative impact on the communities in coal rich regions of the country. The livelihoods of the communities would be negatively impacted, as well as the entrepreneurship opportunities that form part of the coal economic ecosystem in those regions.

4.3. Findings pertaining to research question 2

RQ2: What are the factors that must be considered to promote an employment-led just energy transition?

The research question focused on gaining insights into the factors that need to be considered to promote an employment-led just energy transition. Based on the literature and conceptual framework detailed in Chapter 2 and the predetermined research categories, the semi-structured interview questions were centred on South Africa’s existing renewable energy policies, such as the IRP, REIPPPP, and SAREM. Respondents were asked about their views on the adequacy of the policy landscape in addressing job creation as a just energy transition imperative. They were also probed to give their deep insights on the predetermined themes, such as skilled development and manufacturing as enablers for job creation.

4.3.1. Theme 2.1: Policy and regulatory framework that addresses the creation of sustainable jobs

Many of the study participants emphasised the importance of enhancing the policy and regulatory framework in South Africa. While they acknowledged the significant progress made in policy development and the adoption of various plans and policies, they also pointed out specific areas for improvement, particularly in relation to job creation during the transition from coal to increased wind energy deployment. The code distribution related to this research question can be found in Figure 4.3 below.

Figure 4. 3: Code distribution for Theme 2.1

Source: Author's illustration based on Atlas.ti data organising and visualising functionality

One of the respondents acknowledged that the REIPPPP consideration for economic development as policy elements that must be kept in place and not diluted.

"But I think through the REIPPPP and how it's structured with considerations for economic development in the areas where these plants are built and the local content side of things. I don't think we should lose that or dilute that requirement too much so that we ensure that there is a spillover of skills and benefits that these plants give towards the local communities in which they are housed or built." (Respondent 1)

Many of the study participants pointed out deficiencies in current policies when it comes to their ability to promote economic growth and generate lasting employment opportunities. The main issues identified included a lack of concrete plans for implementation and a slow pace of execution. Respondents also mentioned how countries like China are successfully pursuing renewable energy initiatives without sacrificing economic progress in their own domestic markets.

"...we're never going to compete with China or any of the world superpowers out there regarding the manufacturing of wind components, for your argument's sake. And we've got a policy issue, an implementation issue, which happens very, very late." (Respondent 2)

"But the government itself needs to have a plan and needs to have a focus policy area, and this is why the renewables do not have the intended benefits that people assumed that they would have, umm, in terms of jobs, in terms of economic growth, in terms of anything. Everything including and ending load shedding or even additional capacity." (Respondent 17)

"I don't think there's a lack of thought that's gone into this, whether it's the SAREM or the Just Energy Transition Partnership and the Investment Plan or the multiple plans and funds. There

is definitely an implementation gap." (Respondent 6)

…the issue is policy implementation. If only there was consistency in following what is in the policy. So, let's put it into context, right? We waited for a long time for the IRP 2019 to be finalised. And then so you look at that because there are delays investors were not in place localise and improve local business. We would have captured the market in South Africa, but there's uncertainty in terms of the policy implementation.

Policy geared towards promoting local manufacturing and advancing local content was highlighted to be essential for job creation. Most of the respondents highlighted gaps in that front with some concerns regarding the relaxation of some on the local content policy elements for the REIPPPP.

"…as I said, unless we jack up the complementary manufacturing policy and incentives, we are going to be in trouble. So, I think the biggest gap that I see, which I have also mentioned, is the complementary manufacturing policy framework." (Respondent 11)

"So it doesn't help that over the last year, the government has been cutting down targets for local manufacturing, local manufacturing, and localisation that are directly linked to jobs. So if the government comes out and says we are now not going to do 30% local content is now 10% and that 10% is not compulsory, then, of course, people are not going to follow through" (Respondent 4)

"….for countries like China, who made it clear that they have a huge energy sector, so they are going to create a manufacturing sector that wants to have a global dominance of these renewable components. China, I mean, their own domestic market is enough for them to run these factories, and you are just a drop in the ocean." (Respondent 17)

"Chinese will develop these wind farms, but at the same time, they keep their coal. The power stations and they even build new ones. Of course, with relatively new technologies that emit less or trap that carbon dioxide. Why? Because they want to maintain their jobs at the same time, they want to maintain their competitiveness in manufacturing. Right. But at the same time, they offset this carbon with these renewables that they are building and some of the regulations that they bring on, for instance, on the vehicles, those who are buying, EV they get incentives and their licenses are approved quicker than those." (Respondent 4)

Most of the respondents emphasised that policy issues were a hindrance in attracting and retaining international investments in wind energy development. They expressed concerns about the policy uncertainties regarding the development of renewables. The uncertainty negatively impact the development of local wind energy supply chain which directly translates to job creation.

"I think the policy uncertainty has also been another issue in ensuring anchor demand. REIPPPP started about 10-11 years ago. Uh, and I think there was a huge gap; there was actually a stop in signing RIEPPPP projects for a long period of time. Uh, which also delayed, you know, your supply chain of these turbines." (Respondent 8)

"People had set up in the country. They came, and they invested in the country to grow local manufacturing. Then we had five years, six years of just nothing happening. Can you imagine if you're coming in and you're employing people and you've invested, and your factory stands still with no market to supply? People, a lot of people left the market, and now you want them to come back; a lot of those companies are now just going to the government and getting exemptions. (Respondent 13)

"But the problem has been that there's no consistency in the policies. There's no consistency in the deployment of these projects, so I think it's quite difficult to obviously then localise or even improve, you know, reskilling or the deployment of these skills into these wind farms in that region." (Respondent 15)

Other study respondents challenged the strategic view of the Just Energy Transition with concerns around lack of focus on securing baseload energy supply as a primary objective, and lack of consideration for South Africa's unique socio-economic challenges such as the high level of unemployment.

"…transition as we're seeing them play out in the rest of the world, especially in Europe, has led to energy insecurity. So, it has basically reversed everything that they were trying to do and all because they were in a hurry to execute their transitions without thinking long term, but without also thinking of the geopolitical risks and the economic implications." (Respondent 2)

"…other countries don't drop their baseload energy and their manufacturing capacity. But in South Africa, we are doing it differently, and that's why you'll find you will lose a lot of employment and will have a crisis, whereas other countries that are managing it properly…" (Respondent 4)

"…what the whole just transition tries to address should be managed properly. You know, it should leave no one behind? Nobody's able to answer how we do it without leaving anyone behind. Because I think that global policy, the way that it's structured now, is bullish, it's quite

bullish in that it gives the expectations, but it takes away the liberty for countries to execute things in the way they see fit, especially ones that are involved in trade." (Respondent 8)

4.3.2. Theme 2.2: Local manufacturing or assembly of wind turbine components

Local manufacturing was highlighted as an essential enabler for job creation. The respondents highlighted the need to grow the manufacturing of wind turbines, which are currently being imported. The respondents also acknowledged manufacturing capabilities that also exist in South Africa that can be enhanced to expand local manufacturing and increase the number of jobs that the sector can create. The code distribution for the responses on local manufacturing is presented in Figure 4.4 below.

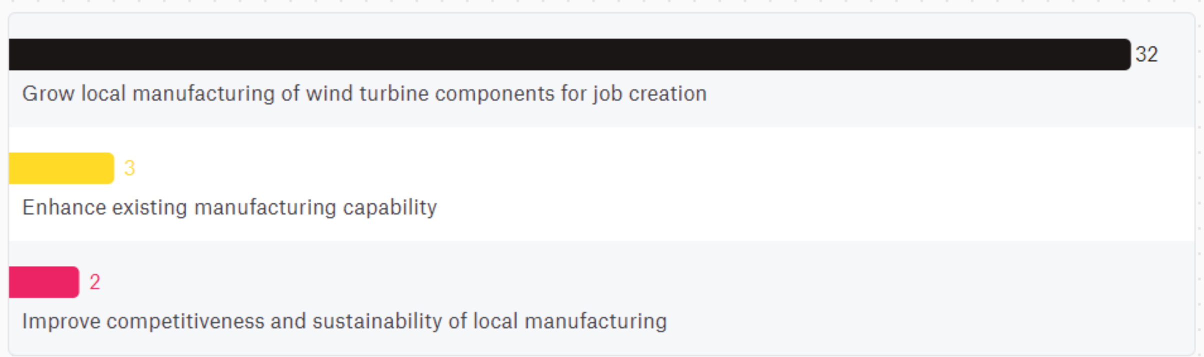

Figure 4. 4: Code distribution for theme 2.2
Source: Author's illustration based on Atlas.ti data organising and visualising functionality

Considering the significant number of people currently employed within the coal value chain, the growing local manufacturing of wind turbine components was highlighted by several study respondents as an essential lever for enhancing job creation within the wind energy value chain.

"You know, coal mining in itself, considering how much it can employ, you cannot duplicate it; it can never be done. Umm, I think the closest would be, and I think the highest jobs would be in the manufacturing of components, but I think that's also an area in which we haven't necessarily made sufficient movement in South Africa." (Respondent 8)

"I think the lack of manufacturing of this renewable energy component means, therefore, we are going to lose a number of jobs; I don't think that the transition was well thought through." (Respondent 15)

One respondent argued that South Africa must focus on energy security and minimising energy costs while temporarily setting aside ambitions for localisation, as the latter may lead to elevated energy costs.

"My thing is, honestly, where South Africa is right now, we need power. We need it cheap, and we need it fast. I really think we should try to separate the things; localisation and all those things make power expensive, and all these rules make it hard to get into the market. I think where we are in South Africa, my recommendation is to take the cheapest power that you can. The cheapest and fastest power you can get, take that, and then use that power to grow your economy." (Respondent 13)

Another respondent highlighted the fact that some of South Africa's policy requirements are viewed negatively by the OEMs, which might also hinder localisation.

"And I think even your OEM's, they, they have this reluctance to set up manufacturing capacity or capability locally because of the localisation rules and all of that." (Respondent 17)

Even though localisation is an undisputed enabler for job creation. One of the respondents highlighted that it is not something that can be achieved swiftly as it also requires energy stability which is a challenge in South Africa.

"In terms of the studies that were done, uh. There is a sense that renewable energy will create jobs in the manufacturing of components. But that one is not something that can happen tomorrow because you still need stable energy for those firms." (Respondent 4)

Enhancing existing manufacturing capability was highlighted by several respondents as one of the efficient options of fast-tracking local manufacturing and maximising job creation. Additionally, the respondents acknowledged that augmenting local manufacturing capabilities might necessitate a trade-off with regards to energy cost.

"What components can we support locally? You know, people always like to say it is cheaper to import, but how about existing competitive suppliers? How do we make sure that those ones are plugged in? Of course, you can buy it from China, but if you can buy it at the same price or marginally more expensive, marginally, let's do that. And how do we ensure that projects do that so that we can maintain our existing local manufacturing base because that's where the jobs are." (Respondent 5)

"...the components that we do manufacture that I could say we are leading are the cables, transformers, and switch gears. You know, we've got people who've been doing switch gears. We can support and grow those existing businesses" (Respondent 7)

"…we manufacture towers, both concrete towers and steel towers. So, we are still doing steel, but I'm not sure about concrete. I know Group 5 liquidated, and they were doing concrete towers, so we have that capability locally." (Respondent 15)

"...towers, anchor cages and the anchor bolts are stuff that can be done locally in-country" (Respondent 17)

The other factor that was highlighted by some respondents is that South Africa might not have a technology cost competitive advantage compared to other players who have been implementing renewables at scale in their countries.

"It's a challenge because European countries have been deploying wind energy for a very long time, obviously with economies of scale and an understanding of how things are done. They have that advantage. Uh, we are behind." (Respondent 5)

4.3.3. Theme 2.3: Skills development and training are required in renewable energy technologies to effect job creation

The study respondents emphasised the skills gap in the nascent wind technology industry in South Africa. The REIPPPP has played a crucial role in addressing this gap and driving the deployment of wind energy in the country. It is worth noting that South Africa does not currently own any intellectual property (IP) in wind energy technology, as this belongs to international wind turbine original equipment manufacturers (OEMs). The code distribution for findings relating to skills development is outlined in Figure 4.5 below.

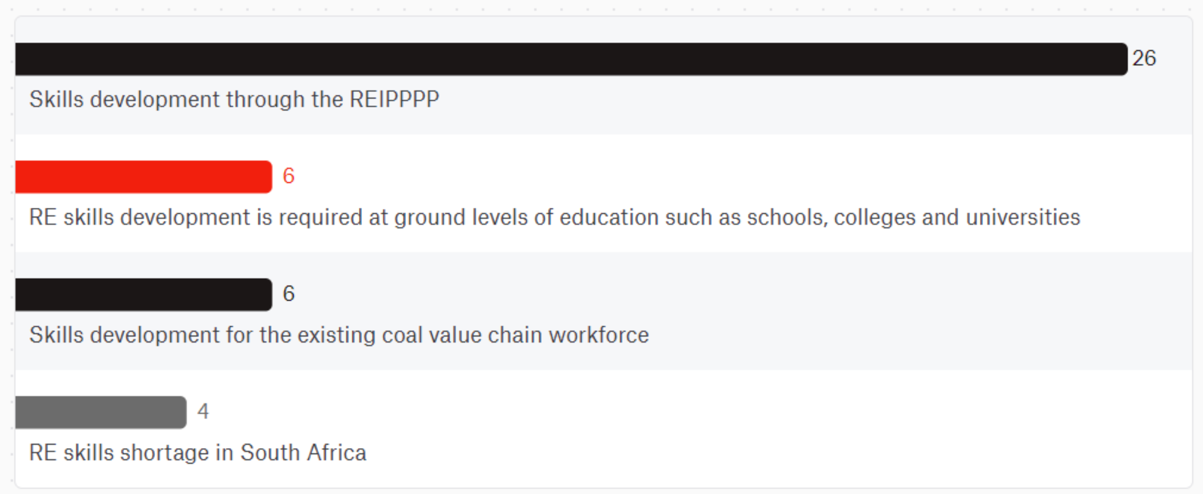

Figure 4. 5: Code distribution for Theme 2.3
Source: Author's illustration based on Atlas.ti data organising and visualising functionality

The REIPPP has contributed greatly to skills transfer from OEM internationals to local citizens. Several respondents gave examples of skills development for the renewable energy sector.

"For me, working for a multinational company, there's a lot of experience I am taping into. So, I believe that in my company, there is skill transfer, and this prior knowledge you know that one can tap into helps solve problems. Having that global leverage to contact my global colleagues to say, guys, I'm facing this. Can you help? It helps a lot." (Respondent 3)

Another respondent raised a concern that some of the skills and training opportunities are limited to a selected few.

"And I think what's also been proven is, yes, the OEMs do train the people at their head offices abroad. But as I've said it, it's very small numbers that get access to such opportunities." (Respondent 16)

The South African government in partnership with certain institutions have also formulated skills development initiatives to address the renewable energy skills gap in the country.

"…we've got SARETEC, which is a South African Renewable Energy Technology Center at Cape Peninsula University of Technology in Cape Town. We are training qualified technicians in the wind sector. So people working at heights, people doing turbine maintenance, those are courses that we can channel more, especially younger people, to be biased in that way towards saying look, here's an actual qualification that at least we know how the renewal, the wind industry sector in South Africa is growing." (Respondent 5)

"But I think one of the things that you see now, like EWSETA, has been running a program

now. I think this is going to be the third year that they do it. So it's an internship program in which they have been funding the salaries for interns to be allocated in different organisations across the wind energy value chain." (Respondent 8)

With the energy transition underway, some study respondents argued that renewable energy skills development is actually required at ground levels of education such as schools, colleges and universities.

"I think we've got to be starting maybe earlier, so schools, high schools, and universities should have these programmes or degrees or qualifications that also speak to the growth of renewables and the transition. That's now looking further beyond just, for instance, saying okay, the job creation in terms of shifting labour from fossils to renewables, which is imperative. However, academic institutions need to make sure that they are creating qualifications that speak to what is required in the market to address this energy transition." (Respondent 1)

"And I also find that the colleges and the formal education systems within the area aren't also quite familiar with regards to the skills that will be required." (Respondent 7)

The other dynamic that the energy transition presents is the need for skills development for the existing coal value chain workforce for enable potentially transitioning the workforce the renewable energy sector.

"But there is a great need of concern because the skills development that they're talking about is not being thoroughly assessed and matched to our existing labour force." (Respondent 12)

"So I think we offer them tokens, and we speak down to them as we repurpose or as we reskill them. We don't upskill them; we think people must just be okay as long as they have a job. Whereas the thing is about upskilling, it is about offering better. It's about a person going forward actively rather than us making them look like, you know what, your alternative is unemployment. Be grateful for this" (Respondent 11)

South Africa is still currently heavily reliant on international wind turbine OEMs for the deployment of wind farms and the skills gap in wind technology is a limitation for local jobs in that area of speciality.

"…because also when things get complex. Umm, when deploying wind technology, for instance, we get guys in from Gold Wind, which is in China, or Siemens Energy in Germany, Switzerland, or Nordex. They get these guys to come into the country and implement on their

behalf, right? So there is still a huge gap in local skills." (Respondent 2)

"We don't have the local skills to deploy these technologies. So right now we procure components from the European and the Asian markets. So we definitely don't have the technology skills." (Respondent 12)

"Uh, no, there's not a lot of skills. We are not well positioned regarding local skills. The just energy transition also is not just in terms of skill set like I told you. When you procure, you are only fundamentally obliged to meet a certain level of social development. So a lot of these IPPs are actually bringing their people to do the job, or they're doing the job remotely from wherever and in their country of origin." (Respondent 7)

4.3.4. Conclusion of research question 2 findings

The findings presented above highlighted that policy and regulatory framework are key factors in enabling maximum job creation as South Africa deploys more wind energy. Sentiments from the respondents indicate that there is a policy formulation gap for economic development and an implementation gap for existing policies. Local manufacturing of wind turbine components was also highlighted as essential for local job creation through the development of local value chains. For local nationals to be able to assume roles in the wind energy sector, proficiency in skills pertinent to the renewables industry is imperative. A comprehensive skills development need exists across various levels of employment, necessitating transformative measures within educational institutions to ensure alignment between qualifications and the requisite skills for forthcoming low-carbon technologies.

4.4. Findings pertaining to research question 3

RQ3: What are the job creation opportunities that can be explored along the wind energy sector value chain?

This research question sought to understand the job opportunities within the wind energy value chain. The respondents were asked to provide insights into the employment and entrepreneurial prospects along the value chain, with a specific focus on project development and design, manufacturing, construction, operations, and maintenance, as indicated in Figure 2. 6 in Chapter 2. Additionally, the respondents were probed to provide insights on the key levers essential for creating the maximum number of jobs.

4.4.1. Theme 3.1: Job creation capability of wind energy deployment in South Africa

Job creation along the value chain is primarily dependent on the nature of the technology and its labour requirements. The findings highlighted that wind farms require fewer people for operations, with more jobs created during the construction phase. The code distributions for wind energy job creation capability are outlined in Figure 4.6 below.

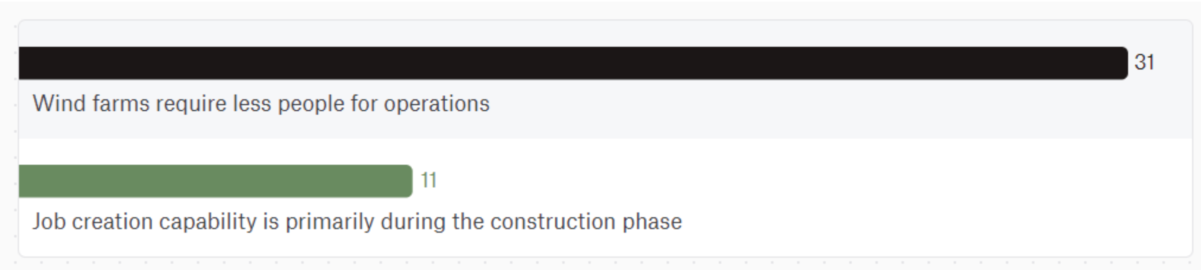

Figure 4. 6: Code distribution for Theme 3.1
Source: Author's illustration based on Atlas.ti data organising and visualising functionality

The predominant emphasis among respondents revolved around delineating the notable disparities in labor demands between wind farms and coal-fired power stations.

"…the human capital required to operate a coal-fired power station versus a wind farm is one of the keys, you know, aspects of the just energy transition because, during construction, there's a lot of job creation. But then again, construction is over a short period of time..." (Respondent 7)

"…the technologies themselves aren't necessarily as intensive as the fossil fuel sector, right? I think that the net effect might be negative because also you've got things like technology that improve productivity, so you don't need to hire that many people." (Respondent 1)

"…like I was saying, 50 is too many people for just grass cutting, security, some engineers on SCADA looking at operations, some maintenance blade cleaning, there is nothing intensive." (Respondent 5)

All participants in the study underscored the observation that the apex of job creation occurs during the construction phase, with a minimal workforce demand during the operational phase of projects. Moreover, the minimal maintenance requisites of wind farms were duly acknowledged.

"So during construction, which is a maximum of 24 months, right? That's where you may have at the peak of about 200 to 300 people, depending on the size of the wind farm. So maybe the peak period is three months. You have 300 people on site, and then it very quickly goes down

once the turbines have been hoisted and the foundations have all been built." (Respondent 5)

"I'll tell you now, the renewable energy job, there's quite a lot of them, especially in construction, but as soon as we're done with constructions, they don't employ the same amount of people as what people say thermal plants are concerned." (Respondent 13)

"There's not much operation and maintenance that you can do in a wind farm. It's a very quiet, very isolated plant. It requires minimal predictive maintenance or planned maintenance." (Respondent 12)

Another critical factor mentioned by one of the respondents is maintenance, which is contracted to the OEMs during the initial operational years and would translate to jobs created in the OEM's country of origin.

"…maintenance also forms part of the contractual agreements. So a lot of these OEM agreements are such that for the 1st 15 years, operations and maintenance will be handled by Siemens, for example, and the O&M agreement will be for a long-term service agreement, and then for the last five years, it will be transferred to the local entity. (Respondent 2)

4.4.2. Theme 3.2: Job creation aligned to South Africa's existing skills and capabilities

Wind technology is nascent in South Africa. However, there are local skills and capabilities that are well-developed and enhanced. Project execution professional skills and balance of plant design and installation were highlighted opportunities that can be harnessed for job creation. The code distribution for South Africa's existing capabilities is outlined in Figure 4.7 below.

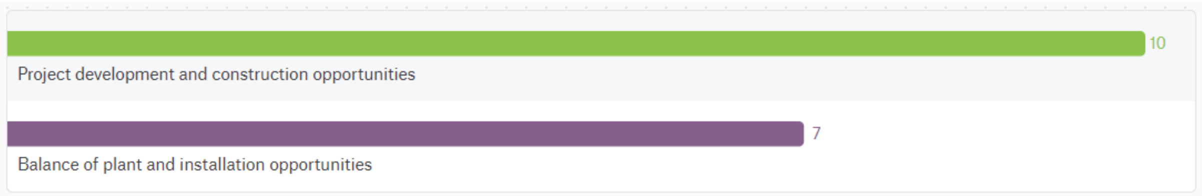

Figure 4. 7: Code distribution for Theme 3.2

Source: Author's illustration based on Atlas.ti data organising and visualising functionality

Several respondents highlighted opportunities in the Engineering, Procurement and Construction (EPC) of wind energy projects.

“Yeah, there are local companies that have found their niche in perhaps the construction of these projects doing the engineering, procurement and construction. And then there are also entrepreneurs that are found an opportunity in maintenance” (Respondent 1)

“Upstream of operations locally, we do have the skill. There are a lot of companies that, you know, engineering companies provide that. Uh, interfacing, obviously, with the OEMs because you need their input.” (Respondent 3)

“Uh construction, I think we are good. We have the likes of WBHO? Umm, big civil companies in terms of constructing wind farms. So there we've got the skill…” (Respondent 15)

“And the grid infrastructure, so all of that in the country we can do, we can even do the grid designs, grid infrastructure designs and install the great.” (Respondent 5)

4.4.3. Conclusion of research question 3 findings

The findings above indicate that the wind value chain does have a range of employment opportunities along its value chain. The number of jobs that are absorbed is relatively lower than that of coal power plants due to technological differences, whereby wind technology requires fewer operations personnel and limited maintenance. A maximum number of jobs are created during the construction phase. However, those jobs are not permanent. South Africa has local capabilities in the development, installation, and balance of the plant phase of the project, which South Africa is well equipped with.

4.5. Findings pertaining to research question 4

RQ4: What recommendations can be made on how an employment-led just energy transition can be pursued without leaving anybody behind?

The intent of this research question was to get additional recommendations and probe for themes that might be outside the predetermined categories. There are two themes that emerged from the study findings on recommendations that the respondents made on how the energy transition can be pursued in a way that leaves no one behind.

4.5.1. Theme 4.1: Wind energy as an enabler for the low carbon value chain ecosystem job creation

Some respondents flagged the need to broaden the perspective of wind energy beyond power generation in order to optimise job creation, identifying it as a key mechanism for fostering the low carbon ecosystem employment opportunities. The dissemination of wind energy's potential as a facilitator for low-carbon job creation is delineated within the framework of the discussion. Code distribution for the low-carbon ecosystem opportunities is outlined in Figure 4.8 below.

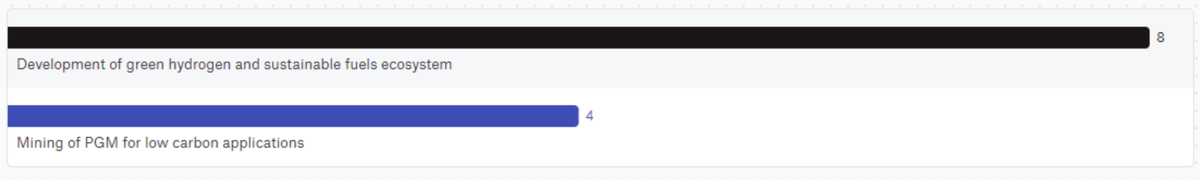

Figure 4. 8: Code distribution for Theme 4.1

Source: Author's illustration based on Atlas.ti data organising and visualising functionality

The development of green hydrogen with wind energy as an energy source will create a sustainable fuel ecosystem.

"…we need to create new opportunities. So let me give you a practical example in that regard; let's say significant RE opens opportunities for the hydrogen value chain with a lot more opportunities. Uh, can you evolve into green hydrogen? In that way, you could then create sustainable fuels and chemicals that the country can produce." (Respondent 4)

"So if you start to look at it from a value chain perspective, there are a number of opportunities the country can pursue. Let's say we fully developed renewables, and we can apply that to the Green hydrogen commercialisation strategy." (Respondent 17)

"If you step back and say OK, coal dies, but that source is still needed, there's a couple of sources that still needed, uh. You know, there's all these products that still need a carbon source. We still need ammonia. We still need fertilisers. So it's just that we're saying all these products need to be in a green form; we still need methanol. So we're not getting rid of all these products; it's just how they're coming in right now. They're grey; we just need to make them green." (Respondent 15)

Other respondents highlighted the mining of PGM, which can be pivoted towards low-carbon applications.

"…how does the country take advantage of the resources? We've got solar and wind, so how do you take advantage of that and create new industries, be it hydrogen, new other industries, be it mining of platinum group metals for use on fuel cell technologies…" (Respondent 4)

"If we look at the EVs, electrolyser technologies and the fuel cells, the platinum base metals will be a huge requirement, and mining could be pivoted in that direction…" (Respondent 17)

"…mining is mining. It's just a matter of transitioning certain skills; you could take the same coal miners and now teach them how to mine platinum, for instance." (Respondent 15)

4.5.2. Theme 4.2: Attention to research and development investment is required

Lack of focus on research and development was flagged as one of the inhibitors of the just energy transition. The respondents highlighted clean coal technology research as an area that South Africa needs to focus on to allow for the use of coal without the associated environmental impacts.

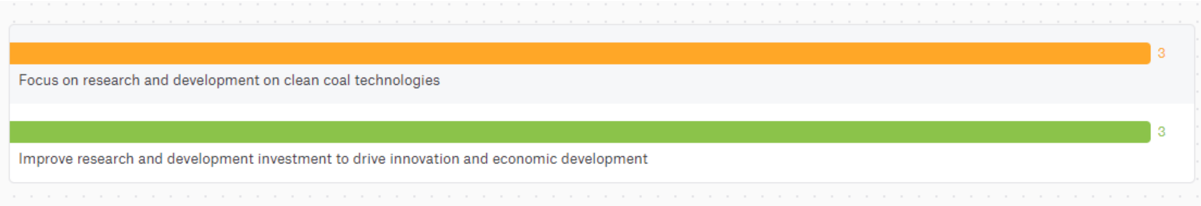

Figure 4. 9: Code distribution for research and development

Source: Author's illustration based on Atlas.ti data organising and visualising functionality

Some of the views from the respondents regarding the gap in research and technology and the need thereof are listed below:

"A lot of research is being done in other countries in terms of carbon capture technologies. I don't think that's something that we are primarily focusing on. We are just focusing on deploying renewable energy technologies and probably not investing more in terms of the research that needs to be done when it comes to coal, umm and the reason why some people out there are looking into clean coal is probably there are possibilities that can be looked at regarding carbon capture technologies." (Respondent 12)

"We wouldn't be here if we were deliberate as a country. Look, the problem is not coal. The problem is greenhouse gas emissions. It is also possible to clean your coal and develop technologies that would eliminate polluting the environment. So, my view is that we should have been intentional as a country to say how we make sure that we solve the problems associated with emissions because the problem is not the coal; it's the greenhouse gas emissions." (Respondent 11)

"As a country, we are very poor in R&D; for instance, the percentage of GDP spent on research and development in South Africa is relatively lower than that of China, India, and your BRICS countries. Generally, it tells you about our attitude towards the value of research and development. Chinese are very intentional about research and development." (Respondent 4)

4.5.3. Conclusion of research question 4 findings

The themes that emerged from the research question was the job creation potential of wind energy as an enabler for the low carbon ecosystem. Wind energy could enable green hydrogen, sustainable fuels, and sustainable chemicals value chains. Research and development was also highlighted as an essential focus are primarily for clean coal technologies.

4.6. Summary of findings

The energy transition will result in a significant disruption in the coal value chain workforce, which is characterised by up to 150 000 employees. The respondents expressed doubt about the renewable energy sector's ability to transition most of the existing coal workforce. The limiting factors that were noted are the technological advancements in renewables, which require fewer people to operate the wind farms, the skills that are required and the lack of local manufacturing. Most of the respondents highlighted policy and regulatory framework as the primary factors that enable maximum job creation along the wind energy value chain. It was noted that South Africa will need to improve policy formulation that addresses economic development and demonstrate consistency and certainty in policy implementation.

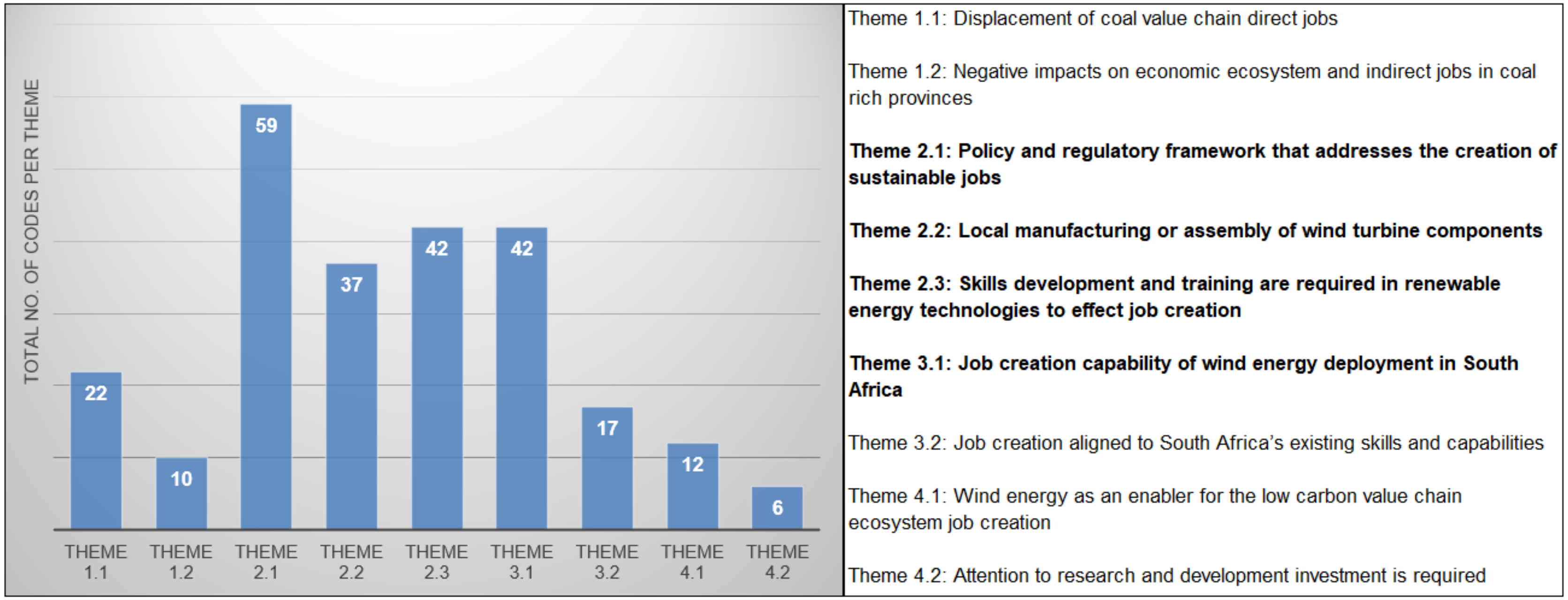

Figure 4. 10: Code distribution across the different themes

Source: Author's illustration

4.7. Comparison of literature review and own findings

Table 4. 1: Comparison of literature review and findings

RQ #	Research question	Prop #	Literature based proposition	Findings from own study
RQ1	What are the employment effects of South Africa's electricity generation transition from coal to wind energy?	P1	The energy transition is poised to disrupt the coal value chain, yielding notable ramifications for both direct and indirect employment within the energy sector. The transition will result in job losses for the workforce associated with the coal value chain, particularly in regions abundant in coal resources, such as Mpumalanga. The adoption of wind energy will create jobs. However, there are conflicting views on whether the number of jobs created will outnumber the job losses. The assessment of the net employment impact of this transition is characterised by conflicting perspectives and uncertainties attributed to inconsistencies observed in the diverse employment metrics utilised for reporting purposes.	*Themes from the study findings:* 1.1. Displacement of coal value chain direct jobs. 1.2. Negative impacts on the economic ecosystem and indirect jobs in coal rich provinces. *Similarities:* The deployment of wind energy as the coal power plants retire will result in job losses for the coal value chain workforce. The disruption will extend to communities in coal rich regions of the country. The deployment of renewables will create jobs, with the peak of jobs created during the construction phase. *New insights:* Coal generation and wind power plants are vastly different in their operational and maintenance labour requirements. Due to technological advancements in wind energy, including remote monitoring, wind farms require far fewer employees for operations and maintenance than coal-fired power plants.

RQ #	Research question	Prop #	Literature based proposition	Findings from own study
RQ2	What are the factors that must be considered to promote an employment-led just energy transition?	P2	Factors to be considered in ensuring an employment-led just energy transition include addressing South Africa's policy implementation gaps related to the socio-economic impact of the transition, a clear directive on skills development for the low-carbon economy, and a focus on developing local manufacturing and assembly of turbine components.	*Themes from the study findings:* 2.1. Policy and regulatory framework that addresses the creation of sustainable jobs. 2.2. Local manufacturing or assembly of wind turbine components. 2.3. Skills development and training for renewable energy technologies. *Similarities:* The focus is required on the implementation aspect of the policies and plans that have been developed to facilitate the deployment of renewable energy sources in South Africa. Local manufacturing is an essential lever for maximising job creation. There is a need for skills and development in renewable energy technologies such as wind. Noted disparities between skills of the current coal mining and coal fired power generation workforce and the skillset required in the wind energy sector. *New insights:* There are several barriers that South Africa need to overcome to make local manufacturing a reality. Barriers such as policy uncertainty, lack of investor confidence due to historical failures,

RQ #	Research question	Prop #	Literature based proposition	Findings from own study
				cost competitiveness compared to the more established manufacturers based in China and Europe and energy security since our current energy baseload is struggling to support existing industry.
RQ3	What are the job creation opportunities that can be explored along the wind energy sector value chain?	P3	The development of wind energy projects offers avenues for employment across various stages, encompassing project development, local manufacturing of certain components, construction, and operational activities. Each phase necessitates distinct skill sets and capabilities. It is imperative for South Africa to acknowledge these requirements and proactively identify strategies to optimise local job creation throughout the wind energy value chain.	*Themes from the study findings:* 3.1. Job creation by wind deployment through the REIPPPP bid windows. 3.2. Enhancing South Africa's existing skills and capabilities. *Similarities:* The REIPPPP has been instrumental in creating jobs as the projects are awarded and implemented. The core technological skill set largely lies with the international OEMs. South Africa has the capacity to explore job opportunities primarily for the construction phase of the projects. *New insights:* Local jobs can be maximised by enhancing already existing EPC capabilities and for existing local manufacturing of components such as steel and concrete towers, anchor cages, anchor bolts and transformers. Jobs created during the construction

RQ #	Research question	Prop #	Literature based proposition	Findings from own study
				phase are temporary jobs and can give a misleading conclusion about the net employment impact of wind energy deployment.
RQ4	What recommendations can be made on how an employment-led just energy transition can be pursued without leaving anybody behind?	P4	Not applicable. The recommendations will allow for emerging themes apart from the predetermined categories in the literature review.	*Emerging themes from the study findings:* 4.1. Wind energy as an enabler for the low carbon value chain ecosystem job creation. 4.2. Attention to research and development investment is required. *New insights:* Jobs created for the energy transition must not be limited to electricity generation using renewables. Wind energy deployment can catalyse the development of the low-carbon ecosystem. The transition to broader low-carbon value chains, such as green hydrogen, will enable new industries that will create jobs. South Africa needs to invest in the research and development of clean coal technologies, which presents an opportunity for the continued use of coal without the negative GHG emissions and environmental impacts.

CHAPTER 5: DISCUSSION OF FINDINGS

5.1. Introduction

The study aims to identify factors that must be considered to expedite wind energy deployment in a manner that enables maximum job creation, facilitating the Just Energy Transition in South Africa. The study's outcomes and findings, derived from responses gathered during semi-structured interviews, are delineated in Chapter 4. This chapter aims to interpret, analyse, and discuss the findings and thematic patterns identified therein, juxtaposing them with the theoretical literature outlined in Chapter 2.

5.2. Discussion pertaining to research question 1

The primary intent of research question 1 (RQ1) was to discern the prospective employment ramifications stemming from the energy transition within South Africa, where the prevailing energy landscape is predominantly reliant on coal-based resources. The research findings highlighted that the transition would result in job losses for the existing coal value chain workforce. Most of the respondents argued that coal mining and processing for power generation and related industries currently absorb many employees, which might not be accommodated in the wind energy value chain. These views and concerns are consistent with the study by Willis (2021), who mentioned that there is a risk that the necessary action to address climate change by shifting from fossil fuels to clean energy sources will disrupt society and result in job losses, making the socio-economic challenges worse in South Africa.

The primary consideration that the study respondents highlighted was the disparity between the labour requirements of coal-fired power stations and wind farms' energy generation. The studies conducted by Patel et al. (2020) also confirmed that direct jobs across the coal value chain equate to around 150 000 workers, with the workforce spread across coal mining, power generation, petrochemical industry, steel industry and cement production. A study by Hartley et al. (2019) also affirmed the eminent displacement of the coal value chain jobs and highlighted that the coal value chain has a relatively high reliance on semi-skilled and low-skilled workers, which will be one of the critical considerations for potential re-employment in the low-carbon economy. On the contrary, up to 70 % of the job opportunities created in the renewable energy sector are, in fact, high-skilled jobs for matric, which is the lowest qualification level (Hartley et al., 2019).

Tyler (2018) indicated in his study that job losses for coal mining employees due to the planned coal-fired power plants are estimated to be up to 35,000. The study findings indicate that the jobs created by wind energy (and broader renewables) will not be sufficient to cover the losses in the coal value chain. A study by Caetano & Thurlow (2015) also concluded that the number of jobs lost in coal mining will surpass the number of jobs gained in renewable energy, nuclear power, or gas. Caetano & Thurlow (2015) argued that even though renewables will have a favourable effect on direct employment with greater job-years per MW, the associated decline in low-skilled positions overshadows the adverse impact on indirect employment, resulting in a negative employment impact.

On the contrary, a study conducted by Hartley et al. (2019) in collaboration with the Council of Science and Industrial Research (CSIR) concluded that South Africa has the potential to substantially enhance overall employment figures by augmenting the proportion of renewable energy sources. Projections suggest that by the year 2050, there could be an increment of over 150,000 fresh employment opportunities (+17%) within the energy sector, factoring in the potential job displacements in the coal industry (Hartley et al., 2019). Furthermore, through the transformation of the power sector, it is estimated that up to 1.6 million supplementary job opportunities could be generated across the economy by 2050 (Hartley et al., 2019). Most recent studies by RESAfrica (2021) also confirm a net gain in jobs in the labour movement from coal-producing regions to industries that may use solar and wind power. RESAfrica (2021) estimated that the amount of employment-related to solar and wind power deployment between 2020 and 2030 is 862,000 direct, indirect, and induced jobs coming from solar and wind PV.

Montmasson-Clair (2021) argues that the perceived tradeoff between the coal jobs displaced by the transition and the renewable energy jobs created is a false conception. His argument is based on the following differences between coal and renewables jobs (Montmasson-Clair, 2021):

- The coal and renewable energy value chains are at different development levels, with the coal industry being far more developed in South Africa.
- There is no theoretical or empirical reason for the jobs at risk of being displaced within the coal value chain to be replaced or created in the renewables value chain. Instead, every opportunity to create jobs should be evaluated on its own merits.
- The jobs created through the deployment of renewables may or may not be located in the same region as the existing coal jobs.
- Similar to other employment opportunities, energy business jobs may require retraining and skills development, and they might include lead times that complicate planning.

The above sentiments were also observed in the study findings, where some respondents highlighted that jobs created from coal-powered power stations should not even be compared to jobs in the renewables value chain since the two energy systems are vastly different. The respondents argued that the energy transition should be viewed as a transition from one economic and power paradigm to another and should not be viewed in a cause-and-effect manner.

The study findings also highlighted the fact that the transition will negatively impact the livelihoods of communities in coal-rich regions of the country, such as Mpumalanga. A study by Montmasson-Clair (2021) also alludes to the fact that the disruption in the coal value chain will not only negatively impact direct and indirect jobs associated with upstream and downstream coal activities, but the impact will extend to the towns and regions that are coal-rich and local economies that depend on the coal ecosystem. A report by Ciaran (2024) estimated that a total of up to 2.5 million people residing in Mpumalanga will likely lose their livelihoods when five coal-fired power plants and fifteen coal mines close by 2030 and four more plants and twenty-three mines by 2040.

The Minister of Forestry, Fisheries and Environment, Barbara Creecy, also highlighted the challenges that extend to communities as the country transmissions and decommission coal power stations as experience with the decommissioning of the Komati power station in Mpumalanga (SABC News, 2023). According to Barbara Creecy (2023), the decommissioning was not just as it was not properly managed, resulting in livelihoods and economic ecosystems in the Komati area being destroyed.

5.3. Discussion pertaining to research question 2

Research question 2 (RQ2) focused on gaining insights into the factors that need to be considered to promote an employment-led just energy transition. The research findings identified three fundamental themes that are essential in ensuring a just energy transition that maximises job creation. The three themes from the study findings are:

- Policy and regulatory framework that addresses the creation of sustainable jobs.
- Local manufacturing or assembly of wind turbine components.
- Skills development and training for renewable energy technologies.

The study findings acknowledged the significant progress made in policy development, with REIPPPP being the flagship for incorporating South Africa’s social and developmental needs.

Studies by Eberhard et al. (2014) and Walwyn & Brent (2015) also confirm the significance of the economic development component of the REIPPPP bid evaluation process, which considers job creation and promotes local development in the host communities where the renewable energy projects are located. As reported by the IPP office, the enforcement of socio-economic considerations into the REIPPPP has resulted in R252.8 billion the total investment attracted into the country for renewable energy projects, with 73 738 job years of employment created as of 31 March 2023 (IPP Office, 2023).

However, the study findings also highlighted policy uncertainties as a major risk and barrier to the development of renewables in a manner that enables maximum job creation. Policy uncertainty negatively impacts the development of the local wind energy supply chain, which directly translates to hindrances in job creation. A report by Miller (2016) also confirmed the negative impacts caused by Eskom not signing PPAs in 2016, which devastated REIPPPP and resulted in investors and wind turbine OEMs losing confidence in renewable energy development in South Africa. A study conducted by Mhlathi (2019) corroborated that the cessation of wind energy development, consequent to Eskom's discontinuation of signing Power Purchase Agreements (PPAs), resulted in the closure of DCD Wind Towers' domestic manufacturing facility situated in Coega. This closure led to the retrenchment of 110 employees.

The study findings also highlighted concerns about the relaxation of some of the local content policy elements for the REIPPPP. The REIPPP was formulated to incorporate the country's socio-economic needs through the economic development (ED) scorecard, which initially had 30% weighting on the bid, with 70% being the electricity tariff (Eberhard et al., 2014). The ED weighting has since been reduced from 70:30 to 90:10 for bid window 5 (GreenCape, 2022).

A study by Li et al. (2023) argues that China's competitiveness in wind energy development has been attributed to the Chinese government’s ambitious wind energy targets coupled with policies that support the development of the domestic wind industry supply chain. Li et al. (2023) stipulate that the policy elements that have anchored China’s wind industry include feed-in tariffs, local content stipulations, and industrial financial subsidies. South Africa has gaps in some of these elements that require attention for the energy transition to be just and enable maximum job creation.

The study findings also identified local manufacturing of wind turbine components as an essential enabler for job creation. Some respondents, however, argued that local manufacturing is a long-term ambition; the primary focus should be on energy security and minimising the energy cost while temporarily setting aside ambitions for localisation as it may lead to elevated energy costs. Some of the barriers that the study findings highlighted for localisation were a gap in the implementation of industrialisation policy elements and the lack of assured demand for the local wind energy supply chain. One of the objectives outlined in the SAREM is job creation through localised manufacturing of components associated with wind and solar PV power generation (Department of Mineral Resources and Energy, 2022). The projected number of direct jobs that can be created through localised renewable energy value chain manufacturing is 36,500 in total and 19,586 for wind energy in particular (Department of Mineral Resources and Energy, 2022).

The study findings highlight gaps in a detailed plan on how local manufacturing will be seeded and how the supplementary policy elements will support and enable the projected job creation. A report by Enerdata (2024) also confirms that for leading countries such as Europe, wind turbine manufacturing capability has been supported by a vast industrial ecosystem of suppliers and manufacturers. The ambitious energy target and policies of the European Commission have also played a significant role in bolstering the wind energy industry in that region (Enerdata, 2024). Most wind turbines currently in use in Europe were manufactured and assembled within the European markets (Enerdata, 2024).

The study findings emphasised the need for South Africa to focus on implementation plans to make local manufacturing a reality by enhancing existing manufacturing capability for components such as steel and concrete towers, anchor cages, anchor bolts and transformers. Studies conducted by Morris et al. (2022) and Rivett-Carnac (2022) confirm components where South Africa has a capability that can be enhanced to establish local manufacturing. As a developing, job creation through local industries is essential (Hansen et al., 2022; Morris et al., 2022; Swilling et al., 2022). Gaps in local manufacturing mean South Africa will import the components and will always be subjected to exchange rates and geopolitics with very limited control over the value chain.

The study findings highlighted the local skills gap in the wind technology industry, which is nascent in South Africa. The REIPPPP has played a crucial role in addressing this gap and driving the deployment of wind energy in the country. The study highlighted efforts by the South African government in partnership with certain institutions that have formulated skills development initiatives to address the renewable energy skills gap in the country. For local nationals to be able to assume roles in the wind energy sector, proficiency in skills pertinent to the renewables industry is imperative. Hartley et al. (2019) also confirmed that the shortage of skills is one of the main challenges across the wind energy sector. A comprehensive skills development need exists across various levels of employment, necessitating transformative measures within educational institutions to ensure alignment between qualifications and the requisite skills for forthcoming low-carbon technologies. A study by Marleny (2023) also affirms the need to upskill local citizens to fulfil the technical roles in the value chain and avoid being over-reliant on global skills.

5.4. Discussion pertaining to research question 3

Research question 3 (RQ3) sought to understand the job opportunities that the wind energy value chain presents for South African citizens. The research findings acknowledged that wind projects do create jobs, with most jobs created during the construction phase of the projects. The study findings highlighted the notable disparities in labour demands between wind farms and coal-fired power stations. Wind farms were noted to require minimal personnel once the projects reached their operational phase. A study by Jasmine Lambert & Pereira Silva (2012) confirms this disparity and highlights the fact that construction and installation jobs are temporary opportunities that can be explored by local skilled labour, whereas else the operations and maintenance opportunities can be explored by semi-skilled locals.

Studies by Hansen et al. (2022), Malope (2022), and Schulte et al. (2022) also flagged the concern that a peak number of jobs are created during the construction phase, with less during the operation and maintenance phases. The construction phase does not create sustainable jobs as the opportunities last for up to 24 months (Schulte et al., 2022). The job opportunities for the operations and maintenance phase are further limited by the fact that wind turbine OEMs do not only supply the equipment, but they also usually have at least a year's renewable contract to operate the facility on behalf of the IPP (Morris et al., 2022). The OEM is contracted to take care of operations and maintenance services such as crane operation, wind tower maintenance, parts replacement, lubrication, etc. (Morris et al., 2022).

The research findings highlight local skills and capabilities such as project execution professional skills and balance of plant design and installation that can be harnessed for job creation.

5.5. Discussion pertaining to research question 4

The intent of research question 4 (RQ4) was to obtain additional recommendations and probe for themes that might be outside the predetermined categories outlined in Chapter 2. The two themes that emerged from the study findings on how the energy transition can be pursued in a way that leaves no one behind are:

- Wind energy is an enabler for the creation of jobs for low-carbon value chain ecosystems.
- Attention to research and development investment is required.

The study findings emphasised the importance of broadening the perspective of wind energy beyond power generation to optimise job creation. Wind energy's deployment was highlighted it as a key technology component for fostering the low carbon ecosystem employment opportunities.

Policy formulations such as the Green Hydrogen Commercialisation Strategy (GHCS) also confirm the essential synergy between renewable energy as an essential value chain for green hydrogen commercialisation in South Africa (Industrial Development Corporation of South Africa, 2022)

Figure 5.1 below illustrates the green hydrogen ecosystem. South Africa is well endowed with Platinum Group Metals (PGM), which can be beneficiated and used as components for fuel cells and electrolysers. The PGM markets can serve the domestic and export markets, which would create local jobs. Green hydrogen can enable local industries to produce sustainable chemicals such as ammonia and methanol, as well as sustainable fuels for aviation and shipping.

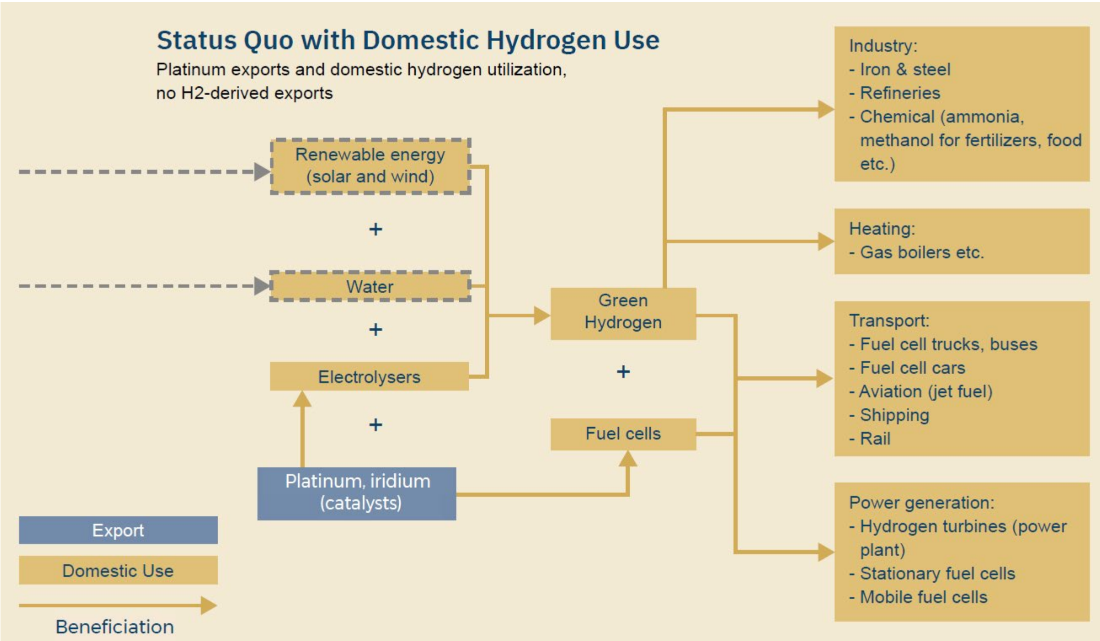

Figure 5. 1: The green hydrogen ecosystem for job creation opportunities

Source: South African Institute of International Affairs (SAIIA). (2022). *The South African Green Hydrogen TVET Ecosystem Just Transition Strategic Framework Synthesis Report*.

Local production of sustainable chemicals and fuels will not only create new jobs but also have the potential to repurpose existing assets and save existing jobs that are at risk due to the energy transition. Sasol facility in Mpumalanga is an example of such a possibility. Sasol presently manufactures an accredited aviation fuel at its Secunda facility located in Mpumalanga, employing grey hydrogen. Concurrently, the company is engaged in a distinct initiative, referred to as HyShiFT, aimed at producing Sustainable Aviation Fuel (SAF) within the same complex utilising green hydrogen (Creamer, 2023).

The study findings also highlighted a need to focus on research and development for carbon capture, utilisation and storage, abbreviated as CCUS. CCUS is a clean coal technology that can be applied to mitigate atmospheric carbon dioxide (CO2) emissions through the capture of CO2 at its source, such as point-source emitters like coal-fired plants. Subsequently, the captured CO2 is transported and stored in subterranean reservoirs. Additionally, a portion of the captured CO2 may find application in supplementary downstream industries, such as diverse petrochemical processes (Dhansay et al., 2022). The storage reservoirs pinpointed by the Council of Geoscience in Mpumalanga possess the potential to exert a direct influence on South Africa, facilitating a sustainable transition towards a low-carbon economy in alignment with targeted climate change mitigation strategies (Dhansay et al., 2022).

5.6. Conclusion

Chapter 5 discussed the research findings presented in Chapter 4 and contrasted the findings against literature that is relevant to the research questions. The conclusions of the study are presented in Chapter 6 and formulated based on the research questions.

CHAPTER 6. RESEARCH CONCLUSIONS AND RECOMMENDATIONS

6.1. Introduction

The study aims to identify factors that must be considered to expedite wind energy deployment in a manner that enables maximum job creation, facilitating the Just Energy Transition in South Africa. This chapter outlined the study conclusions based on the findings discussed in Chapter 5. Chapter 1 establishes the purpose, context, and research questions of this qualitative study. Chapter 2 gives details of literature related to the research questions, which informs the conceptual framework and predetermined themes of the study. Chapter 3 outlines the rationale behind the research methodology applied to obtain the study findings, which are presented in Chapter 4 without any interpretation and discussed in Chapter 5. This chapter is a summary of the conclusions derived from the thematic findings and propositions in relation to each research question. The chapter concludes with recommendations for the study stakeholders identified in Chapter 1 and suggestions for further research.

6.2. Conclusions regarding research question 1

The primary intent of research question 1 (RQ1) was to discern the prospective employment ramifications stemming from the energy transition within South Africa, where the prevailing energy landscape is predominantly reliant on coal-based resources. The study findings and literature-based proposition (P1) both highlight that the energy transition will disrupt the coal value chain workforce. The impact of the transition will not only result in the displacement of the existing coal value chain direct jobs but will extend to negative impacts on the livelihood of communities and the economic ecosystem in coal rich provinces.

Direct jobs across the coal value chain equates to around 150 000 workers, with the workforce spread across coal mining, power generation, petrochemical industry, steel industry and cement production. There are conflicting views on the net employment effect of transitioning from coal to renewable energy, such as wind. The study findings indicate that the wind energy sector will not be able to absorb the displaced coal workforce, resulting in job losses and a negative employment impact. Studies conducted to assess the net employment impact of the transition indicate contradicting views, with earlier studies denoting a negative employment impact and more recent studies indicating a positive employment impact for the power generation sector and the broader economy.

One of the critical elements that lead to the complexity is the lack of agreement on the net impact of the transition and the different metrics applied in the estimation of job numbers across the various energy value chains (Tyler, 2018). The other complexity is the assumptions applied to the different studies, primarily those that evaluate future projected employment impact based on modelled scenarios. A standardised employment metric and consistent set of assumptions for future scenarios need to be established to enable a fair comparison.

6.3. Conclusions regarding research question 2

Research question 2 (RQ2) focused on gaining insights into the factors that need to be considered to promote an employment-led just energy transition. The research study was confirmatory in nature and sought to confirm or disconfirm existing theories regarding factors impacting job creation as the country transitions to renewable energy sources. Findings were presented and obtained for the study participants. Literature-based propositions (P2) highlighted the need to address South Africa's policy implementation gaps related to the socio-economic impact of the transition, a clear directive on skills development for the low-carbon economy, and a focus on developing local manufacturing and assembly of turbine components as key factors to maximise job creation.

The top four factors that were identified from the study findings are:

- Policy and regulatory framework that addresses the creation of sustainable jobs.
- Skills development and training are required in renewable energy technologies to affect job creation.
- Job creation capability of wind energy deployment in South Africa.
- Local manufacturing or assembly of wind turbine components.

There were similarities between the pre-determined themes and study findings. Key insights from the study were that renewable energy policies should not be merely formulated but should ensure that implementation plans have clear economic development plans and are executed timeously and consistently. A number of barriers that hinder local manufacturing were identified as policy uncertainty to ensure anchor demand, lack of investor confidence due to historical failures, cost competitiveness compared to the more established manufacturers based in China and Europe and energy security since our current energy baseload is struggling to support existing industry.

6.4. Conclusions regarding research question 3

Research question 3 (RQ3) sought to understand the job opportunities the wind energy value chain presents for South African citizens. The literature-based proposition (P3) highlighted the spread of opportunities that the wind energy value chain presents. The job opportunities, as outlined by both literature and study findings, can be classified into the following groups:

- *Technological development*: stable jobs that require a speciality skill level. Opportunities are limited for South African citizens with wind technology skill sets that are still in the development phase in South Africa.
- *Construction and installation*: temporary opportunities that can be explored by local skilled labour.
- *Operations and maintenance:* stable opportunities for semi-skilled locals. These present a limited number of employees due to the technological nature of wind energy and remote monitoring, which is largely utilised.
- *Local manufacturing of components:* this presents the greatest potential for local job creation.

Local jobs can be maximised by enhancing already existing EPC capabilities and for existing local manufacturing of components such as steel and concrete towers, anchor cages, anchor bolts and transformers.

6.5. Conclusions regarding research question 4

The intent of research question 4 (RQ4) was to obtain additional recommendations and probe for themes that might be outside the predetermined categories outlined in Chapter 2. The two themes that emerged from the study findings on how the energy transition can be pursued in a way that leaves no one behind are:

- Wind energy is an enabler for the creation of jobs for low-carbon value chain ecosystems.
- Attention to research and development investment is required.

Literature and insights from respondents present an argument that there should be no trade-off expectations between the coal jobs displaced by the transition and the jobs created by renewable energy deployment. The premise of the argument is that the two value chains are different. One of the emerging findings is extending the view of wind energy deployment beyond power generation. South Africa is well endowed with coal, which necessitates a focus of research and development in clean coal technologies such as CCUS should be of primary focus as it would diversify the energy mix, improve baseload energy security and preserve the existing coal value chain jobs that are threatened by the energy transition.

Table 6. 1: Consistency table - research questions, conclusions, and contribution to knowledge

RQ #	Research Question	Literature-based proposition	Conclusion or answer based on own research	Key differences between the initial propositions and the research findings – this is your contribution to knowledge.
RQ1	What are the employment effects of South Africa's electricity generation transition from coal to wind energy?	The energy transition is poised to disrupt the coal value chain, yielding notable ramifications for both direct and indirect employment within the energy sector. The transition presents an employment risk for the workforce associated with the coal value chain, particularly in regions abundant in coal resources, such as Mpumalanga. The assessment of the net employment impact of this transition is characterised by conflicting perspectives and uncertainties attributed to inconsistencies observed in the	The deployment of wind energy and intentional capping of coal fired power stations will result in job losses for the coal value chain workforce. The disruption will impact both direct and indirect jobs and extend to communities in coal rich regions of the country. The deployment of renewables will create jobs, with the peak of jobs created during the construction phase. However, the jobs created will not surpass the jobs created. The disparities in net employment effect are due to technological advancement in wind energy, including remote monitoring; wind farms require far fewer employees for operations and	Coal generation and wind power plants are vastly different in their value chain, maturity in South Africa, labour requirements, skills requirements, and technological advancements. The employment effect of the transition cannot be viewed in a cause-and-effect manner. The employment effects are complex as the transition presents multiple interdependences and uncertainties across of the various factors.

RQ #	Research Question	Literature-based proposition	Conclusion or answer based on own research	Key differences between the initial propositions and the research findings – this is your contribution to knowledge.
		diverse employment metrics utilised for reporting purposes.	maintenance compared to coal-fired power plants.	
RQ2	What are the factors that must be considered to promote an employment-led just energy transition?	Factors to be considered in ensuring an employment-led just energy transition include addressing South Africa’s policy implementation gaps related to the socio-economic impact of the transition, a clear directive on skills development for the low-carbon economy, and a focus on developing local manufacturing and assembly of turbine components.	There is a required focus on the implementation aspect of the policies and plans that have been developed to expedite the deployment of wind energy in the energy mix. Local manufacturing is an essential lever for maximising job creation. There is a need for skills and development in renewable energy technologies such as wind. Noted disparities between skills of the current coal mining and coal fired power generation workforce and skillset required in the wind energy sector.	There is alignment between the initial proposition and research findings. The study findings identify barriers such as policy uncertainty, lack of investor confidence due to historical failures, and cost competitiveness as hindrances for local manufacturing.

RQ #	Research Question	Literature-based proposition	Conclusion or answer based on own research	Key differences between the initial propositions and the research findings – this is your contribution to knowledge.
RQ3	What are the job creation opportunities that can be explored along the wind energy sector value chain?	The development of wind energy projects offers avenues for employment across various stages, encompassing project development, local manufacturing of certain components, construction, and operational activities. Each phase necessitates distinct skill sets and capabilities. It is imperative for South Africa to acknowledge these requirements and proactively identify strategies to optimise local job creation throughout the wind energy value chain.	The wind energy value chain presents job creation opportunities along its value chain. Peak number of jobs are created during the construction phase. Manufacturing of components presents the largest potential for job creation. Local jobs can be maximised by enhancing already existing EPC capabilities and for existing local manufacturing of components such as steel and concrete towers, anchor cages, anchor bolts and transformers.	There is alignment between the initial proposition and research findings. The study also highlights job opportunities aligned to South Africa's existing skills and capabilities.
RQ4	What recommendations	Not applicable. The recommendations will allow for	The deployment of wind energy and its impact on job creation need to be	It is not applicable as the recommendations were not pre-

RQ #	Research Question	Literature-based proposition	Conclusion or answer based on own research	Key differences between the initial propositions and the research findings – this is your contribution to knowledge.
	can be made on how an employment-led just energy transition can be pursued without leaving anybody behind?	emerging themes apart from the predetermined categories in the literature review.	viewed beyond electricity generation. There are job opportunities that renewables such as wind will enable in the low-carbon value chain. Parallel to the deployment of wind energy as a mitigation measure against climate change and an imperative for energy security, South Africa needs to invest in research on clean coal technologies such as CCUS.	determined but emerged from the insights of the study respondents.

6.6. Recommendations

This section outlines recommendations for each of the study stakeholders identified in Chapter 1.

6.6.1. Policymakers and government bodies

Based on the study insights, the energy transition presents a lot of interdependencies and requires a holistic view and systems thinking to factor in South Africa's unique socio-economic needs. Policymakers and government bodies need to have an integrated view and drive policy implementation that results in maximum industrialisation. Figure 6.1 below gives an overview of job opportunities in the existing coal value chain, the opportunities that the renewables present and the potential industries for a low-carbon economy.

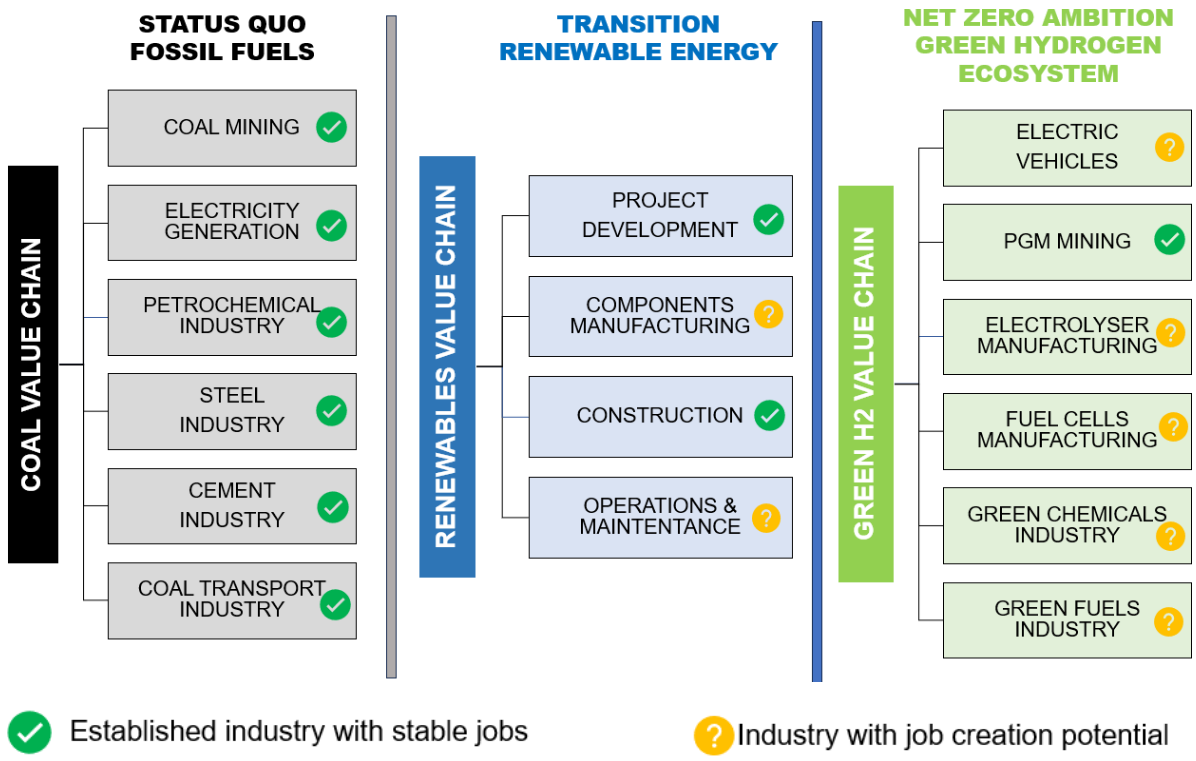

Figure 6. 1: Job creation capability for the energy transition

Source: Author's illustration

6.6.2. Financiers and project developers

The study highlights the significant negative impact that the transition presents to the communities reliant on coal-rich provinces. Financers and developers must consider this region for wind energy development to provide alternative employment for the coal value chain workforce that will be displaced as the country decommissions the coal-fired power stations. The wind capability must not be the best in those regions, and consideration for the government would be for the tariff to be regional to provide some incentive to make those projects bankable.

6.6.3. Entrepreneurs and job seekers

The transition to renewables is already underway and will continue as such. The skills gap outlined in this study highlights opportunities that still need to be explored by local citizens. Entrepreneurs and job seekers can upskill themselves to ensure that they have the skill set that is required for the renewable energy sector and broader low-carbon economy. Prospects for local manufacturing and the development of local supply chains present opportunities for entrepreneurs and job seekers.

6.7. Suggestions for further research

The study’s aim was to identify factors that must be considered to expedite wind energy deployment in a manner that enables maximum job creation. The research methodology applied was qualitative, and the data collection approach was cross-sectional since all the interviews were conducted at a single time in January 2024. It is recommended that a study with the objective of assessing the job creation capability of REIPPPP be conducted using a quantitative methodology and a longitudinal approach using actual data from the IPP office. The IPP office provides cumulative employment data without any view of how the policy elements, such as economic development, have influenced job creation on a year-to-year comparison.

One of the key conclusions of the study is the conflicting views on whether the number of jobs created by renewables will outnumber the coal value chain job losses. It must be noted that trade unions were not included as participants during the study, it would be beneficial to obtain the opinions of participants from trade unions such as National Union of Metalworkers of South Africa (NUMSA), National Union of Mineworkers (NUM) and Congress of South African Trade Unions (COSATU) in furfure research. The conflicting perspectives and uncertainties are attributed to inconsistencies observed in the diverse employment metrics utilised for reporting purposes. A study to determine a standardised approach fit for the South African context clearly defines the assumptions for future scenarios. Sensitivity analysis can also be evaluated to the scenarios to avoid presenting the best-case scenario, which might never materialise.

REFERENCES

Adams, W. C. (2015). Conducting semi-structured interviews. *Handbook of Practical Program Evaluation*, *4*, 492–505.

Akinbami, O. M., Oke, S. R., & Bodunrin, M. O. (2021). The state of renewable energy development in South Africa: An overview. *Alexandria Engineering Journal*, *60*(6), 5077–5093. https://doi.org/10.1016/j.aej.2021.03.065

Andrade, C. (2021). The Inconvenient Truth About Convenience and Purposive Samples. *Indian Journal of Psychological Medicine*, *43*(1), 86–88. https://doi.org/10.1177/0253717620977000

Baker, L. (2012). *Power shifts? The political economy of socio- technical transitions in South Africa's electricity sector*. University of East Anglia.

Bennett, N. J., Blythe, J., Cisneros-Montemayor, A. M., Singh, G. G., & Sumaila, U. R. (2019). Just transformations to Sustainability. *Sustainability*, *11*(3881), 1–18. https://doi.org/10.3390/su11143881

Biggam, J. (2015). Succeeding with Your Master's Dissertation: A Step-by-Step Handbook. *London: McGraw-Hill Education*.

Boadu, S., & Otoo, E. (2024). A comprehensive review on wind energy in Africa: Challenges, benefits and recommendations. *Renewable and Sustainable Energy Reviews*, *191*. https://doi.org/10.1016/j.rser.2023.114035

Bohlmann, H. R., Bohlmann, J. A., Chitiga-Mabugu, M., & Inglesi-Lotz, R. (2023). Just Energy Transition of South Africa in a Post-COVID Era. *Sustainability (Switzerland)*, *15*(14). https://doi.org/10.3390/su151410854

BP. (2021). *Statistical Review of World Energy 2021 | 70th edition*. https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-full-report.pdf

Brear, M. R., & Gordon, R. (2021). Translating the Principle of Beneficence into Ethical Participatory Development Research Practice. *Journal of International Development*, *33*(1), 109–126. https://doi.org/10.1002/jid.3514

Burkhardt, P. (2019, July 30). *Eskom, Sasol Emit Over Half of S. Africa's Greenhouse Gas*. Https://Www.Bloomberg.Com/News/Articles/2019-07-30/Eskom-Sasol-Emit-over-Half-of-South-Africa-s-Greenhouse-Gas.

Caetano, T., & Thurlow, J. (2015). The Socioeconomic Implications of Renewable Energy and Low Carbon Trajectories in South Africa. In *Inequality and Climate Change* (pp. 9–30). CODESRIA. https://doi.org/10.2307/j.ctvh8r0w3.6

Cameron, L., & Van Der Zwaan, B. (2015). *Employment factors for wind and solar energy technologies: A literature review*. https://doi.org/10.1016/j.rser.2015.01.001

Castillo-Montoya, M. (2016). Preparing for Interview Research: The Interview Protocol Refinement Framework. *Qualitative Report*, *5*.

Centre for Climate and Energy Solutions. (2021). *Paris Climate Agreement Q&A*. Https://Www.C2es.Org/Content/Paris-Climate-Agreement-Qa/2021.

Charli, M. S., Eshete, S. K., & Debela, K. L. (2022). Learning How Research Design Methods Work: A Review of Creswell's Research Design: Qualitative, Quantitative and Mixed Methods Approaches. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2022.5901

Ciaran, R. (2024, February 19). *Coal mine closures to impact 2.5m people, mainly in Mpumalanga*. Moneyweb. https://www.moneyweb.co.za/mineweb/coal-mine-closures-to-impact-2-5m-people-mainly-in-mpumalanga/?bid=120_26267_7636326

Creamer, T. (2023, June 23). *Sasol, Topsoe form JV to accelerate global production of sustainable aviation fuel*. Engineering News. https://www.engineeringnews.co.za/article/sasol-topsoe-form-business-to-accelerate-global-production-of-sustainable-aviation-fuels-2023-06-21

Department of Energy and Mineral Resources, S. A. (2011). *Integrated Resource Plan For Electricity 2010 - 2030*.

Department of Environmental Affairs. (2012). *National Climate Change Response: White*

Paper. http://www.climateresponse.co.za/
Department of Environmental Affairs. (2018). *South Africa Climate Change Bill*. www.gpwonline.co.za
Department of Forestry, F. and the E. (2022). *National GHG Inventory Report, South Africa 2000 - 2020*. www.gpwonline.co.za
Department of Mineral Resources and Energy. (2001). *Renewable Energy | Department: Energy | Republic of South Africa*. https://www.energy.gov.za/files/esources/renewables/r_wind.html
Department of Mineral Resources and Energy. (2019). *Integrated Resource Plan 2019*. http://www.energy.gov.za/IRP/2019/IRP-2019.pdf
Department of Mineral Resources and Energy. (2022). *South African Renewable Energy Masterplan (SAREM)*.
Department of Minerals and Energy, R. of S. A. (2004). *White Paper on the Renewable Energy Policy of the Republic of South Africa*. https://www.gov.za/sites/default/files/gcis_document/201409/261691.pdf
Dhansay, T., Maupa, T., Twala, M., Sibewu, Z., Nengovhela, V., Mudau, P., Schalenkamp, M., Mashale, N., Muedi, T., Ndou, C., Zilibokwe, N., Mothupi, T., Safi, M., & Hicks, N. (2022). CO2 storage potential of basaltic rocks, Mpumalanga: Implications for the Just Transition. *South African Journal of Science*, *118*(7–8). https://doi.org/10.17159/sajs.2022/12396
Du Plooy, N. (2017). *Fostering Sustainable Energy Transitions in South Africa: A System Dynamics Approach to Achieving a Sustainable Electricity Sector* [Thesis]. Stellenbosch University.
Eberhard, A., Kolker, J., & Leigland, J. (2014). *South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons*. www.ppiaf.org
Enerdata. (2024). *Wind Market Share*. https://d1owejb4br3l12.cloudfront.net/publications/executive-briefing/wind-turbines-manufacturers-market-share.pdf
Eskom. (2020). *Eskom Fact Sheet: CO 0007 Coal in SA REV 15*. https://www.eskom.co.za/AboutElectricity/FactsFigures/Pages/Facts_Figures.aspx
Eskom. (2021a). *Eskom 2021 Integrated Report*.
Eskom. (2021b). *Eskom 2021 Sustainability Report*.
Farrimond, H. R. (2017). Ethics of research. *Handbook of Educational Research, London: SAGE*.
Flick, U. (2011). Introducing Research Methodology: A Beginner's Guide to Doing a Research Project. *Thousand Oaks, California: SAGE*, 251.
Ghai, D. (2003). Concepts and Indicators. *International Labour Review*, *2*(142), 114–146. https://www.ilo.org/public/english/revue/download/pdf/ghai.pdf
Glynn, P. J., & Błachowicz, A. (2020). *Incorporating just transition strategies in developing country Nationally Determined Contributions*.
GreenCape. (2022). *LARGE-SCALE RENEWABLE ENERGY MARKET INTELLIGENCE REPORT*. https://greencape.co.za/wp-content/uploads/2022/10/RE_MIR_29_3_22_FINAL-3.pdf
Hansen, U. E., Nygaard, I., Morris, M., & Robbins, G. (2022). Servicification of Manufacturing in Global Value Chains: Upgrading of Local Suppliers of Embedded Services in the South African Market for Wind Turbines. *Journal of Development Studies*, *58*(4), 787–808. https://doi.org/10.1080/00220388.2021.2017892
Hanto, J., Krawielicki, L., Krumm, A., Moskalenko, N., Löffler, K., Hauenstein, C., & Oei, P. Y. (2021). Effects of decarbonization on the energy system and related employment effects in South Africa. *Environmental Science and Policy*, *124*, 73–84. https://doi.org/10.1016/j.envsci.2021.06.001
Hanto, J., Schroth, A., Krawielicki, L., Oei, P. Y., & Burton, J. (2022). South Africa's energy transition – Unraveling its political economy. *Energy for Sustainable Development*, *69*, 164–178. https://doi.org/10.1016/j.esd.2022.06.006
Hartley, F., Burton, J., Cunliffe, G., McCall, B., Caetano, T., Ntuli, N., Fourie, R., & Chiloane,

L. (2019). *Future skills and job creation through renewable energy in South Africa: Assessing the co-benefits of decarbonising the power sector*. www.cobenefits.info.
Hennink, M., Hutter, I., & Bailey, A. (2023). Qualitative Research Methods. *Quality & Quantity*, *57*(5), 4935–4938. https://doi.org/10.1007/s11135-023-01660-5
Hermanus, L. (2022). *Employment Metrics in South Africa's Electricity Value Chains: Creating Basis for Coherent Discourse and Decision-Making*.
Industrial Development Corporation of South Africa (IDC). (2022). *Proposed South African Green Hydrogen (GH2) Commercialisation Strategy*.
Intergovernmental Panel on Climate Change (IPCC). (2014). *Chapter Climate Change 2014 Synthesis Report Summary for Policymakers Summary for Policymakers*.
International Labour Organisation (ILO). (1999). *Report of the Director-General: Decent work*.
International Labour Organisation (ILO). (2015). *Guidelines for a just transition towards environmentally sustainable economies and societies for all*. https://www.ilo.org/global/topics/green-jobs/publications/WCMS_432859/lang--en/index.htm
International Trade Union Confederation (ITUC). (2011). *Workers and Climate Change: Key Demands for Durban*. Durban: ITUC. https://www.tuc.org.uk/research-
IPP Office. (2023). *AN OVERVIEW INDEPENDENT POWER PRODUCERS PROCUREMENT PROGRAMME (IPPPP) As at 31 March 2023*. https://www.ipp-projects.co.za/Publications
IPP Office, Development Bank of Southern Africa, & National Treasury. (2020). *Independent Power Producers Procurement Programme (REIPPP): An Overview*.
Jain, S., & Jain, P. K. (2017a). The rise of Renewable Energy implementation in South Africa. *Energy Procedia*, *143*, 721–726. https://doi.org/10.1016/J.EGYPRO.2017.12.752
Jain, S., & Jain, P. K. (2017b). The rise of Renewable Energy implementation in South Africa. *Energy Procedia*, *143*, 721–726. https://doi.org/10.1016/j.egypro.2017.12.752
Jasmine Lambert, R., & Pereira Silva, P. (2012). *The challenges of determining the employment effects of renewable energy*. https://doi.org/10.1016/j.rser.2012.03.072
Jenna, C. (PhD). (2021, April). *What (Exactly) Is Thematic Analysis?* Grad Coach. https://gradcoach.com/what-is-thematic-analysis/
King, N., Horrocks, C., & Brooks, J. (2018). Interviews in qualitative research. *Sage*.
Kothari, C. (2017). Research methodology methods and techniques. *New Age International (P) Ltd.*
Kumar, R. (2014). Research Methodology: A Step-by-Step Guide for Beginners. *California: SAGE Publications*.
Larsen, T. H., & Hansen, U. E. (2022). Sustainable industrialization in Africa: the localization of wind-turbine component production in South Africa. *Innovation and Development*, *12*(2), 189–208. https://doi.org/10.1080/2157930X.2020.1720937
Lewis, J. I., & Wiser, R. H. (2007). Fostering a renewable energy technology industry: An international comparison of wind industry policy support mechanisms. *Energy Policy*, *35*(3), 1844–1857.
Li, A., Sun, Y., & Song, X. (2023). Gradual improvement and reactive intervention: China's policy pathway for developing the wind power industry. *Renewable Energy*, *216*. https://doi.org/10.1016/j.renene.2023.119068
Lincoln, Y., & Guba, E. G. (1985). Naturalistic inquiry. *Newbury Park, CA: Sage*.
Malope, B. J. (2022). *Power struggles: An exploration of the contribution of renewable energy to sustainable development, decent work and the "just transition" through a case study of wind farm development outside Loeriesfontein, Northern Cape Province (2011-2020)*. https://scholar.sun.ac.za
Marleny, A. (2023, June 22). *Renewable energy skills shortage poses major challenge to sector's growth*. Engineering News. https://www.engineeringnews.co.za/article/renewable-energy-skills-shortage-poses-major-challenge-to-sectors-growth-2023-06-22
Mason, M. (2010). *Sample size and saturation in PhD studies using qualitative interviews.*

McGrath, C., Palmgren, P. J., & Liljedahl, M. (2019). Twelve tips for conducting qualitative research interviews. *Medical Teacher*, *41*(9), 1002–1006.
Mhlathi, Y. (2019, April 19). *Uncertainty over renewable energy results in job losses at wind turbine company*. SABC News. https://www.sabcnews.com/sabcnews/uncertainty-over-renewable-energy-results-in-job-losses-at-wind-turbine-company/
Miller, J. (2016, November 11). *NERSA Should Take Eskom To Task Over Illegal Refusal To Sign PPAs*. Cullinan & Associates . https://www.polity.org.za/article/nersa-should-take-eskom-to-task-over-illegal-refusal-to-sign-ppas-2016-11-11
Montmasson-Clair, G. (2021). *Making sense of jobs in South Africa's just energy transition: Managing the impact of a coal transition on employment OVERVIEW*. www.tips.org.za
Morris, M., Robbins, G., Hansen, U., & Nygard, I. (2022). The wind energy global value chain localisation and industrial policy failure in South Africa. *Journal of International Business Policy*, *5*(4), 490–511. https://doi.org/10.1057/s42214-021-00123-8
Mukonza, C., & Nhamo, G. (2018). Wind energy in South Africa: A review of policies, institutions and programmes. *Journal of Energy in Southern Africa*, *29*(2), 21–28. https://doi.org/10.17159/2413-3051/2018/v29i2a1433
National Research Council. (2012). Climate change: Evidence, impacts, and choices: PDF booklet. In *Climate Change: Evidence, Impacts, and Choices: PDF Booklet*. National Academies Press. https://doi.org/10.17226/14673
Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, *16*(1). https://doi.org/10.1177/1609406917733847
Patel, M., Makgetla, N., Maseko, N., & Montmasson-Clair, G. (2020). *SECTOR JOBS RESILIENCE PLAN: COAL VALUE CHAIN*. www.tips.org.za
Petty, N. J., Thomson, O. P., & Stew, G. (2012). Ready for a paradigm shift? Part 2: Introducing qualitative research methodologies and methods. *Manual Therapy*, *17*(5), 378–384. https://doi.org/10.1016/j.math.2012.03.004
Pieper, I., & Thomson, C. J. H. (2016). Beneficence as a principle in human research. *Monash Bioethics Review*, *34*(2), 117–135. https://doi.org/10.1007/s40592-016-0061-3
Pillay, P., & Stiftung, F. E. (2000). *South Africa in the 21st century : key socio-economic challenges*. Friedrich-Ebert-Stiftung (South Africa).
Presidency of the Republic of South Africa. (2019, September 23). *Statement by H.E. President Cyril Ramaphosa of South Africa to the United Nations Secretary-General's Climate Summit*. https://dirco.gov.za/statement-by-h-e-president-cyril-ramaphosa-of-south-africa-to-the-united-nations-secretary-generals-climate-summit-23-september-2019/
PWC. (2020, October). *SA Mines 2020: Essential and Resilient*. Https://Www.Pwc.Co.Za/En/Assets/Pdf/Sa-Mine-2020.Pdf. https://www.pwc.co.za/en/assets/pdf/sa-mine-2020.pdf
PWC. (2021). *What a "just transition" means for jobs in South Africa*. Https://Www.Pwc.Co.Za/En/Assets/Pdf/What-a-Just-Transition-Means-for-Jobs-in-South-Africa.Pdf. https://www.pwc.co.za/en/assets/pdf/what-a-just-transition-means-for-jobs-in-south-africa.pdf
Ramabu, N. M. (2020). Whose autonomy is it? Botswana socio-ethical approach to the consenting process. *Developing World Bioethics*, *20*(4), 184–193. https://doi.org/10.1111/dewb.12253
Raworth, K. (2019). *Conducting semi-structured interviews*. Https://Oxfamilibrary.Openrepository.Com/Bitstream/Handle/10546/252993/Ml-Guideline-Conducting-Semistructured-Interviews-221112-En.Pdf;Jsessionid=480F76B6351CDF2154100CD639AF7925?Sequence=13.
REN21. (2022). *Renewables 2022 Global Status Report*.
Republic of South Africa. (2016). *South Africa's Intended Nationally Determined Contribution (INDC)*. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/South%20Africa%20First/South%20Africa.pdf

Resnik, D. B. (2023, September 2). *What Is Ethics in Research & Why Is It Important?* . Https://Www.Niehs.Nih.Gov/Research/Resources/Bioethics/Whatis/Index.Cfm.
Rivett-Carnac, K. (2022). *Insights into the wind energy value chain in South Africa*. www.tips.org.za
Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., & Lambin, E. F. (2009). A Safe Operating Space for Humanity. *Nature*, *461*(7263), 472–475.
SABC News. (2023, December 3). *Minister Creecy engages World Bank on Komati Power Plant closure impact*. Https://Www.Youtube.Com/Watch?V=JDz8-FutnnY. https://www.youtube.com/watch?v=JDz8-futnnY
Sardana, N., Shekoohi, S., Cornett, E. M., & Kaye, A. D. (2023). Qualitative and quantitative research methods. In *Substance Use and Addiction Research* (pp. 65–69). Elsevier. https://doi.org/10.1016/B978-0-323-98814-8.00008-1
Sasol. (2021, September). *Sasol Limited Integrated Report*. Https://Www.Sasol.Com/Sites/Default/Files/2022-08/Sasol%20Integrated%20Report_2021_22Sep21.Pdf.
Saunders, M., Lewis, P., Thornhill, A., & Bristow, A. (2016). Research Methods for Business Students. *London: Pearson*.
SAWEA. (2019). *South African Wind Energy Association | About*. https://sawea.org.za/about/
Schmid, N., & Lumsden, C. (2023). Sowing the seeds of change: Policy feedback and ratcheting up in South African energy policy. *Energy Policy*, *178*. https://doi.org/10.1016/j.enpol.2023.113597
Schulte, L., Klindt, M. P., Robinson, B., Stephens, S., & Umney, C. (2022). Wind Energy and the Just Transition: Political and Socio-Economic Pinch Points in Wind Turbine Manufacturing and Windfarm Communities in Europe and South Africa. *London: The British Academy*.
Sguazzin, A. (2021, August 5). *South Africa Wealth Gap Unchanged Since Apartheid, Says World Inequality Lab*. Https://Time.Com/6087699/South-Africa-Wealth-Gap-Unchanged-since-Apartheid/.
Simas, M., & Pacca, S. (2014). Assessing employment in renewable energy technologies: A case study for wind power in Brazil. In *Renewable and Sustainable Energy Reviews* (Vol. 31, pp. 83–90). Elsevier Ltd. https://doi.org/10.1016/j.rser.2013.11.046
Simon, M. K., & Goes, J. (2013). *Assumptions, Limitations, Delimitations, and Scope of the Study*. www.dissertationrecipes.com
Smith, S. (2017). *Just Transition: A Report for the OECD*. https://www.oecd.org/environment/cc/g20-climate/collapsecontents/Just-Transition-Centre-report-just-transition.pdf
Solidarity. (2022, November 7). *The rise and rise of Eskom's tariffs over the years*. https://solidariteit.co.za/en/the-rise-and-rise-of-eskoms-tariffs-over-the-years/#:~:text=From%20the%202008%20electricity%20crisis,over%20this%20period%20was%20129%25.
South Africa National Planning Commission. (2012). *National Development Plan, 2030*. National Planning Commission. https://www.gov.za/sites/default/files/gcis_document/201409/ndp-2030-our-future-make-it-workr.pdf
South African Government. (2011). *Renewable Independent Power Producer Programme*. https://www.gov.za/about-government/government-programmes/renewable-independent-power-producer-programme
South African Institute of International Affairs (SAIIA). (2022). *The South African Green Hydrogen TVET Ecosystem Just Transition Strategic Framework Synthesis Report*.
South African National Energy Development Institute (SANEDI). (2020, December). *Wind Atlas for South Africa (WASA) SANEDI*. http://www.wasaproject.info/
Statistics South Africa. (2016, July 1). *Community Survey 2016 Statistical Release*. P0301. http://cs2016.statssa.gov.za/wp-content/uploads/2016/07/NT-30-06-2016-RELEASE-for-CS-2016-_Statistical-releas_1-July-2016.pdf
Stats SA. (2023). *Unemployment rate in South Africa*.

https://www.statssa.gov.za/?page_id=737&id=1
Swilling, M., Nygaard, I., Kruger, W., Wlokas, H., Jhetam, T., Davies, M., Jacob, M., Morris, M., Robbins, G., Funder, M., Khan, B. S., & Cronin, T. (2022). Linking the energy transition and economic development: A framework for analysis of energy transitions in the global South. *Energy Research and Social Science*, *90*. https://doi.org/10.1016/j.erss.2022.102567
Terry, G., Hayfield, N., Clarke, V., & Braun. Virginia. (2017). Thematic Analysis. In C. Willig & W. S. Rogers (Eds.), *The SAGE Handbook of Qualitative Research in Psychology* (pp. 17–35). SAGE Publications. https://0-web-s-ebscohost-com.innopac.wits.ac.za/ehost/ebookviewer/ebook/bmxlYmtfXzE1Mzg1MjJfX0FO0?sid=22ad5515-65a5-49c2-98e4-8891e6f2f5cc@redis&vid=2&format=EB&rid=1
The Just Transition Centre. (2023, September). *JUST TRANSITION CENTRE*. Https://Www.Ituc-Csi.Org/Just-Transition-Centre.
Tobin, G. A., & Begley, C. M. (2004). Methodological rigour within a qualitative framework. *Journal of Advanced Nursing*, *48*, 388–396.
Tyler, E. (2018). *Briefing Paper: An overview of the employment implications of the South African power sector transition*.
United Nations. (2015). *Transforming our World: The 2030 Agenda for Sustainable Development*. https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf
Walwyn, D. R., & Brent, A. C. (2015). Renewable energy gathers steam in South Africa. *Renewable and Sustainable Energy Reviews*, *41*, 390–401. https://doi.org/10.1016/J.RSER.2014.08.049
Wang, S., Wang, S., & Liu, J. (2018). *Life-cycle green-house gas emissions of onshore and offshore wind turbines*. https://doi.org/10.1016/j.jclepro.2018.11.031
Wang, X., & Lo, K. (2021). Just transition: A conceptual review. *Energy Research & Social Science*, *82*, 102291. https://doi.org/10.1016/j.erss.2021.102291
Williams, C. (2007). Research Methods. *Journal of Business & Economic Research-March*, *5*, 65.
Willis, A. (2021). *Investigating The Net Employment Impacts of Renewable Energy In South Africa*. http://repository.tudelft.nl/.
World Energy Council. (2021). *World Energy Trilemma Index*. www.worldenergy.org

APPENDIX A: PARTICIPANT INFORMATION SHEET

2 St Davids Place
Parktown
Johannesburg
2050
[Date]

Dear Mr./Ms./Dr./Professor [Title followed by potential participant name and surname]

Invitation to participate in research study semi-structured interview

My name is Nomvula Zondi, I am a Master of Science (Interdisciplinary Global Change Studies) student at the University of the Witwatersrand, Johannesburg. I am conducting a research study as part of the requirements for the Master's qualification, and my research topic is **"The impact of the just energy transition on job creation in South Africa: a case of the wind energy sector".** My supervisor is Prof. Lwazi Ngubevana. The research investigates whether the deployment of wind energy in South Africa to date sufficiently addresses the socio-economic objectives such as job creation. The research aim is to identify enabling critical factors that must be considered to expedite the deployment of wind energy in a manner that enables maximum job creation and aid the Just Energy Transition in South Africa.

I like to request your participation in a semi-structured interview to address the research questions. If you decide to take part, your participation in this research study will last for 30-45 minutes over a virtual interview on either Teams or Zoom at a time convenient to you.

With your permission, I would like to audio record the interview. Your participation will be treated with confidentiality and anonymity, and the data will be stored in a password-protected folder when the study is still in progress. The data will be stored for five years after completion of the study and then deleted after that. During the research activity, I will need to ask for personal information about you, including your highest qualification and area of expertise. Such personal information will be anonymised and kept confidential. When I share the research study results, I will not include your name or anything else that could identify you.

Participation in this study is voluntary. You can withdraw your participation in the study at any time during the interview, and recorded responses will not be used. You will not get any direct benefits if you choose to join the research study. You will not lose any services, benefits or rights you usually have if you decide not to join. Taking part in the research study will not cost you anything. You will not be paid for being in this research study. The risks for this research study are no more than what happens in everyday life.

This research study will be written up as a research report. The report will be available on the university library website. If you would like to receive a summary of this report, I will gladly share it.

Your participation will be greatly appreciated. If you have any questions during or after this research study, please contact me or my supervisor using the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical) by telephone at +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

Yours sincerely,
Nomvula Zondi

Researcher:
Nomvula Zondi, 2310932@students.wits.ac.za, 082 479 2282

Supervisor:
Prof. Lwazi Ngubevana, lwazi.ngubevana@wits.ac.za, +27 11 717 3564

APPENDIX B: PARTICIPANT CONSENT FORM

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

CONSENT TO PARTICIPATE IN THE MASTER OF SCIENCE RESEARCH STUDY TITLED:

**THE IMPACT OF THE JUST ENERGY TRANSITION ON JOB CREATION IN SOUTH AFRICA:
A CASE OF THE WIND ENERGY SECTOR**

BY

NOMVULA BERYL ZONDI

STUDENT NO: 2310932

I,...agree to participate in this research project and hereby grant permission to Ms. Nomvula B. Zondi to interview me for her MSc research study titled **THE IMPACT OF THE JUST ENERGY TRANSITION ON JOB CREATION IN SOUTH AFRICA: A CASE OF THE WIND ENERGY SECTOR**

I agree to the following *(Please tick the relevant options below)*:

a)	The research study was explained to me. I understand what this study is about.	YES ☐	NO ☐
b)	I understand that I am taking part in the study on a voluntary basis.	YES ☐	NO ☐
c)	I agree that the interview may be audio-recorded for later transcription	YES ☐	NO ☐
d)	I agree that direct quotations from my interview may be used by the researcher in their research report anonymously without any reference to my name or any specific details that could lead to identification.	YES ☐	NO ☐
e)	I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report).	YES ☐	NO ☐
f)	I agree that other researchers may use the information I provide in my interview depending on their own ethics clearance being obtained but my name and any personal information will not be used or passed on.	YES ☐	NO ☐

Signed on: ....

Participant Designation / Area of Expertise: ....

NBZondi...

Ms Nomvula Beryl Zondi	[Participant Name]
Researcher Signature	Participant Signature

APPENDIX C: RESEARCH INSTRUMENT – INTERVIEW GUIDE

SECTION A: BIOGRAPHICAL DATA

1. Gender	MALE	☐	FEMALE	☐	
2. Highest Qualification	**Tick X**	**3. Area of expertise**			**Tick X**
Below Matric	☐	**Policy & Regulation**			☐
Matric	☐	Researcher / Policy Interest Group			☐
Certificate	☐	Government Regulator			☐
Diploma	☐	Association of Wind Energy / Advocacy			☐
Bachelor's Degree	☐	**Wind Value Chain**			☐
Master's Degree	☐	Wind Turbine OEM			☐
Doctoral Degree	☐	Wind Farm Developer			☐
Other (specify)	☐	Wind Farm Employee / Entrepreneur			☐
		Engineering, procurement, and construction (EPC)			☐
		Other (specify)			☐
4. Years of experience in the area of expertise identified in question 3	<12 months	1-5 years	6-10 years	11-15 Years	>15 years
	☐	☐	☐	☒	☐

SECTION B: INTERVIEW GUIDE QUESTIONS

1. Introduction	
1.1.	Tell me about yourself, your experience, and your role as the energy sector transitions to renewable energy sources.
1.2.	What does your role (and that of your institution or organisation) entail in the energy value chain as the country transitions from fossil fuels to renewable energy sources?
2. The employment effect of the energy transition	
2.1.	What are the possible net employment effects of South Africa's transition from coal to renewable energy sources such as wind for electricity generation? *In your answer, please consider the following key aspects:* • The nascent nature of wind energy technologies in South Africa. • Impacted communities. • Impact on various employment groups (skilled labour, professionals, contractors)

2.2.	Does the fossil fuels workforce need to be concerned about their job security as South Africa transitions from coal energy sources to deploying wind energy into the energy mix? *In your answer, consider the following key aspects.* • Skills required for the low carbon economy • The rationale and urgency of the energy transition
2.3.	What are the threats or opportunities for the impacted fossil fuels workforce?
3. Factors that must be considered to promote an employment-led just energy transition	
3.1.	South Africa has adopted several renewable energy deployment policies to accelerate a just energy transition that leaves no one behind. Does our policy regulatory framework effectively promote an employment-led just energy transition? *In your answer, consider policies such as:* • REIPPPP bidding requirements • Integrated Resource Plan (IRP) • 2030 National Development Plan (NDP) vision • South African Renewable Energy Masterplan (SAREM) • White Paper on Renewable Energy of 2003
3.2.	Which skill set is South Africa well positioned in as the country adopts the nascent wind energy technology? *In your answer, consider the different project phases listed below:* • Project development • Procurement of services • Manufacturing • Construction and installation • Operations and maintenance
3.3.	Are independent power producers (IPPs) well-positioned to create local jobs? *In your answer, consider the following key aspects* • Power purchase agreement between the IPPs and Eskom • REIPPPP policy framework for economic development
4. Job creation opportunities that can be explored along the wind energy sector value chain	
4.1.	What are the employment or entrepreneurial opportunities that are associated with wind energy deployment in South Africa? *In your answer, consider the different project phases listed below:* • Project development • Procurement of services • Manufacturing • Construction and installation • Operations and maintenance

4.2.	How can the wind energy sector value chain promote an employment-led just energy transition? What are the key drivers for job creation? *In your answer, consider the following key aspects:* • Manufacturing • Direct and indirect jobs • South Africa capabilities and limitations
4.3.	What challenges and barriers hinder the swift deployment of wind energy, and how can they be effectively addressed to optimise job creation along the energy value chain?
4.4.	What recommendations can you make on how to pursue the just energy transition to maximise job creation without leaving anyone behind?