



**The Just Energy Transition Framework as a solution to resolve load
shedding in South Africa**

Applied Research Project

Submitted by

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DECLARATION

I, **Sibongile Greetar Mondalamo**, declare that this research project is my work, I was not assisted from the development to completion of the thesis by any person or artificial intelligence application. The degree is submitted in fulfilment of Master of Business Administration at the University of Witwatersrand, Johannesburg. It has been submitted before for any degree or examination at any higher institutions in South Africa and internationally.



_____ (Signature of student) on this **29** day of
_____**February**____ 2024, in _____**Pretoria.**

A Mini dissertation submitted to the Faculty of Law, Commerce, and Management at the University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Business Administration.

DEDICATION

Considering the pressing need for a reliable and sustainable energy supply in South Africa, this study is dedicated to various stakeholders in the government and private sectors who are committed to better understanding the role and impact of the Just Energy Transition Framework. This framework is being seen as a potential solution to address the load-shedding issue in South Africa through investment priorities committed to increasing investment in electricity capacity and infrastructure development.

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ABSTRACT

This study examines the Just Energy Transition (JET) Framework as a response to South Africa's persistent load-shedding crisis. Due to aging infrastructure and limited generation capacity, the need to decarbonize and ongoing power cuts necessitate a shift towards renewable energy.

Launched in 2022, the JET Framework aims to facilitate a transition from coal and fossil fuels. It seeks collaboration with Independent Power Producers (IPPs) to achieve this goal, with initial funding of USD 8.5 billion secured through concessional loans. While initial cost estimates amount to \$98 billion, historical trends suggest potential price increases as the project progresses.

The research holds significance in light of South Africa's current challenge of reconciling its energy demands with environmental sustainability and social equity. A structured study can facilitate identifying and assessing feasible solutions for an equitable energy transition.

A comparative research design analysed secondary data from 20 documents associated with countries aligned with the Paris Agreement. The data was sampled using non-random selection, collected through desktop research, and analysed using the document analysis technique. The study results suggest the JET Framework's potential to address load shedding, is contingent upon sufficient funding, skilled labour, effective management, a political will, and policy certainty. However, challenges remain, including resistance to coal dependence reduction, the socio-economic impact of closing coal plants, and implementation bottlenecks within the National Energy Crisis Committee (NECOM) initiatives.

In conclusion, South Africa faces ongoing challenges in achieving energy security and decarbonization goals. Addressing these obstacles and fostering a cohesive energy policy based on scientific and economic analysis is crucial for a successful energy transition. The Energy Action Plan's progress in sourcing 6000 MW additional capacity to meet electricity demand demonstrates the potential of private sector involvement.

Keywords: Just Energy Transition, Load shedding, Energy Mix, Transition, Decarbonization, Energy Efficiency, Just Transition, Sustainability

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ACRONYMS

BRICS	: Brazil, Russia, India, China, and South Africa
BP	: British Petroleum
CSIR	: Council for Scientific and Industrial Research
CSP	: Centralized Solar Power
DOE	: Department of Energy
EAP	: Energy Action Plan
GDP	: Gross Domestic Product
GWH	: Gigawatt in hours
KWH	: Kilowatt hour
IEP	: Integrated Energy Plan
IPCC	: Intergovernmental Panel for Climate Change
IPPs	: Independent Power Producers
IPR	: Inevitable Policy Response
IRP	: Integrated Resource Plan
JET IP	: Just Energy Transition Implementation Plan
JET	: Just Energy Transition
MES	: Minimum Emissions Standard
NECOM	: National Energy Crisis Committee
PSA	: Public Servants Association
PVC	: Photovoltaics
REIPPP	: Renewable Energy Independent Power Producer Procurement Programme
RMIPPP	: Risk Mitigation Independent Power Producer Procurement Programme
RSA	: Republic of South Africa
SAREM	: South African Renewable Energy Plan
TDP	: Transmission Development Plan
TWH	: Trillion-watt in hours
YTD	: Year-To-Date

CHAPTER 1 - BACKGROUND

1.1 Introduction

South Africa is on the verge of an economic downturn stemming from the persistent electricity crisis. This situation has significantly contributed to a loss of business output and profitability. State-owned institutions and major business industries struggle to operate optimally to render goods and services (Nheko & Inambao, 2020). Nheko and Inambao (2020) recommend calling the South African government to embark on carefully planned and modern ways to decentralize electricity generation and distribution in partnership with strategic energy industry partners and experts.

South Africa today still faces unprecedented and intermittent power cuts because of limited power capacity to supply the rest of the country since 2007 (PSA, 2015). The author added that the crisis is primarily attributed to the aged and overworked infrastructure and equipment, which the power utility cannot afford to replace or maintain as prescribed. From this affirmation, the root cause of the energy crisis alludes to insufficient investment initiatives to keep power generation capacitated; instead, the major electricity producer and supplier, referred to as Eskom, has instilled a culture of electricity monopoly, which hinders sufficient revenue from funding projects and efforts to increase capacity generation. South Africa's president, Cyril Ramaphosa, announced plans to shift dependence on fossil fuels to renewable energy initiatives by partnering with Independent Power Producers (Business Tech, 2022). The project to transition will be implemented by adopting the Just Transition Framework (Business Tech, 2022).

My Broadband (2024) reported Eskom has provided an outlook for the electricity system in 2024, indicating that there may be an electricity shortage throughout the year. As a result, more frequent and prolonged power cuts should be expected. The increasing state of electricity shortage has intensified and is undeniably underestimated by stakeholders in the electricity generation process; however, fundamental and validated insights have been discovered to prove the existence of

feasible solutions aimed at curbing and resolving the constant energy cuts, which also advocate for the support of green initiatives and lessen emissions (Steyn *et al.* (2022).

Bridle *et al* (2022) propose that fiscal energy policies could be potentially associated with supporting national energy generation and supply security. The authors mention the importance of aligning the national energy fiscal policy objectives with renewable energy subsidies to influence energy generation and consumption significantly and positively. Energy subsidies form part of key economic drivers that the government can utilize to spur energy production and consumption. The South African government should shift focus from providing energy subsidies to promoting electricity generation from fossil fuels to renewable sources to enhance energy security and access to affordable energy. Given the above assertion, the effects of subsidies must be discussed and observed. A viewpoint made by Bridle *et al* (2022) calls for rigorous and continuous engagements on the cost of subsidies from the South African government incurred to support the energy sector. According to the IISD (2022), energy subsidies in South Africa experienced a significant increase, more than tripling between the financial years 2017 and 2020. This translates to ZAR 172 billion, marking the highest recorded subsidy allocation towards fossil fuels, which includes coal-based electricity generation.

The progression to higher stages (a move to Stage 5 and 6) of load shedding has negatively impacted South Africa's economic growth outlook and has deprived the country's prospects of recovering from COVID-19 lockdown growth limitations (Lawlor, 2023). Load shedding regressed the country's GDP by 2.1% in quarter 3 of 2022 (Lawlor, 2023).

The South African government is still indecisive in shifting away from the monopolistic market dominated by a state-owned company, Eskom; addressing this issue is crucial to resolving recurring power outages experienced by citizens (Allan & Ovary, 2023). The government can take several intervention measures to establish and intensify competition, including a well-regulated trading system, which is essential for achieving optimal results (Allan & Ovary, 2023). In February 2022, the government proposed a Bill to amend the Electricity Regulation Act (2006) to facilitate the shift from a

predominantly Eskom-dominated electricity industry to a more diverse and competitive one, overseen by a Transmission System Operator (Allan & Ovary, 2023).

The bill aims to create a new framework to regulate the electricity sector, designating NERSA as the driver and overseer of the dispensation. This bill is currently being reviewed by Parliament and it seems that the government plans to implement a hybrid market system, which would allow wholesale power to be traded in three ways simultaneously: through a trading platform, regulated power purchase agreements involving government and municipalities buying electricity through a diversified procurement process, where the counterparty can either be a municipality or a transmission system operator, and private Independent Power Producers entering into long-term power purchase agreements directly with end-users through direct supply arrangements. Yet, the direction in which these complex market reforms will take will be largely influenced by market policies that are not yet developed and may not be revealed in the next two years.

According to Burkhardt (2023), Politically linked corruption, coal criminal gangs, and the electricity industry manipulation are some of the significant factors pushing South Africa's electricity market to the edge of total collapse. Throughout its supply chain, Eskom has consistently encountered challenges such as armed robbery, fuel theft, acts of sabotage, and instances of corruption, necessitating the power utility to continuously defend itself.

Even before the violence and vandalism, Eskom's ability to meet the demand was already a problem due to the continuous delay in replacing the failing power plants. As challenges within Eskom escalated, the utility board has allegedly taken drastic measures to address graft cases, however, their efforts have not been fruitful (Burkhardt, 2023). Employees within the utility who are willing to disclose criminal syndicates are intimidated and threatened with violence. Despite an annual expenditure of R3.2 billion on private security, these deficiencies have still not been contained (Burkhardt, 2023).

According to Creamer (2023), the widespread electricity crisis has affected both municipalities' ability to pay their Eskom bills and the lack of investment in new

distribution assets and maintenance of existing infrastructure. As of July 2023, the total overdue municipal debt to Eskom was R63.2 billion, which is an increase of R4.7 billion from the previous year-end figure. The energy security threat posed by these conditions requires attention like what the capacity generation industry has seen recently. To tackle the crisis, policy considerations such as the future of municipal revenue, funding for infrastructure investments, and regulatory certainty regarding feed-in tariffs and wheeling agreements are receiving urgent attention (Creamer, 2023). The National Treasury is also taking steps to deal with Eskom's debt problem, which is harming Eskom's ability to maintain its operations and invest in new infrastructure. By addressing Eskom's debt, investments can be made in essential transmission and other infrastructure, as well as proper maintenance and equipment of power stations (Department of Mineral Resources and Energy, 2024).

The community of Muizenburg, located in Cape Town, South Africa, has expressed dissatisfaction and frustration with the frequent power outages. As a result, they have taken radical steps to form a community electricity crisis committee. The committee aims to explore and implement possible initiatives to stabilize the electricity supply. After brainstorming ideas, the committee devised a plan to create microgrids. Individual households funded the "Big Muizenburg Battery" project, which aims to take the entire community off the national grid.

(Bezuidenhout, 2023).

According to Daniels (2023), South Africa is planning to adopt more renewable energy technology to ensure a stable and sustainable supply of energy for all citizens. This is part of the country's efforts to reduce carbon emissions in the power sector. The South African government developed the South African Renewable Energy Masterplan (SAMREM) to represent a collaboration between the government, private sector, and Labour unions, its primary focus is to harness investment in renewable energy and storage value chain to drive industrial growth, create quality employment opportunities and advance inclusive development (Daniels, 2023).

The master plan revealed that during the years 2010 and 2022, South Africa's renewable energy industry mainly depended on imports. During this time, the country imported solar panels, inverters, lithium-ion batteries, and wind turbines which

amounted to R31 billion, R53 billion, R22 billion, and R30 billion respectively (Daniels, 2023). The investment in renewable energy imports is an indication of the pace at which the private sector is rapidly driving growth toward green initiatives.

Daniels (2023) recorded South Africa's plan to transition to more renewable energy technology to ensure a stable and sustainable supply of energy for all citizens. This is part of the country's efforts to reduce carbon emissions in the power sector. The South African Renewable Energy Masterplan (SAREM) is a collaborative effort between the government, private sector, and labour unions to invest in renewable energy and storage value chains to drive industrial growth, create jobs, and promote inclusive development (Daniels, 2023). The master plan shows that between 2010 and 2022, South Africa imported solar panels, inverters, lithium-ion batteries, and wind turbines worth billions of rand. However, the private sector is now driving growth towards green initiatives without financially burdening the government (Daniels, 2023).

The scale-up of public procurement of renewable energy and battery storage is set for implementation and completion between 2022 and 2030 respectively. By February 2023, the private sector has made significant progress in generating wind and solar PV to counter the generation shortfall. However, Jacobs (2024) reported Eskom's transmission grid expansion backlog, which is estimated to cost around R372 billion to construct, currently spans across 14,000 km. This poses a significant challenge for South Africa to connect more renewable energy projects in the coastal regions and put an end to load-shedding. Though Eskom aims to build 14,000 km of transmission lines over the next decade, the amount has increased significantly due to the private sector's large-scale renewable energy projects in areas with little to no grid capacity. Eskom has stated that it would require an additional R100 billion in the 2025 financial year to execute its transmission development plan, which would increase annually to R170 billion in 2029 (Jacobs, 2024). The South African National Energy Development Institute's Professor Sampson Mamphweli suggests that Eskom, and even the government, with its poor balance sheet, cannot afford to fund such an expansion and will need to seek assistance from the private sector (Jacobs, 2024).

The recent IRP Energy plan (2023) draft was published in the South African Government Gazette and is due for public comments (World Nuclear News, 2024).

The plan aims to address current issues in the electricity generation sector and meet the demand from 2023 until 2030. The second time frame, from 2031 to 2050, focuses on long-term planning to achieve a net-zero electricity sector by 2050 (World Nuclear News, 2024). Since the implementation of IRP (2019), there have been various advancements in the electricity sector in South Africa (Department of Mineral Resources and Energy, 2024). One of these includes the formation of the Presidential Climate Commission, which is a group of stakeholders appointed by the President to guide the country's response to climate change and strategies to transition to a low-carbon economy. The commission has produced the Just Energy Transition Framework as one of its key outcomes. Moreover, in addition, the Energy Action Plan was announced by the President on July 25, 2022, to reduce load shedding and achieve energy security. The National Energy Crisis Committee oversees the implementation of the energy plan (Department of Mineral Resources and Energy, 2024).

1.2 Problem Statement

According to the World Bank (2023), South Africa has a significant reliance on a coal power generation system that is aging, unreliable, polluting the environment, and struggling to meet the electricity demand of the population, business, and all sectors of the economy. Furthermore, the current power supply deficit is estimated to be between 4 to 6 Gigawatts (GW), leading to up to 10 hours of load shedding per day, affecting people's livelihoods and economic growth prospects. The World Bank (2023) further records that approximately 10% of the population has no access to electricity and about 47% is regarded as energy-poor, therefore, the country needs energy investment initiatives that provide a reliable electricity supply.

The state-owned power producer in South Africa formerly produced about 95% of the country's total power capacity, however, due to intermittent power outages, production capacity reduced to 80% after the year 2013 (Eskom, 2023). According to the power producer, all efforts are made to ensure stability in the national grid to balance supply and demand as Eskom must continually manage and adapt to the increasing quantities of electricity needs (PSA, 2015). According to Business Tech (2023), the South African

Reserve Bank, in collaboration with financial sector regulators including JSE (Johannesburg Stock Exchange), is working on a business contingency plan that prepares the bank payments system, in the event the national electricity grid collapses. The preparation process began in 2015 and involves planning on risks related to the functioning of the financial system and determining mitigation factors that would stabilize the system (Moonstone, 2023).

The energy crisis in South Africa has had a profound impact on various sectors, including business, health, and education. According to Business Tech (2023), the retail sector has been particularly affected by load shedding. One of the biggest retail giants, Pick n Pay, has had to spend a significant amount of money to keep its operations running. As per the report, the company spent approximately R522 million in the 2022/2023 financial year, and this expenditure increased to R60 million a month on diesel to keep its generators operational. This expenditure has reportedly affected company profitability. Because of increasing electricity demand, Eskom is planning to roll out mandatory smart meter devices which will be remotely controlled by Eskom and will thus compel every household to switch off major home appliances (Greyling, 2023). The plan is already documented and will be implemented through a smart grid framework, which outlines the distribution and usage of electricity being integrated through a connection, and monitoring the activity of all electricity stakeholders, comprising of users and producers, to achieve a sustainable, reliable, and affordable supply (Mathe, 2023).

The state-owned power producer and supplier operates and dominates as a natural monopoly because of debates that power production and distribution is a natural monopoly (PSA, 2015). The concept of a natural monopoly is defined as a market structure in which a single supplier dominates and controls a particular market. Greer (2011) explained that historically, a natural monopoly was found in a scenario where market structures were touted as naturally monopolistic. Barriers to entering the market were presented through high start-up capital outlay and overhead costs which decreased with increases in output. In this case, economies of scale are so substantial to an extent that a company can present itself as an efficient and sole supplier of a product or service. This viewpoint explains the monopolistic nature of the supply of the electricity market.

1.3 Research Questions

Electricity supply in South Africa is in dire state to the point that the president of South Africa declared a state of disaster following a series of power blackouts which have greatly impacted business and other important sectors of the economy (Macaulay, 2023). To assess the research topic, the following primary research questions will aid in investigating the JET Framework's prospects of resolving load shedding:

- i. In the effort to address high carbon emissions challenges inherited from the use of coal and fossil fuels to generate electricity, is there an opportunity to resolve load shedding through the implementation of the JET Framework in South Africa?
- ii. Apart from the Just Energy Transition framework, what other measures are being taken to address load-shedding, and what impact do they have in combating it?

1.4 Research Objective

To guide the research process, research objectives are formulated to support the aim of the study. The following research objectives have been defined to respond to the research questions.

- i. To investigate whether the Just Energy Transition Framework is a suitable approach to resolve load shedding in South Africa, amongst other initiatives proposed by the National Energy Crisis Committee, the Integrated Resource Plan, and the Energy Action Plan.
- ii. To evaluate the measures designed to minimize the factors contributing to load-shedding.

1.5 The Aim of the Study

The study aimed to investigate the development and implementation of the Just Energy Transition Framework. The framework has the potential to facilitate the shift from non-renewable coal and fossil fuel power generation to sustainable and renewable energy sources. Moreover, the study analysed the joint efforts of the government and private

sector in implementing crucial initiatives to tackle the electricity shortage in the country since the JET framework will not be sufficient to resolve the overall electricity crisis in South Africa.

1.6 Justification of the study

This study aimed to delve into the underlying reasons behind load shedding and assess the impact of global energy transition in various countries that are part of the Just Energy Transition Framework. The core objective behind examining the JET framework and its implementation in different countries is based on the belief that tackling the social and economic issues nations face, such as load shedding, requires simultaneous efforts toward climate action and sustainable development. This study sought to address how load shedding has contributed to the economic downturn in South Africa, and how the JET framework and energy initiatives can help mitigate its impact.

1.7 Delimitation of the study

Energy transition initiatives that are implemented internationally are instrumental in the research process to allow benchmarking of the JET framework objectives and outcomes to address the load-shedding crisis in South Africa. The study investigated South Africa's energy sector, including Eskom's plans towards the Just Energy Framework. Theoretical underpinnings are motivated by existing frameworks within the context of transition and sustainability with the adoption of inductive reasoning to guide the theoretical framework.

1.8 Operational Definitions

To facilitate comprehension of the study and its underlying theories that pertain to the energy sector, key definitions within the energy transition spectrum have been extracted from various articles and presented in a contextualized manner. These definitions serve to elucidate operational concepts that are crucial to the study and to enhance the reader's understanding of the subject matter.

1.8.1 Transition: Roggema *et al.*, (2012) describe transition as a shift from a particular point of status quo or existing situation towards a more sustainable change. The authors further alluded that the concept of transition is a systematic and continuous process of change in society, structurally changing certain features of the society. The concept of Just Transition and its development towards environmentally sustainable economies and societies gained traction since its inception in 2015 (United Nations, 2022). Generally, the Just Transition concept refers to the institution and establishment of policies, practices, and measures put in place to ensure that countries and their economies are not excluded from the progress or development made toward transition to low-carbon and environmentally sustainable economies and societies (United Nations, 2022).

1.8.2 Sustainability: Literature provides definitions of the concept of sustainability from diverse perspectives, depending on which industry, theory, or business framework the author is abstracting the definition from (Fredriksson & Ytterfors, 2015). Sakalasooriya (2021) the conception of sustainability has been in existence and embedded in societal norms, and heritage across all human races. The concept was traced back to 1972 and introduced in context by the United Nations. The term refers to the continuous nurturing of capacity for all living organisms, all to improve the quality of social systems (Sakalasooriya, 2021). The author further echoed that sustainability is an ongoing and evolving process, instead of an outcome. These definitions do not limit the scope of sustainability.

1.8.3 Load Shedding: is described as an intended or planned and predetermined scheduling of electricity cuts as a measure to prevent the collapse of South Africa's power system (Matsheta & Sefoka, 2023). The process is instituted to reduce demand pressure on the power grid, as an energy-saving initiative. Load shedding is implemented when the electricity demand exceeds the supply capacity, leading to imbalances in the national electricity grid, consequently causing uncontrollable interruptions in the electricity supply (Eskom, 2023). contrary to load shedding, power outages can result from other factors excluding the demand and supply influences (Nowakowska & Tubis, 2015).

1.8.4 Energy Security: Zhinzin *et al.*, (2020) define energy security as a state of continuous access to energy resources at economical prices. The concept predominantly focuses on putting customers first principle. The concept has four characteristics widely used in definitions found in literature, are availability, affordability, acceptability, and accessibility (Cherp & Jewell, 2014).

1.8.5 Decarbonization: The concept of decarbonization is described by the United Nations (2023) as a process of eliminating a specific amount of carbon dioxide emissions generated in an economy to zero net emissions. To achieve a significant reduction of carbon (CO₂) emissions, the process would require an overhaul of certain elements of the economy which includes shifting to alternative approaches of producing energy, goods, and services, changing the way real assets are developed and used (United Nations, 2023). The Paris Agreement on climate change compels various countries and their respective business sector to swiftly adopt and implement programmes that will steer decarbonization objectives by the year 2030 (United Nations, 2013).

1.9. Structure of the paper

The study was structured in the following manner: Chapter 1 presented the background of the study, Chapter 2 focused on a critical review of literature extracted from articles in academic journals, business articles, news pages, and data from company and government websites. Literature was derived from key concepts which are informed by problem statement and research questions. The chapter also suggests various intervention measures to tackle the electricity crisis and ultimately end load shedding. Chapter 3 discussed the research methodology used in the study, Chapter 4 focused analysis and discussion of collected data, and finally, Chapter 5 concluded and provided recommendations that emerged from the study.

CHAPTER 2: CRITICAL LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter was to provide an in-depth understanding of existing research relevant to the research topic and problem statement. Theoretical frameworks were utilized to narrow the scope of research and define key concepts, constructs, and relevant frameworks. The research focused on primary energy supply issues in South Africa and presented an overview of the role of government and private sectors in addressing load shedding through initiatives proposed in the Energy Action Plan (EAP), Integrated Resource Plan (IRP), Just Energy Transition framework (JETP), including the latter's framework's impact in other economies. Additionally, various energy initiatives, specifically in the electricity sector, were reviewed as part of the process of dealing with the electricity crisis and reforming the energy sector. This chapter further aimed to provide readers with a comprehensive understanding of the energy landscape in South Africa and the potential solutions to address the challenges underpinning load shedding in the country.

2.2 Background of South Africa's Energy Sector

Energy in South Africa is an essential commodity that drives socio-economic activities that grow the economy (Department of Energy, 2019). The energy sector in South Africa is predominantly an enabler that drives business, production, and transportation of goods and services in the country. The industry also boasts as the driving force behind the economic and social development process that is key to economic growth and job creation (Ratshomo & Nembahe (2019). It is for this reason that the energy sector avails energy resources that are cheaper, reliable, and sustainable. At the same time, the rules and regulations on environmentally safe energy-producing components are considered (Department of Energy, 2019).

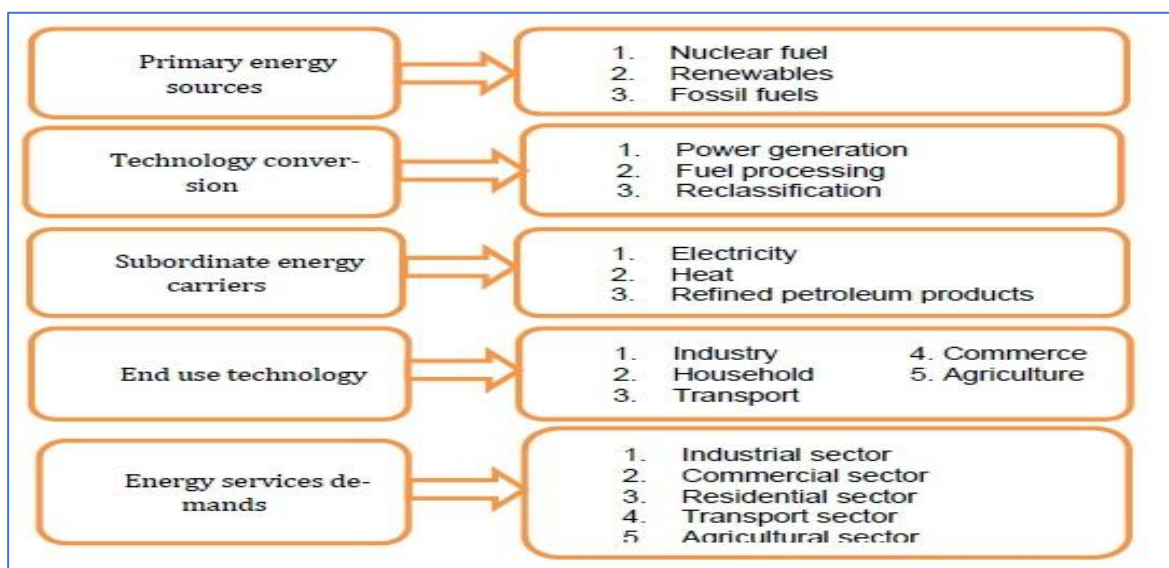
The Department of Energy developed and introduced an Integrated Energy Plan, which was introduced through the white paper policy to guide the process of rolling out future energy initiatives in South Africa. It provides clear instructions on energy

infrastructure and investments. The Integrated Energy Plan is a document that guides the country's overall energy plan for implementing electricity, gas, and liquid fuel power initiatives (Akom, et al., 2021). The energy sector's role governed by the state is to ensure energy security (Department of Energy, 2019).

The difference between the Integrated Energy Plan (IEP) and the Integrated Resource Plan (IRP) is that the latter provides a more detailed roadmap that guides the generation and supply of electricity. It further outlines a live plan that is continuously revised and updated by the Department of Energy according to changes in forecast energy demands for a particular period. Meanwhile, the Integrated Energy Plan is the overall energy action plan for the country's electricity and liquid fuels, which include petrol, paraffin, and diesel (Madingwane, 2017).

South Africa has adopted a scope to roll out the national energy plan framework, from which today's ongoing energy crisis originates. Figure 1 shows a national strategy adopted for the period 2015-2050. Akom *et al.* (2021) analysed the existing South African national integrated energy plan for 2015-2050, as presented in Figure 1. The Department of Energy has set out energy policies and regulations on supply sources that constitute the entire end-to-end supply chain process.

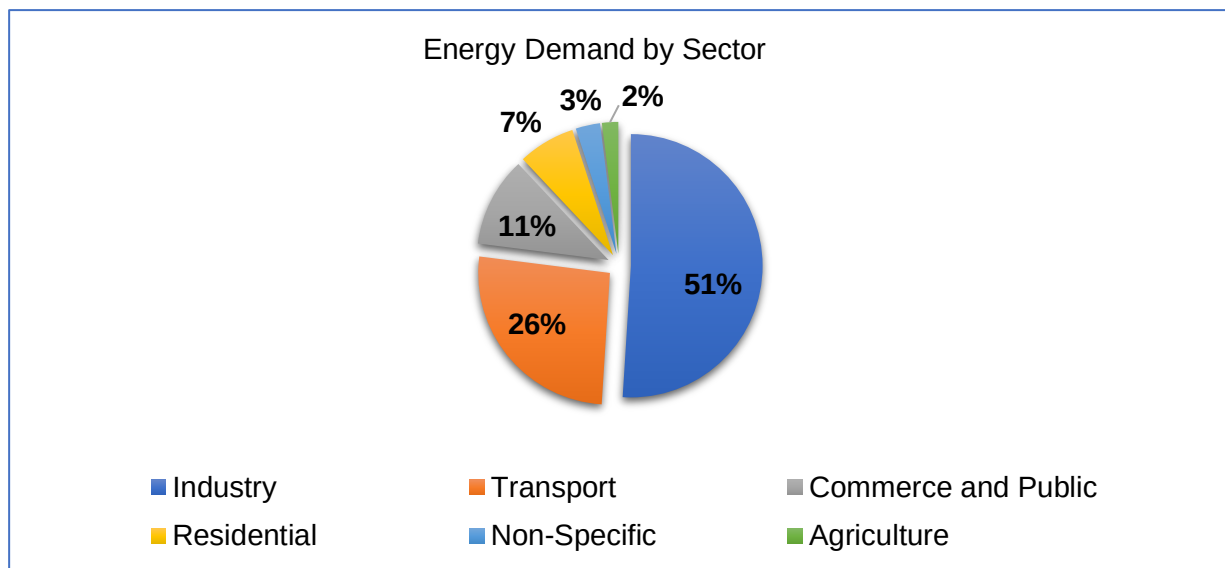
Figure 2. 1: The scope of the IEP



2.3 Demand and Supply Energy Forecast and Analysis

Energy is the driving force and forms part of important sectors of the economy. It is thus responsible for job creation by unleashing, transforming, and distributing production output throughout the value chain of the economy (Department of Energy, 2019). The industry sector takes up most of the consumption, followed by the transport sector.

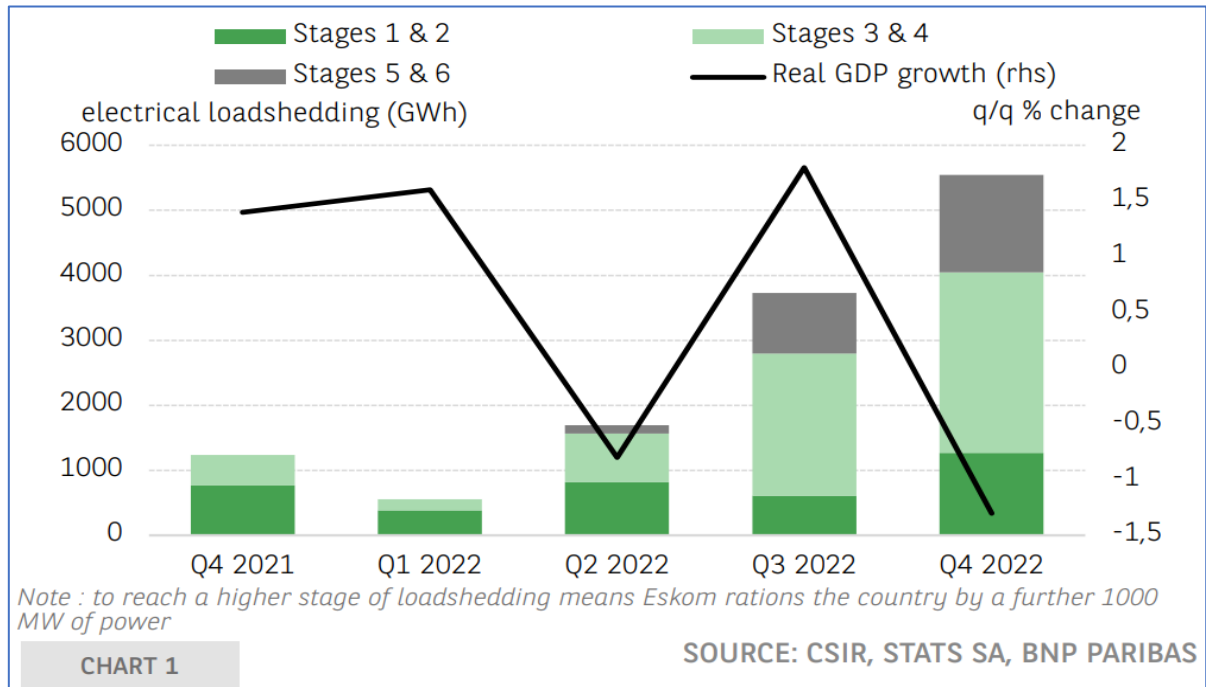
Figure 2. 2: Showing energy demand by sector, DoE Energy Balances, (2018)



2.3.1 Intensity measures of electricity load shedding

BNP Paribas (2023) measures the incidence and intensity of electricity load shedding by comparing the frequency of power cut stages from 2021 to 2022. The analysis found that the country experienced irregular load shedding for 75 and 207 days in 2021 and 2022, respectively. Quarter 4 of 2022, as shown in Figure 1, illustrates a significant rise in frequency and intensity compared to Quarter 4 of 2021.

Figure 2. 3: Showing SA Load shedding increase in frequency and intensity, BNP Paribas (2023)



2.3.2 Sources of electricity generation capacity to boost the national grid system.

The current energy mix scenario for all utility-scale generation technologies for the period 1990 to 2020 shows an increase in renewable generation, especially hydro technology.

Table 2. 1: Electricity generation by source from 1990-2020, CSIR (2023)

Year of use	Coal	Nuclear	Hydro	Oil	Biofuels	Wind	Solar PV	Solar thermal	Units
1990	155926	8449	2851						GWh
1995	173160	11301	1803	391					GWh
2000	193419	13010	3934		307				GWh
2005	229073	11293	4199	78	267	12			GWh
2010	242001	12099	5067	197	203	34			GWh
2015	228572	12237	3729	183	298	2500	1946	190	GWh
2020	211738	9903	6239	322	350	5937	3603	1428	GWh

Power generation for period 1 January – 31 December 2022

Statistics on capacity generation revealed constant electricity system demand figure for year 2021 and 2022, which still sits at 5.2 Twh (Trillion Watts-hours), which was at a low of 2.2% prior to the Covid-19 pandemic. The use of coal in generating power remains a predominant technology in the energy mix, contributing about 80% to the national system grid. In relation to renewable energy transition programmes, there is a decline in the use of wind, solar photovoltaics (PVC), and concentrated solar power (CSP), providing capacity of 6.2 Gw (Gigawatt) of installed capacity. These renewable energy technologies (excluding hydro) added only 7.3% to the total energy mix capacity. The report further shown an increase in the use of diesel. Relative to load shedding, 3 773 hours of load shedding were recorded for the period.

Table 2. 2: Electricity generation by source from 1 January – 30 December 2022, CSIR (2023)

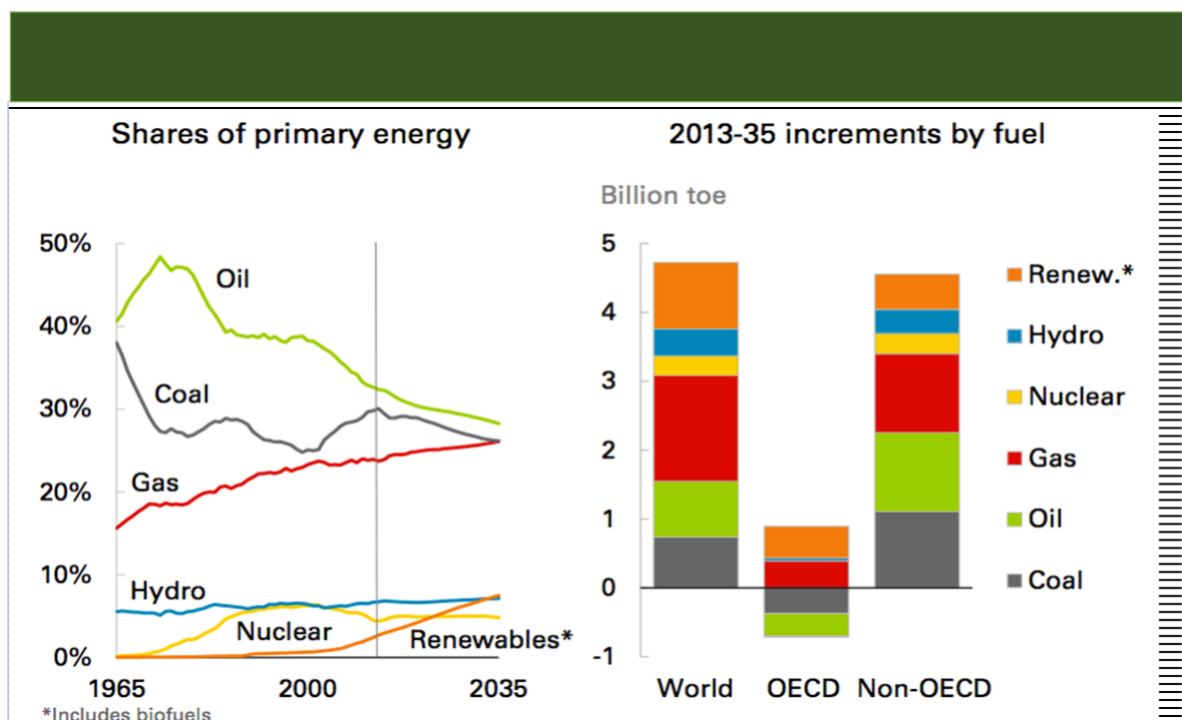
Energy source	% Contribution to system demand	2022 Units Contribution to system demand	Units
Coal	80.1%	176.6	GWh
Nuclear Energy	4.6%	10.1	GWh
Renewable energy	13.7%	30.2	GWh
Renewable energy (Excludes Hydro)	7.3%	16.2	GWh
Nuclear Energy	4.6	10.1	GWh
Diesel generated power	1.6%	3.6	GWh

2.3.3 Future outlook on energy: A base case for the energy mix in South Africa

The diagram provides an outlook on how the energy landscape can be transitioned by shifting the energy mix into sustainable, clean, and efficient energy, a milestone that can be attained in the next 20 years. A perspective into the increased use of fossil fuels as dominant sources of energy to provide at least 60% beyond 2023 and at most reach 80% of the energy by 2035. The move is fundamentally driven by changes in policy, technology, and the economy. A rise in the use of gas-powered sources of energy supported by the global natural gas market, will also be one of the fastest-growing and dominant sectors of energy (BP, 2016). Rapid growth in renewable energy was

influenced by the RMIPPPP and REIPPPP programmes as contained in the white paper policies for renewable energy, exponentially increasing to be the third main source of energy (BP, 2016).

Figure 2. 4: The changing global fuel mix for the primary base case: Outlook till 2035, BP (2016)



2.4 The Impact of Load Shedding on the South African Economy

South Africa is not alone in facing a persistent electricity crisis. Power outages have plagued various countries for decades, causing significant economic disruptions. In South Africa's case, the crisis has had a profound negative impact, leading to industry closures, a sharp decline in productivity, job losses, and cascading effects on healthcare and education. Notably, the year 2022 witnessed the most severe load shedding ever experienced in the country (Naidoo, 2023). The consequences of load shedding on three primary sectors of the economy are briefly explained below:

- Impact on Small Businesses in the Township Economy

According to Nedbank (2023), Small businesses play a vital role in the economy by stimulating economic growth and employment opportunities within their local communities. To ensure their continued operation, many small businesses are compelled to explore alternative methods to sustain their activities, such as investing in alternative energy sources, continuously leading to increased operational expenses. The frequency of load shedding further exacerbates the situation, causing many small businesses to cease operations for extended periods, consequently impacting their revenue and profitability. These challenges are particularly acute for small businesses situated in townships and rural areas, where access to information and affordable alternative energy solutions is limited.

To assess the impact of load-shedding on township small and medium enterprises (SMEs), a collaborative survey was conducted by Nedbank and the Township Entrepreneurs Alliance (TEA) in February 2023. The survey encompassed over 200 businesses across South Africa, and revealed that a significant majority (over 60%) are not currently implementing strategies to cope with load shedding's negative impacts. This finding is particularly concerning in a nation grappling with high unemployment, poverty, and income inequality. The survey also found that 66% of these businesses have been forced to reduce their workforce due to load shedding. The disruptions caused by power outages lead to increased operating costs across various sectors. Small business owners face a double burden: they need to invest in alternative energy solutions to mitigate the impact of outages, and they experience reduced production due to these outages, leading to diminished profit margins. While generators are the most commonly used alternative energy source, solar power is the preferred option for many businesses. However, a knowledge gap exists, as a majority of respondents expressed uncertainty about how to implement solar solutions (Nedbank, 2023).

- Impact of load shedding on South Africa's Gross Domestic Product Growth

The South African Reserve Bank economic report analyzes the decrease in South African economic growth since the global financial crisis, attributing it to internal constraints exacerbated by power outages. The bank estimates that power outages have harmed growth by -0.7 to -3.2 % percent points, and it is crucial to implement

energy reforms and promote private sector involvement and investment to prevent further decline. The report emphasized the sustained decline in growth and emphasizes the need for energy reforms to stimulate investment in electricity generation, ultimately enhancing potential growth in the long term (Van Rensburg & Morema, 2023).

- Impact of load shedding on consumer households

Inglesi-Lotz (2023) highlighted that the interruption of power supply can disrupt daily routines, leading to food spoilage and other challenges. As a result, households have had to adapt to the inability to meet their electricity needs during these power outages. Since the onset of power cuts in South Africa in 2008, households have been continuously reassessing their strategies to cope with the lack of electricity. They have been exploring alternative resources such as diesel-powered generators, solar panels, or wood and charcoal. Some households also choose to postpone activities until power is restored, although this can strain the grid and impact their daily lives later on. While load shedding affects all households, it disproportionately impacts low-income households, which are the most vulnerable in the South African economy. The diversity of households in South Africa, including differences in income, behaviour, and preferences, means that they are affected in varying ways by load shedding. These differences may stem from internal factors or external factors such as geographical location. Low-income households are often situated in areas with aging and unreliable infrastructure, which makes them more susceptible to frequent breakdowns, exacerbating the impact of scheduled load shedding experienced by higher-income households and businesses, particularly in urban areas.

2.5 Key Factors Causing Load Shedding

The electricity sector in South Africa faces various limitations that hinder the sustainable supply of electricity. These limitations include imbalances in supply and demand, and institutional, political, policy-related, and financial challenges. Scholars and researchers have identified and listed these challenges in various literature sources to understand the supply challenges that exacerbate load shedding.

2.5.1 Growth in electricity demand and underinvestment in generation capacity

BNP Paribas (2023) recorded an exponential increase in South Africa's electricity needs between 1991 – 2021, with an average annual population growth rate of 1.0% (World Bank, 2022), while within the same period, the state-owned monopoly electricity provider only managed to construct one power plant. BNP Paribas (2023) highlighted lack of interest in investment initiatives towards increasing capacity generation.

2.5.2 Internal Organizational Dynamics Delaying Measures to resolve Load shedding.

Despite numerous consultations with relevant stakeholders in the process of tackling the energy supply crisis, energy reform programs were then instituted and operationalized through working committees. Subsequently, decisions from those committees were taken to decentralize power generation stations into clusters as a measure to improve in-house generation capacity competition, an operational strategy which the state-owned power producer consequently rejected. This viewpoint links the energy crisis to short-sighted energy administrative planning within the organization (Phalatse, 2020).

2.5.3 Significant dependence on the use of coal to generate electricity.

Due to a significant regression in the global coal production market as countries move towards a cleaner environmental power producing initiatives, coal producing and distributing companies have transitioned to green energy advances. This move reduced global demand for coal, lowering coal tariffs, however, owing to the state-owned power utility cost structure, there has been significant increase in the average energy cost (Phalatse, 2020). Countries have begun a process of restricting reliance on coal such as India, which has implemented economic policy objectives to reduce coal by at least 60% by 2030, a converse move by Eskom increasing reliance on coal by building two additional major coal-powered stations (Phalatse, 2020).

2.5.4 Constraints in the implementation of policies that promote renewable energy.

Musango *et al.*, (2011) state that the white paper policy (2003) on renewable energy was developed fundamentally to promote the use of alternative green energy generation initiatives. In the document, it is explicitly construed that the generation of renewables should reach a target of 10 000 Gwh to complement energy consumption by the year 2013. Renewable sources include the production of energy from biomass, wind, solar, and hydrogen at a limited scope. Progress on implementation of this policy to measure if the targeted Gwh was produced as required.

In addition, Akom *et al.*, (2021) allude that the critical challenge South Africa is facing today relates to a requirement to reduce CO₂ emissions and ensure energy efficiency in the economy, which is impossible to achieve through market activity. South Africa's economy is energy-intensive, as a significant amount of energy is required for every rand of production output, in addition, the country has been ranked top of the world's largest carbon-consuming countries. Halsey *et al.*, (2018) argue that lower quantities of quality coal are sourced and used locally, whereas approximately 30% of quality coal is exported. Allocating to the national electricity grid, 60% of quality coal is assigned for electricity generation at different power stations.

2.5.5 Inadequately maintained coal power stations

The constrained power grid system makes it difficult to schedule regular maintenance of coal power stations. In addition, the state of the independent power producer's financial distress limits the power utility's plans to adequately and timely maintain the plants as required (Steyn *et al.*, 2022).

For many years, electricity prices in South Africa were kept artificially low, which led to underinvestment and insufficient maintenance. These low prices did not encourage efficient behaviour from consumers, service providers, and investors. As a result, Eskom, the national electricity provider, consistently lacked the necessary funds for maintenance and new investments. This led to a decline in plant performance, frequent breakdowns, and a decrease in overall plant availability. Additionally, Eskom's revenue

shortfalls forced the company to seek government support, leading to increased government interference and a loss of autonomy, further impacting its efficiency (Kessides, 2020).

2.5.6 Internal Challenges Encountered at Eskom

In presenting the company system's year-to-date performance in the 2022/23 financial year, Eskom highlighted additional challenges experienced by different power stations that contribute to ongoing and increasing load shedding (Eskom, 2022).

- Eskom asserted that there are many factors contributing to load shedding, however, the primary factor relates to the lack of funding to increase electricity generation capacity and build new capacity to meet high utilization from the population in South Africa.
- Increasing municipal debt incurred from non-payment of electricity usage remains a challenge.
- Energy loss from electricity theft continues to increase and pose operational and financial risks on the severely indebted power utility.
- Theft and vandalism of electricity network equipment impact the operations and electricity distribution, which creates electricity supply interruption incidents.
- The availability rate of existing coal power stations is performing at 59%, a rate that is below the Year-to-Date performance target levels of 77%. The low-performance results from major planned maintenance of power stations infrastructure and equipment.
- Explosions of gas air heaters are caused by internal factors, which may be ascribed to sabotage by employees or senior officials.

A recent convergence of efforts by investigative journalists, civil society organizations, anti-corruption activists, industry and academic experts, political parties, and concerned citizens has brought to light prima facie evidence of state capture in South Africa. This evidence suggests a widespread network of actors, both political and commercial, engaged in a coordinated effort to divert public resources for private gain. Notably, Eskom, a major state-owned utility, has been a focal point of these allegations. Accusations of gross negligence, mismanagement, and

maladministration have been levelled against Eskom's top executives, with the utility's financial woes and insolvency attributed, in large part, to years of corruption and poor governance. While discerning the absolute truth from sometimes conflicting narratives can be challenging, the sheer volume and diverse sources of these allegations and extensive documentation raise significant concerns (Kessides, 2020).

Kessides (2020) further cited accusations that state capture, governance failures, and rampant corruption have compromised Eskom's ability to fulfill its mandated role. Over time, a systematic erosion of Eskom's governance structures and procedures has occurred, marked by instances of corruption, compromised functionality, or deliberate subversion. Financial mismanagement, alongside a pattern of questionable and irregular procurement practices, is the most evident manifestation of this corruption. These issues, coupled with the escalating costs of Eskom's capital expenditure programs and operational expenses, paint a concerning picture of the utility's current state.

2.5.7 Capacity generation-related issues

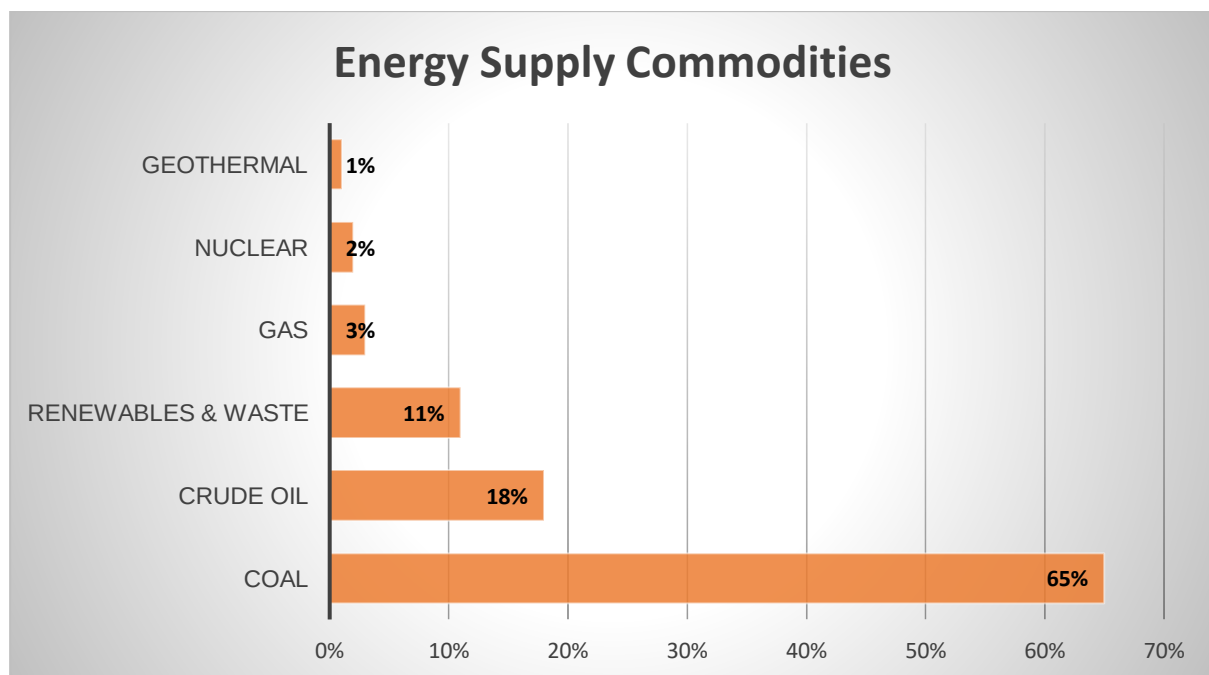
According to Trace (2020), load shedding is caused by a lack of sufficient generating capacity in South Africa, which produces around 47,000 MW of electricity despite having an installed generation capacity of 52,000 MW. This is due to various factors, including operational failures, maintenance issues, and breakdowns at aging power stations that have been poorly maintained. Much of the problem is due to underinvestment in the power sector, which has left Eskom struggling with high debts. To avoid further financial woes, Eskom is seeking higher tariffs than those awarded last year. In January 2020, President Ramaphosa announced that companies and households would be allowed to generate their power to ease the pressure on Eskom.

2.6 An Overview of Managing Energy in South Africa

South Africa's Integrated Plan spells out a long-term diversification of the energy mix targeted by the year 2030, with a transition plan towards a backward move from a carbon footprint (International Energy Agency, 2021). South Africa has substantially large coal reserves (Halsey *et al* (2017). Based on limited oil reserves, South Africa

imports about 90% of crude oil from three countries. Over the years to date, coal has been the major resource base, taking about 65% of the total energy production. The use of coal is predominantly widespread internationally as a primary fuel source, constituting 36% of usage in the world. Approximately 77% of South Africa`s coal produced is currently used to meet the primary needs of energy generation (Department of Energy, 2019).

Figure 2. 5: Showing Energy Supply Commodities, DoE Balances, (2018)



2.6.1 Key Objectives of the Integrated Energy Plan

The key objectives of Integrated Energy Plan cited by Ratshomo & Nembahe (2021). The plan was developed with the strategic intent to accommodate South Africa`s energy requirements for period 2015-2050, serving as a guiding document on energy investments and energy policy development. Contained in the IEP (integrated Energy Plan) is the process within which the energy department determines current and future energy trends by analyzing energy consumption by sector to forecast future consumption based on creation of scenarios. The objectives are fundamentally aimed at ensuring energy security, supply environmentally clean energy, and minimize the

cost of producing, supplying, and consuming energy cheaper, diversifying the energy mix in the supply energy sources, amongst others.

2.7 Energy Transition in South Africa

The global energy transformation development in South Africa reached a low in 2019 and was ranked the second last in energy system performance among 115 countries. Many countries are also encountering transformation challenges in the energy sector, facing pressing issues ranging from dealing with climate change to protecting the environment and sustaining energy security (Lloyd, 2021). The reconfiguration of the green-economy initiatives since the beginning of the global economic crisis in 2007/2008 has gathered a significant weight of a motion, subsequently creating a deliberation on the next energy development cycle. A process of transitioning from coal-powered electricity generation to renewable energy resources because of sustainability restrictions (Mqadi *et al.*, 2018). The concept of sustainable energy transition under these country circumstances poses a question of how a sustainable transformation framework can be conceptualized to tackle low-carbon greenhouse gas emissions that pollute the environment (Halsey *et al.*, 2017).

2.7.1 Transitioning to renewable energy by adopting India`s energy transition strategy.

The Intergovernmental Panel for Climate Change (IPCC) rolled out a directive that compels countries to support an initiative in achieving a global objective that sees a move to zero-carbon emissions economy prior to year 2030 to mitigate catastrophic effects of risen global temperatures (Phalatse, 2020). This global objective contradicts the 2035 outlook on the shift to increase fossil fuels by 2035, also with the state-owned power utility`s in-progress coal building plans placing South Africa as one of the most environment-polluting nations, burning 60% of greenhouse gas emissions. However, the renewable energy fraction creates a more favourable environment to increase renewable energy generation through the existing Renewable Energy Independent Power Procurement Programme, which is defined as a programme initiated to allow independent power producers (IPPs) to “submit price bids for the design, development

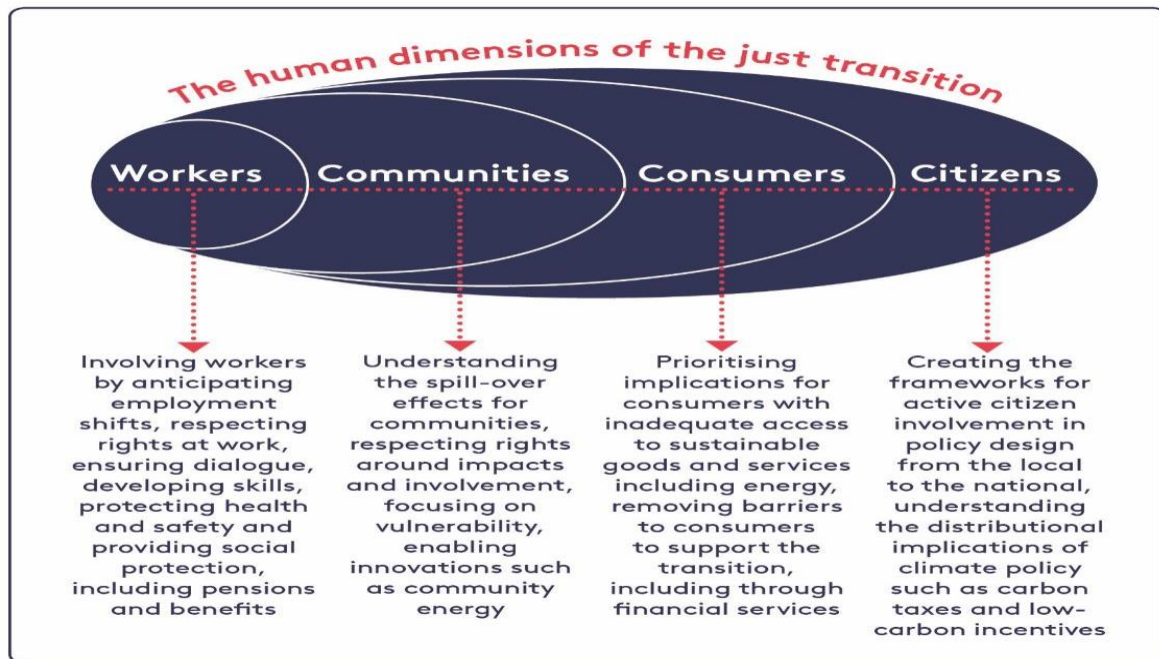
and operation of large-scale renewable energy plants in South Africa”. The human dimension of the Just transition framework adopted by India to shift from green-house gas emissions through economic policy reforms by decreasing dependency on coal by 60% by 2030 (Phalatse, 2020).

2.7.2 The Just Transition Framework

Inevitable Policy Response (2019) alludes that the transition strategies necessary to develop economies into a net-zero carbon footprint have been realised. In the quest to address insufficient energy supply and environmental concerns calls for the shift to sustainable production systems. Though there are many proposed solutions, the process to abruptly shift is difficult than realised. However, some transitions are necessary, and they are summed up by the Just Transition framework in figure 6.

- Transition between sectors that no longer serve the purpose or are unsustainable.
- Transition within sectors that carry less risk and improve resilience such as moving towards sustainable energy generation powered from renewable energy.
- Provide financial support to employees during the transition process.
- Equip workers with necessary skills required to ensure a seamless and beneficial transition.
- Enhance social inclusion and equality through social dialogues such as the Local Resource-Based mechanism which targets vulnerable communities.

Figure 2. 6: The human dimension of the just transition, IPR (2019)



2.8 A Global Transition to Sustainable Energy

Increasing levels of climate change, continuous shortages of energy, and political instability globally have necessitated the need to expedite energy transition (United Nations, 2023). Energy transition is defined as a continuous process that requires plotting and planning long-term energy strategies that apply to the unique challenges of each country to transition energy technologies to achieve net-zero emissions (United Nations, 2023). The efforts to attain net-zero emissions will succeed if trade-offs in the energy supply and demand are recognized and alleviated. The interpretation from this observation means an integrated approach that is people-driven, in which all energy technologies at the disposal of a country play an integral role in transforming local and national energy systems (United Nations, 2023). The Just Energy transition is defined as an approach for multidimensional financing by developed countries to support energy transition investment initiatives in developing countries (Drishti Ias, 2023). It is a shift from dependence on coal and fossil fuels to renewable energy to alleviate the effects of climate change and support sustainability (Drishti Ias, 2023).

2.9 South African Government Initiatives to resolve load shedding through EAP, IRP, JETIP, and other energy initiatives to bolster electricity supply security.

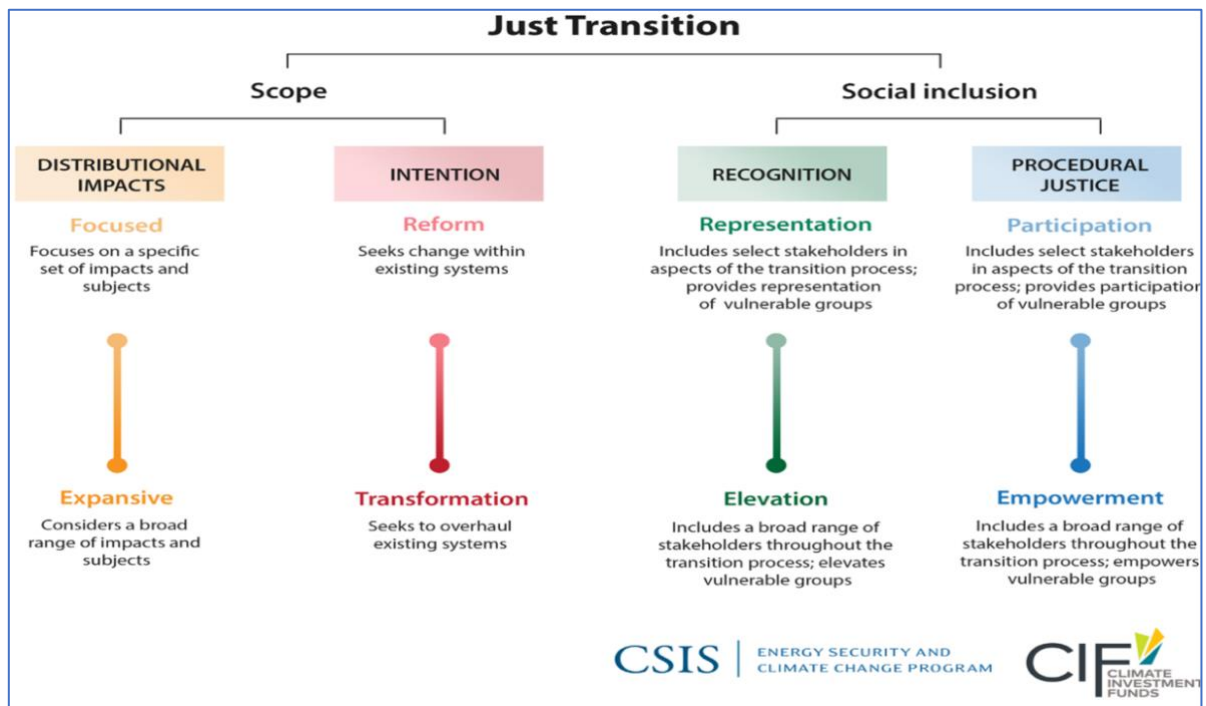
South Africa's economic development is significantly constrained by the ongoing series of load shedding. The government has implemented a multi-pronged strategy to address both the immediate crisis and eliminate load shedding. Resource allocation is being optimized, and unwavering commitment is pledged to achieve energy security. Through a targeted approach focusing on impactful interventions and decisive, time-sensitive actions, load shedding can be eradicated (The Presidency Republic of South Africa, 2024). Initiatives developed by the government include the Energy Action Plan (EAP), Just Energy Transition Implementation Plan (JETIP), and the Integrated Resource Plan (IRP) are discussed underneath

2.9.1 The Just Energy Transition Framework and Its Relevance in the South African Context

The seriousness of climate change in a country calls for a thorough and speedy transformation process to the economy and society as the conventional ways of effecting change are inevitably ineffective. However, the literature has not provided a specific and widely acceptable definition of Just transitions to effect these changes (Center for Strategic and International Studies, 2020). Because the conceptualization of Just transitions differs, it is important to determine guiding principles to provide a precise understanding of various definitions among stakeholders and their associated perspectives contained in the framework (Center for Strategic and International Studies, 2020).

The framework below seeks to pioneer as a guiding pillar to arrive at an ideal and single definition of just transitions and to determine where individual theory perspectives and priorities meet and vary. The intention of the framework at the stage of defining the concept was not to arrive at an ideal description. However, the objective is directed toward exemplifying a landscape of definitions (Center for Strategic and International Studies, 2020).

Figure 2. 7: A framework to assess Just transition definitions, Centre for Strategic and International Studies, (2020)



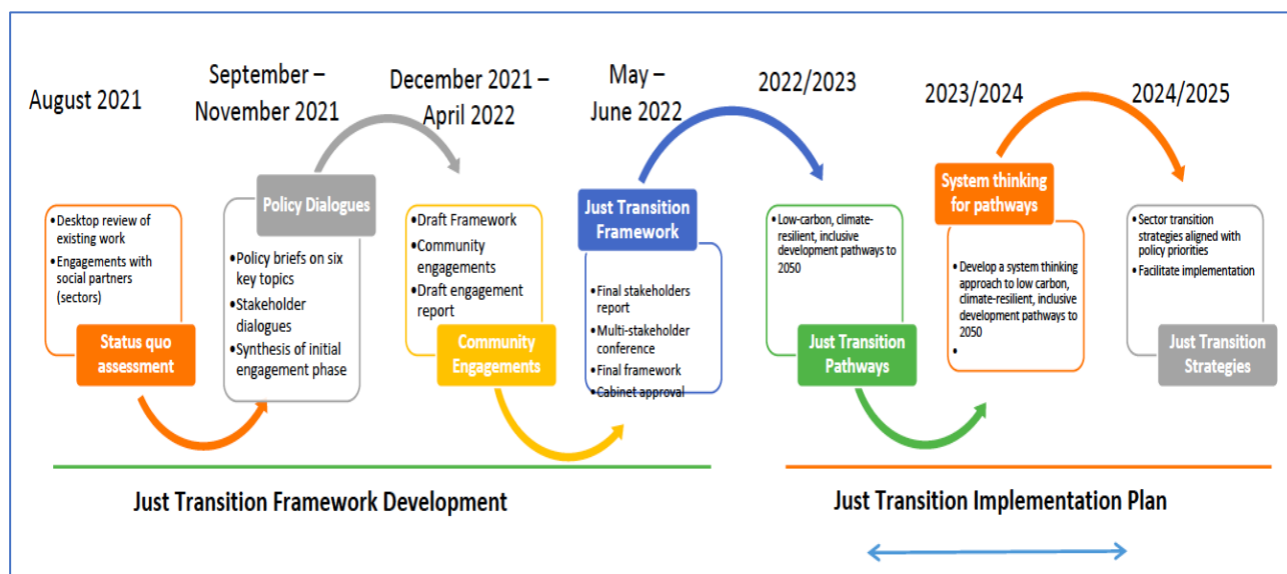
In reviewing the wider concept of Just Transition, South Africa's framework for a Just Transition was necessitated by a commitment to developing an approach to restore historical failures by promoting and improving existing mechanisms that include providing equitable access to environmental resources, land reforms and programmes aimed at promoting equal opportunities, and resolving energy poverty (United Nations, 2022). Other countries such as Antigua and Barbuda pursue the Just Transition concept to address job creation and equitable opportunities for Women. In South Africa, most dialogues on the Just Transition concept involve shifting away from the use of fossil fuels and other environmentally polluting technologies used to generate electricity; action taken to reduce vulnerability to the effects of climate change can also have social and environmental impacts for which the Just Transition Framework are applicable (United Nations, 2022). The World Bank (2023) notes Eskom's \$497 million project supported by the South African government to decommission one of the largest coal-fired power stations and repurpose the project into electricity generation from renewables to create job opportunities for Eskom employees and communities.

2.9.2 The Just Energy Transition Framework Implementation Plan in South Africa

The Just Energy Transition Implementation Plan (JETIP) was endorsed for implementation over five years (2023 – 2027) by the South African National Assembly (Herbert Smith Freehills, 2023). The plan stipulates key intervention and investment measures that have the potential to transform South Africa's energy sector from a high carbon footprint to an energy-efficient economy. The plan was derived from South Africa's National Development Plan (NDP) 2030 to address several socio-economic challenges such as poverty, low employment, and inequality (Herbert Smith Freehills, 2023). If implemented successfully, South Africa's energy transition will entrench the potential to support energy security objectives and drive positive economic growth and industrial development (Herbert Smith Freehills, 2023). To achieve targeted energy security, transition, and development goals, the JET IP has included a scope of investment priorities in these sectors: Electricity, New Energy Vehicles (NEV), and Green Hydrogen (GH₂) (Herbert Smith Freehills, 2023). However, emphasis is directed towards the electricity sector, where the following critical infrastructure investment priorities were set to be achieved:

- Managing the deactivation of the aged coal plants by the IRP and in alignment with the generation of electricity from renewable energy at a proportionate pace and capacity.
- Continuously spur the use of renewable sources of energy in the national power grid system.
- Adopt new systems and processes to generate and distribute electricity.

Figure 2. 8: A Process for Creating and Implementing the JET Framework, Presidential Climate Commission (2022)



2.9.3 A Critical Evaluation of the Just Energy Transition

The Just Energy Transition Implementation Plan (JET-IP) is acknowledged as a crucial step towards South Africa's net-zero carbon emissions target. By facilitating stakeholder engagement and detailed planning for priority projects and programs, the JET-IP lays the groundwork for achieving national objectives by 2030. Recognizing its practical application, the PCC is conducting a thorough appraisal of the JET-IP's alignment with the broader energy transition agenda and the Commission's ongoing work (Presidential Climate Commission, 2023).

While drafted by the joint secretariat to the Just Energy Transition Partnership (JETP), the JET-IP underwent rigorous evaluation by the Presidential Climate Finance Task Team (PCFTT) to ensure its specific relevance to South African circumstances and priorities. The JETP aims to support South Africa's transition away from coal and manage the associated social consequences.

However, stakeholder concerns regarding the JET-IP necessitate thorough consideration during implementation. These concerns include the timing of the consultation process, the perceived marginalization of social justice issues, the prioritization of skills development and economic diversification, potential job losses in

the coal sector, perceived privatization tendencies in the energy sector, and the focus on new energy vehicles and green hydrogen. Additionally, communities have raised concerns regarding the insufficient attention paid to human development, health, and energy poverty issues. Addressing these valid criticisms comprehensively is paramount for successful implementation (Presidential Climate Commission, 2023).

The expansion of national grid capacity emerges as a critical national priority, not only as an enabler for the long-term just energy transition but also as an immediate solution to the current load-shedding crisis. While the Just Energy Transition Implementation Plan (JET-IP) acknowledges grid capacity, a stronger emphasis is warranted. This increased focus should permeate both the electricity sector-specific strategies and the overall JET-IP framework, particularly in the coming five years as Eskom's Transmission Development Plan (TDP) undergoes significant implementation efforts. Given the rapidly evolving research landscape and the government's recent budgetary and policy shifts, close alignment between the JET-IP implementation plan and the latest TDP revision is crucial (Presidential Climate Commission, 2023).

Furthermore, the JET-IP requires a clear and comprehensive strategy for financing grid expansion, particularly considering the constraints on public sector funding. Exploring alternative investment models for the state-owned transmission grid presents itself as a viable approach. Public-private partnerships (PPPs) have demonstrated success globally and within Africa, offering a cost-effective and efficient solution with appropriate risk-sharing mechanisms. Notably, transmission PPPs can attract private-sector investment due to their high bankability and creditworthiness (Presidential Climate Commission, 2023).

2.9.4 The *Integrated Resource Plan (IRP)* as a *Guiding Document to Resolve Load Shedding*

The Integrated Resource Plan (IRP) is a dynamic plan used to maintain a secure and reliable electricity supply by managing the balance between supply and demand, while also considering environmental factors and the overall cost of supply. The plan must be frequently assessed considering any changes in the energy sector.

There have been several important changes in key assumptions since the IRP (2019) was introduced, such as changes in electricity demand projection, Eskom's plant performance, and new technology costs. As a result, the IRP has been reviewed and updated, leading to the creation of the draft IRP (2023). It includes the following factors that underpinned the key initiatives in the Energy Plan and NECOM workstream activities developed to end load shedding by primarily focusing on improving the performance of existing power stations, new generation capacity and development of transmission lines (Department of Mineral Resources and Energy, 2024).

2.9.5 The Energy Action Plan (EAP) Initiatives to Resolve Load Shedding

The International Trade Administration (2023), on July 25, 2022, President Cyril Ramaphosa announced a comprehensive plan to counteract load shedding and ensure energy stability in the country. The National Energy Crisis Committee (NECOM) was formed to ensure that the Energy Action Plan is implemented effectively under the leadership of Minister Kgosientsho Ramokgopa. The committee comprises more than 100 high-level officials from government and Eskom, who are working together with business and other social partners.

The primary objective of NECOM is to remove obstacles to new generation capacity and promote the use of various energy sources (NDP, 2030). The National Energy Crisis Committee (NECOM) has since overseen the execution of the following five critical measures to address load shedding:

- Address the issues with Eskom and enhance the accessibility of the current power supply.
- Facilitate and expedite private investments in power generation capabilities.
- Speed up the process of acquiring new power generation capabilities based on renewable sources, gas, and battery storage.
- Empower households and businesses to invest in rooftop solar panels.
- Transform the electricity industry to ensure sustained energy security in the long run.

2.10 The Role of South African Private Sector to Resolve Load Shedding

The government and private sector have collaborated to address six of the ten energy crisis workstreams. To procure skills and expertise, businesses have raised R100 million, which will be donated to the presidency on an arm's length basis. The National Energy Crisis Committee (NECOM) operates under the Presidency and will benefit from this initiative (Creamer, 2023). Martin Kingston, who is the chairperson of Business for South Africa (B4SA), has stated that the goal of ending load shedding by the end of 2024, as part of the joint energy effort, is achievable from a technical standpoint. Additionally, the effort also aims to address the issues of transportation and logistics, as well as crime and corruption (Creamer, 2023). Furthermore, all the workstreams in the relevant areas of focus are currently operational or in the process of being initiated. There are some preliminary indications of substantial advancement and development, but it will take a few months to observe any significant progress (Creamer, 2023).

The issue of load shedding has been a persistent problem for a long time, and it cannot be resolved quickly. However, the first positive step towards resolving this issue is the decision to work jointly, collaborate, and establish joint oversight structures and governance. This will ensure that the necessary capacity is in place, both in the public and private sectors (Creamer, 2023).

Pillay (2023) documented a statement by the Minister of Electricity regarding the primary goal of the ministry, which is to address the challenges faced by Eskom and improve the accessibility of electricity supply as the country is currently short of 6000 MW to meet demand. To achieve this goal, the government must encourage private investment in developing new electricity generation capacity. The Minister also highlighted the need to ensure a reliable and sufficient electricity supply. This can be done by facilitating private sector investments in new power generation capacity from renewable sources such as gas and storage.

Table 2. 3: NECTOM workstreams, National Business Initiative, (2023)

Workstream Focus Area	Responsible Entities:
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	Government/Private Sector
Workstream 1: is to enhance the performance of the current Eskom plants and reinforce the grid. The primary objective of Workstream 1 involves collaborating with Eskom to conduct a comprehensive analysis of plant performance to identify areas for improvement in operating practices, expertise, and other factors. Moreover, it will prioritize the expansion and reinforcement of transmission infrastructure to facilitate the integration of new generation capacity, notably large-scale renewable energy.	Private Sector and Government
Workstream 2: The Regulatory and Legal Workstream The second work stream aims to address policy, legal, and regulatory issues across different areas. Its primary objective is to introduce legislation to reduce bureaucratic procedures for energy projects for two years. The existing Embedded Generation Intervention Task Team will be part of this work stream and work towards creating a one-stop shop for energy-related applications.	Government
Workstream 3: New Capacity Generation This plan aims to speed up the integration of new power sources, encourage private investment in new generation capacity, and make it easier for customers to install small-scale power generation systems. It involves implementing a feed-in tariff scheme and expanding tax incentives for small-scale power generation.	Private Sector
Workstream 4: Procurement and Finance The fourth workstream will concentrate on exempting emergency procurement of electricity and maintenance from the PFMA. It will also analyse the cost and financial resources required for implementing the Action Plan to end load shedding.	Government
Workstream 5: Demand Management Workstream 5 aims to create a comprehensive strategy to enhance the management of energy demands and execute measures that promote energy efficiency and customer engagement.	Private Sector and Government
Workstream 6: Safety and Security The sixth workstream is focused on developing plans to prevent theft and fraud at Eskom, cable theft, and illegal connections by roping in various law enforcement agencies. It also aims to safeguard important infrastructure by addressing continuous economic sabotage through intelligence capabilities.	Private Sector and Government

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Workstream 7: Data Analytics and Research The seventh workstream aims to offer continuous assistance through data analysis and research to aid in making informed decisions. This includes creating models to predict the outcome of measures taken to address the energy deficit.	Private Sector
Workstream 8: Communication The eighth workstream concentrates on effectively communicating the strategy to the public, providing regular updates on progress, and maintaining active stakeholder engagement.	Government
Workstream 9: Distribution The 9th workstream aims to tackle the issues related to distribution and ensure that everyone in South Africa gets access to the benefits of new energy generation capacity.	Private Sector

2.11 Identified Research Gaps in Literature

Harichandan *et al.*, (2022) concluded that the recent Russia-Ukraine conflict and the Covid-19 pandemic reshaped the South African government thinking around revisiting their energy framework solutions to bolster electricity supply. A new approach should include addressing climate change, adopting alternative energy options, a governance approach, and using less carbon footprint emissions, which are important factors to incorporate. Research gaps in the literature include:

- A contextualized, precise definition of the Just Energy Framework is still not conceptualized in academic literature as it is still a globally developing concept, though countries have developed objectives and recommendations tailor-made for their unique economic, social, and environmental challenges.
- The implementation of a sustainable energy transition in strategy and technology.
- The impact of load shedding is widely published in academia; however, the causes of the supply crisis are largely deliberated by the business and government sectors.

2.12 Theoretical Framework

2.12. 1 Introduction

Defining a theoretical framework narrows the scope of the study, by focusing on specific key constructs already identified in the literature review. Kivunja (2018) distinguishes a theory and theoretical framework by defining a theory as the grouping of concepts that contribute towards a viewpoint of phenomena, by identifying a pattern of relationships between variables to arrive at a determined phenomenon. Conversely, a theoretical framework includes a series of theories developed by academic research experts in a specific research field, upon which a research study is built to serve as a core foundation for developing arguments and analysis. Adom *et al.*, (2018) characterize a theoretical framework as a model that guides a research study, is derived from an existing theory, and should speak to every component of the study process, from the research topic, and problem statement to the research methodology.

2.12.2 Existing Transitions Theories

Several theories on energy transitions were developed that take cognizance of sustainability, and economic, social, and environmental aspects of the economy. The study used theories within a context of energy transition derived from key concepts defined in Chapter 1.

Heun's (2016) theory on energy transition connects macroeconomic growth to energy. The theory is based on suggestions that must be conceptualized and understood if a country is committed to transitioning to a growing economy by shifting the energy landscape to renewable energy. The first viewpoint is an existing relationship between energy and the broader economy, secondly, the transition to an improved low-carbon energy system is incompatible with an uncertain energy-economy system. A theory by Grubler (2012) proposes three fundamental insights on technological development in the pursuit of energy transition policies and innovation efforts.

Generally, energy end-use capacity is invariably significantly larger than supply generation capacity. From this insight, transitions in energy services can lead to energy

supply transitions. The levels of transitioning in energy differ from country to country, they progress slower in developed economies but faster in smaller economies that less large-scale infrastructure. Patterns that distinguish successful advancement of technologies and industries that drive past energy transitions.

2.13 The Research questions and their relations to the theoretical framework

2.13.1 Theoretical Underpinnings: Sustainability, Energy Transition, Energy Efficiency

The role of this section was to suggest a framework that guides the use of theory in qualitative research methods. Concerning the application of the theoretical framework, Nguyen *et al* (2022) affirm that qualitative studies are highly attributable to the inductive research methodology, and lead to the development of theory, or theory description. In the instance that theory is used, in many research scenarios the theory was instrumented as a framework for data analysis and interpretation. The research questions were answered through the integration of theoretical framework with grounded theory because the subject of load shedding, transitioning to alternative, sustainable energy for this research study links the flow of interactions of key factors that are a prerequisite for investigating whether the Just Energy Transition Framework is a suitable tool to address energy challenges in South Africa.

2.14 Application of Inductive Reasoning Approach

Malhotra (2017) asserts inductive reasoning as a strategy used to construct a theory about the distribution of linked patterns, observed or measured characteristics of individuals, and social philosophy. The approach builds conceptualization from observation of specific scenarios, ranging from an individual viewpoint to arriving at general assumptions (Malhotra, 2017). A process for developing theory from multidisciplinary data is explained by Dudovski (2022) as follows:

- A social situation is observed.
- Data is collected based on the reasons it exists, and trends in the data are explained.

- A theory is developed from this data to explain the social phenomenon.

Figure 2. 9: An Inductive Reasoning Process, Dudovskiy (2022)



2.15 Implications for practice: Limitations

The study investigated the JET framework and related practices, the Energy Action Plan and, other government initiatives and committees aimed at resolving load shedding. The electricity crisis in South Africa is a complex and difficult problem, making it a challenging task for the researcher to arrive at a comprehensive solution for the entire country. The research process and time required for this task may be extensive

2.16 Conclusion

The chapter reviewed the literature related to the study by scrutinizing the theoretical, conceptual, and empirical frameworks that enhanced the understanding of the concept of Just Energy Transition and its objective to ease energy deficiency in South Africa (Loadshedding) that is working against economic development. The next chapter discussed a continuum of research methodologies that were using to build up the study.

CHAPTER 3 - RESEARCH METHODOLOGY

3.1 Introduction

This chapter described a structured process for collecting, analysing, and interpreting data used to examine emerging initiatives adopted by different economies in the quest to transition to sustainable energy, including South Africa`s short- and long-term plans to end load shedding. It outlined the techniques applied in planning and implementing a structured approach to address research questions and achieve research objectives, including the selection of appropriate research methods for data collection, as well as the analysis and interpretation of findings. Fundamentally, it illustrated how the researcher planned to execute the study while ensuring the validity, reliability, and ethical conduct of the research.

3.2 Research Approach

Qualitative research is a method used to study a social subject in a natural setting. The researcher is the main data collection instrument in this approach, where critical and analytical practices are used to understand the practical world (Haradham, 2018). Teherani *et al.*, (2015) concur that qualitative research is distinct from quantitative studies, as it focuses on non-numerical data, such as texts and videos. This research approach provides a comprehensive and detailed understanding of the research problem, and it requires an in-depth and contextualized outlook of social experiences. This study followed a qualitative research approach to gain a detailed and thorough understanding of the subject matter.

3.3 Research Paradigm

The term 'research paradigm' refers to a way of thinking that forms the basis of an educational study. While it was initially used to describe a philosophical approach, it now has a broader perspective of thinking (Khatri, 2020). Scholars believe that paradigms serve as a guide or foundation to a world that shapes the research subject and significantly influences the researcher's thought process about the topic.

Essentially, paradigms represent the researcher's beliefs and values (Kamal, 2019). It is crucial to present an empirical view of a research paradigm as it provides direction towards solving a problem. Every researcher is required to make assumptions about the research world they are exploring (Brown and Dueñas, 2019).

The study was guided by a philosophical framework based on the interpretivism research paradigm. This paradigm was chosen due to the nature of the study and research objectives. The interpretivist paradigm acknowledges that the research methods used in human and social sciences fundamentally differ from those used in physical sciences (Pham, 2018). It recognizes that understanding and knowledge in these fields requires unique and distinct approaches.

3.4 Research Strategy

This study employed a comparative research design. In this approach, data is analysed by identifying similarities and differences in trends between units (Miri & Dehdashti, 2019). Comparative research is suited to generating knowledge about real-world phenomena and is commonly used to assess and interpret cases relative to both concrete and theoretical criteria (Miri & Dehdashti, 2019).

The selection of this design was based on the need to compare various datasets in order to identify and evaluate contexts within the comparative process, as this is crucial for answering the research questions (Miri & Dehdashti, 2019). Specifically, comparative analysis is relevant here because it allowed the researcher to compare the similarities and differences between various energy transition plans developed and adopted by different sectors of economies and nations. This comparative approach, combined with inductive reasoning, will ultimately guide us towards a conclusion.

3.5 Research Design

Data collection is a crucial process in research that involves identifying key concepts at regular intervals to answer research questions (Kabir, 2016). Collecting real and accurate data is essential for researchers in all disciplines, and investing significant

time in this process leads to the generation of accurate and sufficient data (Taherdoost, 2021). The type of data collected for a study largely depended on the research questions (Parveen & Showkat, 2017). For this study, the desk-based research method was used, which involved studying documents sourced from literature, company and public institution websites, and online reports. This technique helped to identify and evaluate applied and proposed energy solution trends.

3.6 Sampling Procedure

The population of the study is a group of units of analysis that can be made up of people, events, or objects (Shukla, 2020). Sampling is a procedure that a researcher uses to select a smaller number that represents the larger group systematically. The study used a non-random selection method called purposive sampling, which is a tool that is restricted to specific types of units of analysis that possess information related to the research inquiry (Sekaran and Bougie, 2016).

3.7 Population

The research analysed 20 report publications that were accessible on online platforms as units of analysis. Out of these 20 reports, 10 were chosen to determine the effect of implementing the JET framework on resolving load shedding in South Africa. These documents are presented in Table 3.1.

Table 3. 1: Documents for analysing JET framework, Researcher (2024)

No.	Document/Report Title	Geographical scope	Author (Year)
1.	Just Energy Transition Plan Experience in South Africa, Indonesia, and lessons learnt for Vietnam	South Africa, Indonesia & Vietnam	United Nations Office for Project Services (2023)
2.	Just Energy Transition Fact Finding	South Africa	Eskom (2023)
3.	Navigating The Path To A Just Transition: Employment Implications Of China's Green Transition.	China	China Institute of Energy (2023)

4.	National Energy Transition Framework (2022 – 2070)	Ghana	Ministry of Energy
5.	Draft Energy Strategy and Just Transition Plan	Scotland	Scottish Government (2023)
6.	International Forum for Environmental Sustainability and Technology: Policies, Plans and Instituting Mechanisms	India	International Forum for Environment, Sustainability & Technology (2023)
7.	Just Energy Transition Implementation Plan 2023 – 2027 (Updated)	South Africa	The Presidency Republic of South Africa (2023)
8.	Spain, 4 years towards a Just Energy Transition	Spain	Ministry for Ecological Transition and Demographic Challenge (2023)
9.	Energy Transitions and Just Energy Transition Partnerships In Nigeria	Nigeria	Nweke-Eze, C. (2022)
10.	Resource Mobilization Plan: Implementing Viet Nam`s Just Energy Transition Partnership (JETP)	Viet Nam	Socialist Republic of Vietnam (2023)

To identify additional measures adopted to combat causes of load-shedding, a total number of 10 reports related to the electricity sector, the data was collected from journals and business sites in the form of reports and This data was collected from various online government and publication websites and is presented in table 3.2

Table 3. 2: Documents for analysing EAP initiatives (2024)

No.	Document/Report Title	Document Type	Author (Year)
1.	Presidency says Progress Being Made to Increase Grant Funding for Just Energy Transition Investment Plan.	Progress Report	Creamer, T. (2023)
2.	Climate change Report for the Year Ended 30 June 2022	Progress Report	Sasol Limited (2022).
3.	Just energy transitions and partnerships in Africa: a South African case study.	Academic Journal	Tyler, E., Mgoduso, L. (2022).

4.	Maximining local benefit potential in South Africa's REIPPP, International Institute for Environment and Development.	Academic Journal	Tait L, Wlokas H. (2022).
5.	South Africa's Energy Transition – Unraveling its political economy,	Academic Journal	Hanto, J., Schroth, A. Krawielicki, L., Oei, P., & Jesse Burton, (2022)
6.	Actors in multi-sector transitions discourse analysis on hydrogen in Germany, Environmental Innovation and Societal Transitions	Academic Journal	Ohlendorf, I., Löhr, M., & Markard, J. (2023)
7.	The Coal Value Chain in South Africa	Academic Journal	Makgetla, N. & Patel,M. (2021).
8.	Barriers To Powering Past Coal: Implications for a Just Energy Transition in South Africa,	Academic Journal	Mirzania, P., Gordon,J.A., Balta-Ozkan, N., Sayan, R.C., & Marais, L. (2023)
9.	South Africa`s Cabinet has Approved the Just Energy Transition Implementation Plan	Progress Report	Herbert Smith Freehills (2023).
10.	Towards New Configurations Of Urban Energy Governance in South Africa's Renewable Energy Procurement Programmes	Academic Journal	Davies M, et al. (2023).

3.8 Data Analysis Procedure

The analysis of secondary data was conducted by using document analysis, which is defined as a methodical process used to assess various types of documents, whether they are in print or electronic format. This approach involves carefully examining and interpreting data to extract meaning, gain insight, and generate factual knowledge. It is a qualitative research technique widely used to understand and analyze written materials (Bowen, 2009). Document analysis is relevant to the study to gather, evaluate, and combine data from various sources to address research inquiries. To provide the relevant information required to answer research questions and achieve research goals, a criterion was established from key challenges identified in the

literature review and aligned with the theoretical framework and key operational definitions. This criterion is presented in Table 3.2.

Table 3. 3: Country comparison and evaluation criteria

JET IP Objectives	Do objectives align with improving the current state of electricity infrastructure and capacity?
Technological Development	What technological developments have been done on the electricity supply infrastructure since implementation of the Just Energy Transition Implementation Plan?
Sustainable Energy	Are JET programmes and projects designed to improve access to sustainable electricity in the long term?
Capacity Generation	Does the JET IP include investment initiatives directed toward increasing electricity capacity generation? How much generation capacity will be gained from JET projects?
Transformation of existing coal and fossil fuels power stations	What are the plans to improve the performance of existing power stations?
Construction and maintenance of transmission and distribution lines	Are there plans to support the maintenance of electricity distribution grids?
Financial Viability	Given the dire state of South Africa`s balance sheet, how will the JET projects be funded?

3.9 Reliability

The process of data analysis involved digital transcribing of data into an excel spreadsheet as a measure to ensure stability of multiple document data sets to produce same results multiple times. By studying data obtained from different sources, i.e. scientific articles, energy technical perspectives, government and private sector publications and industry experts, the researcher was able to verify findings across data sets and minimize potential biases.

3.10 Validity

The method used to guarantee the authenticity of the research can be summarized as follows:

- There was a system of checks and balances between the researcher and the supervisors.
- The collected data sets were cross-checked with data obtained from other reliable sources to ensure their accuracy.
- To maintain the reliability of the data source, information was solely obtained from trustworthy sources such as the government, institutions, and scientific organizations.

3.11 Ethical Considerations

The ethical clearance waiver was obtained from the faculty as per **Appendix A** before data collection. The study further complied with the research guidelines on plagiarism through Turnitin and APA referencing set by the university. The study achieved an average of 32% plagiarism score, with a majority of similarities traced in references, tables, and figures that supported the development of the study.

3.12 Conclusion

The chapter presented a continuum of research methodologies that were used in conducting the study. Key concepts such as research design, approach, population of the study, and sampling procedures were also deliberated to show how the study was conducted. Data collection criteria and methods and data analysis methods were also discussed. The next chapter presents the findings and discussions of the results.

CHAPTER 4: PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Introduction

The section presented and analysed the outcomes that arose from the research. The results from actual data suggested that the Just Energy Transition Framework methodology is appropriate for resolving load shedding in South Africa. The section also discussed the implementation of the JET approach in the South African context, the difficulties associated with the Just Energy Transition, the underlying reasons for load shedding, the execution of EAP initiatives to address the issue of load-shedding, and the impact of the global energy transition on various countries that are part of the Just Energy Transition Framework.

4.2 The suitability of the Just Energy Transition Framework approach to resolve load shedding in South Africa.

Based on the selected articles, it was found that the South African National Assembly has endorsed the Just Energy Transition Implementation Plan (JETIP) to be implemented over five years, from 2023 to 2027. This endorsement was also noted by Freehills in 2023. The study revealed that the JETIP framework has effectively reduced the impact of load-shedding and is expected to continue until 2027. It is projected that the framework will also minimize or contain the economic disadvantage caused by load-shedding on the South African economy.

In reviewing the JET dispensation, civil society organizations and businesses have expressed their dissatisfaction with the emphasis on green hydrogen and have urged for more focus on the current capacity of grid infrastructure. They have also raised doubts about the compatibility of the JET-IP with the JTF. They subsequently proposed that the bulk of energy generation should be distributed through small-scale grids and households. They also highlighted the need for programs to enhance the resilience of vulnerable townships.

The results also established that, if implemented successfully, South Africa's energy transition will entrench the potential to support electricity security objectives and drive positive economic growth and industrial development. It also emerged from the study

that, to achieve targeted energy security, transition, and development goals, the JET initiative has included a scope of investment priorities in three sectors such as electricity, New Energy Vehicles (NEV), and Green Hydrogen (GH₂). However, according to indications of Freehills, (2023), emphasis is directed towards the electricity sector, where critical infrastructure investment priorities were set to be achieved, such as managing the deactivation of the aged coal plants by the IRP and in alignment with the generation of electricity from renewable energy at a proportionate pace and capacity as well as continuously spur the use of renewable sources of energy in the national power grid system and adoption of new systems and processes to generate and distribute electricity.

After analyzing 10 journal publications available online, it can be concluded that the transition towards renewable energy and phasing out coal in South Africa will depend on various factors related to technology, economics, politics, and society. The way these factors interact with each other will have a significant impact on the achievement of energy justice. Mirzania et al. (2023) article "Barriers to Powering Past Coal: Implications for a Just Energy Transition in South Africa" further explores these indications.

4.3 The implementation of the JET framework in the South African Context

From a pool of 20 articles and reports considered as a unit of analysis for the study, 10 were selected to investigate whether implementing the JET framework would have an impact in resolving load shedding in South Africa and the successes of its implementation. The study's findings indicated that to mobilize its energy transition, the South African government instigated its flagship renewable energy policy, the so-called REIPPP project (the Renewable Energy Independent Power Producer Procurement Project). This was established on four criteria: local job creation, local ownership, economic development, and socio-economic development. This program has seen the JET framework yield results in resolving the load-shedding crisis in South Africa.

It also emerged from the study that the JET framework was derived from South Africa's National Development Plan (NDP) 2030 to address several socio-economic challenges such as poverty, low employment, and inequality. The framework aims to enhance

South Africa's energy transition to entrench the potential to support energy security objectives and drive positive economic growth and industrial development. The study's findings also indicated that to achieve targeted energy security, transition, and development goals, the JET IP has included a scope of investment priorities in three sectors: electricity, New Energy Vehicles (NEV), and Green Hydrogen (GH2). However, emphasis is directed towards the electricity sector, where the following critical infrastructure investment priorities were set to be achieved through managing the deactivation of the aged coal plants by the IRP and in alignment with the generation of electricity from renewable energy at a proportionate pace and capacity, continuously spur the use of renewable sources of energy in the national power grid system and adopt new systems and processes to generate and distribute electricity.

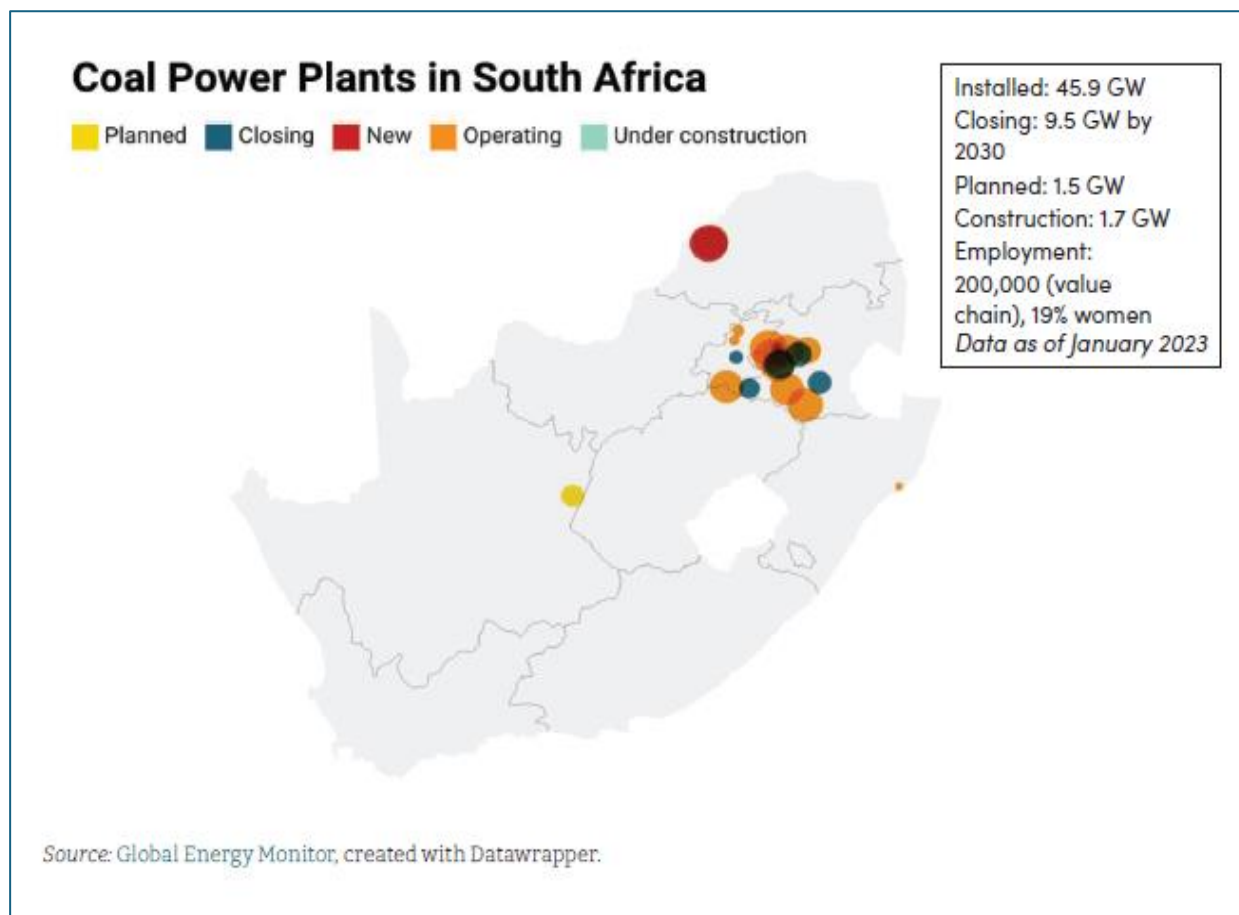
In liaison with the above findings, Media briefing reports of the Department of Mineral Resources and Energy also indicated that ESKOM occupies a central position in the country's national energy strategy. It is the largest electricity generator in Africa and is described as the 6th largest company. ESKOM's comprehensive responsibilities and powers include power generation, transmission, and distribution. This implies that by leveraging the JET framework, Eskom and other relevant boards can eradicate load-shedding challenges in South Africa.

4.4 Just Energy transition challenges

Despite the JET framework's aim to resolve load-shedding challenges, it has its challenges that were also deliberated by the study. The study's findings indicated that successful implementation of the JET as a measure against the detriments of load shedding had been constrained by compromised power generation sources and resources such as maximum utilization of coal. In support of this deliberation, the United Nations Office for Project Services (2023) reported that South Africa's main mining region, Mpumalanga, is underperforming across several economic indicators when compared to the national average, underlining the need for an energy transformation. It also emerged from the study that, at present, South Africa remains in a risky position in terms of its economic capacity, which refers to the availability of resources to support low-carbon technologies or to compensate for losses incurred by phasing out carbon-intensive technologies as indicated by Creamer, (2023). It also

emerged from the study that, from the outset, it is apparent that specific policies are needed to assist mining affected areas, such as Mpumalanga, which are set to incur higher negative impacts from the energy transition.

Figure 4.1: Coal power plants in South Africa



The study indicated that South Africa has an older coal fleet of 45.9 GW and an average of 42 years, with 74 percent of installed operating capacity in Mpumalanga Province. It also emerged that an additional 1.7 GW of new capacity is under construction, and another 1.5 GW is in the planning phase. The coal value chain employs 200,000 workers, 19 percent of whom are women. Findings also show that the geographical concentration of coal plants and mines in one single region could result in negative multiplier impacts from the decommissioning of plants, and this was also found to be a barrier to the effective implementation of the JET framework aimed at alleviating the negative effects of load shedding in South Africa.

The study also established that despite the urgency to curb load-shedding, the energy transition is particularly challenging for a country like South Africa. In consultation with

these findings, Business Tech (2023) also indicated that, at present, estimates suggest that 88% of South Africa's electricity generation is coming from coal. Two important players in the energy domain in South Africa are Eskom and Sasol. Eskom is a state-owned company that produces over 90% of the country's electricity primarily through coal combustion. It accounts for 45% of the country's emissions (Makgetla, 2021). This makes Eskom a highly powerful actor in the energy transition in South Africa. Another important and influential actor in this context is a former state-owned company called Sasol. Sasol provides energy in the form of liquid fuels, gas, and chemicals to the country and is thereby responsible for 13% of the country's emissions, as indicated by (Hanto et al., 2022; Sasol, 2022; Makgetla, 2021). The findings of the study also indicated that from the 190 million tonnes of coal that were consumed in South Africa in 2020, Sasol consumed 30 million tonnes, with reference to the 110 million tonnes used by Eskom, as also indicated by Makgetla (2021).

The Heun's (2016) theory on energy transition that connects macroeconomic growth to energy also agrees with the findings. Further, it expands the knowledge on the association between South African economic growth and the impacts of the successes and failures of initiatives aimed to eradicate load-shedding challenges such as the JET framework, EAP, IRP, and others. On the same note, the theory is based on suggestions if a country is committed to transitioning to a growing economy, it should do so by shifting the energy landscape to renewable energy.

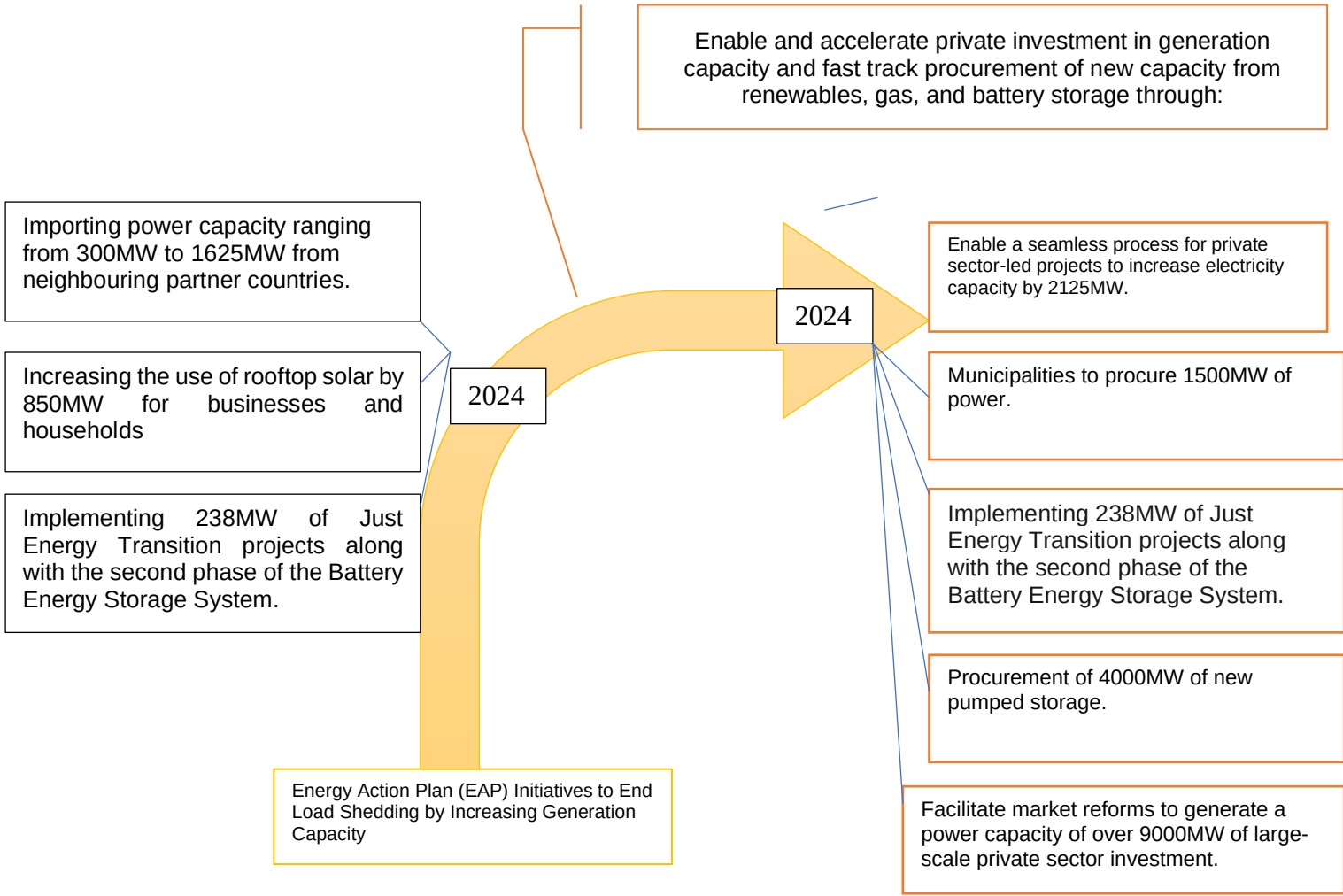
4.5 The underlying reasons behind load shedding

The study's findings indicated that the cause of load shedding could mostly be traced back to Eskom, which has been accused of mismanagement of its power stations and adverse authority relations, according to Bowman (2020). It also emerged from the study that Eskom is facing staggering debts of 26 billion dollars, as indicated by BBC (2023). Moreover, there are more than allegations of corruption and intentional sabotage of power stations within Eskom. The complexity of the relations within and with Eskom was also apparent when the CEO of Eskom resigned in late December 2022 (The Guardian, 2023).

4.6 Implementation of EAP initiatives to resolve load shedding.

The findings of the study established that the Energy Action Plan is also one of the initiatives operating beside the JET framework aimed to resolve load-shedding constraints in South Africa through the generation of over 6000 MW capacity needed to meet electricity demand; the table was used to monitor the progress of the planned projects. Below are some of the projected action plans to resolve load-shedding in South Africa.

Figure 4.2: Implementation of EAP initiatives to resolve load shedding.



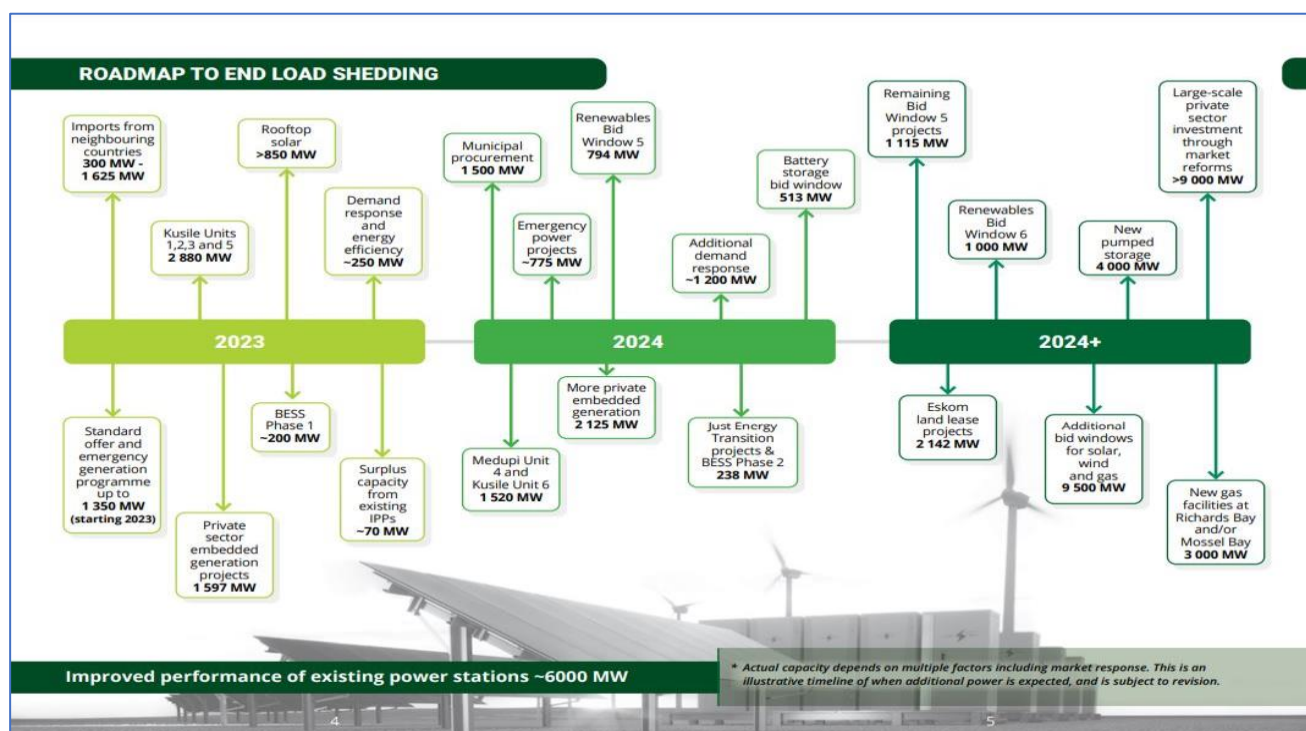
The findings also indicated that to fix Eskom`s coal-fired power stations and improve the availability of existing supply, the JET framework, as well as the energy action plan (EAP), objects to enable and accelerate private investment in generation capacity and fast-track procurement of new capacity from renewables, gas, and battery storage through several strategies and initiatives such as Importing power capacity ranging from 300MW to 1625MW from neighbouring partner countries implemented from 2023

to Facilitate market reforms to generate a power capacity of over 9000MW of large-scale private sector investment in 2024 . This implies that JET framework and as well as the energy action plan (EAP) are aimed at resolving loadshedding constraints in South Africa and the projects have since been executed.

4.7 National Energy Crisis Committee workstreams (NECOM) towards resolving load shedding.

The study also established that the International Trade Administration (2023) also plans to end load-shedding and ensure a stable power supply in the country through government intervention, including several initiatives that were and will be implemented over the next few years. These initiatives were derived from the National Energy Crisis Committee workstreams (NECOM) and are also in alignment with the NDP Vision 2023 and JET, EAP, and IRP initiatives aimed at eradicating load-shedding constraints in South Africa.

4.3: NECOM Roadmap to End Load Shedding, Business Tech (2023)



4.8 Key factors to improve Plant Performance and Generation Capacity under JET Framework through Integrated Resource Plan (IRP).

The findings gathered from the selected articles and reports used as units of the analysis indicated that Integrated Resource Plan initiatives are also used alongside the JET framework to improve capacity generation and resolve load-shedding in South Africa. In agreement with these findings, the IRP, (2023) progress report also indicated that apart from the Energy Action Plan is one of the initiatives operating beside the JET framework, the Integrated Resource Plan objects to rejuvenating Eskom plant performance and Shutdown Plan as well as counter-attacking the new build challenges, developing of the Koeberg power plant long-term operational plan, compliance with minimum emission standard, timing and rollout of new capacity generation, timing, and rollout of new capacity generation, development of the transmission grid. By so doing, these initiatives, together with the JET framework, will resolve the load-shedding challenges terrorizing the economy and societies of South Africa through frequent power cuts.

Table 4. 4: Integrated Resource Plan initiatives to improve capacity generation, IRP, (2023)

Key factors reviewed to improve Plant Performance and Generation Capacity	Factor Description
Eskom Plant Performance	The Energy Availability Factor (EAF) of Eskom's plant in 2019 was below average, reaching an alarming low of 55% in 2023. This has raised serious concerns about the performance of the plant and necessitated immediate measures to improve it. To address the issue, the Department of Mineral Resources and Energy has commissioned an independent technical review of Eskom's power stations to diagnose the underlying challenges and recommend actions for improvement.
Eskom Shutdown Plan	Since the 2019 Integrated Resource Plan (IRP) was introduced, Eskom has revised its shutdown strategy as part of the Eskom 2035 plan. As a result, several

	power stations that were initially earmarked for closure before 2035 have been kept operational for longer than anticipated. This revision has helped to alleviate the power shortage to a certain extent, although it is still insufficient. For instance, the revised strategy has postponed the shutdown of Tutuka power station, which was originally scheduled to be decommissioned before its 50-year lifespan. If the original plan had been followed, all six units of Tutuka would have been shut down by the end of September 2030, 10 years before the end of its design life. This would have resulted in a shortage of 3,500MW, which is the amount of power currently generated by the station.
Eskom New Build Challenges	Eskom began its new Build Program by constructing the Medupi 6 power station in August 2015, and other units have since been connected to the national grid. However, the performance of these units has not been up to the expected levels due to various issues such as design and construction defects. The Kusile power station also faces similar challenges that affect the power output of its commissioned units. The company is currently focusing on fixing major plant defects, and the trend seems to be moving in the right direction based on last year's performance. Kusile unit 5 and 6 are yet to be commissioned, and the latest forecast estimates their completion in April 2024 and February 2025 respectively.
Koeberg Power Plant Long-term Operational Plan	The IRP acknowledged the importance of nuclear power in South Africa's energy mix and recognized Koeberg nuclear power station's role in this regard. However, as the site license expires in 2024, IRP 2019 supported Eskom's efforts to obtain a Long-Term Operation (LTO) license for an additional 20

	years. After IRP 2019 was enacted, Eskom submitted a safety case in 2022, which underwent a peer-review by the International Atomic Energy Agency. The National Nuclear Regulator (NNR) is currently evaluating this safety case in support of the 2019 life extension policy decision.
Compliance with minimum Emission Standard	According to the air quality regulations established under the National Environmental Management Act: Air Quality (Act No. 39 of 2004), coal power plants that are part of Eskom's fleet must comply with the Minimum Emission Standard (MES) within a certain time frame. Failure to do so would mean that these plants would not be able to operate legally. However, implementing these regulations would result in the loss of approximately 16,000MW of baseload generation capacity in the short to medium term, and up to 30,000MW after March 2025. Therefore, it is necessary to find a balance between energy security, the negative health effects caused by poor air quality, and the economic costs associated with shutting down these power plants.
Timing and Rollout of New Capacity Generation	Since the IRP (2019) was introduced, more than 6000 MW of new generation capacity has been acquired through different procurement programs. However, some of the projects have been delayed or failed to obtain legal and financial clearance, while others are progressing at differing stages of implementation.
Development of the Transmission Grid	The Eskom Transmission Development Plan (TDP) 2022-2032 highlights the significant capacity constraints in the transmission networks of the Eastern and Northern Cape regions. The plan reveals that in the past nine years, from 2013 to 2022, only

	4000 km of transmission lines were constructed, whereas more than 14 000 km of new lines are required by 2032. Therefore, the country needs to speed up investments in transmission infrastructure by creating new corridors and substations and strengthening existing substations. To unlock grid capacity, Eskom is taking measures to accelerate transformer projects.
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4.9 The impact of global energy transition in various countries that are part of the Just Energy Transition Framework.

The findings of the study indicated that the JET framework and its implementation in different countries globally is based on the belief that tackling the social and economic issues faced by nations, such as load shedding, requires simultaneous efforts towards climate action and sustainable development and has yielded positive results from its implementation. It emerged from the study that load shedding has contributed to the economic downturn in South Africa, and the JET framework and energy initiatives are some of the actions that mitigate this impact.

The study, based on empirical evidence, established that energy transition is significantly relevant on the African continent, considering that the combination of population and economic growth is expected to increase the continent's energy demand significantly, which was also in line with the indications of Tyler and Mgoduso (2022). The findings also indicated that, within the African continent, South Africa is responsible for 42% of the continent's emissions. It emerged from the study that, globally, South Africa is ranked thirteenth out of the top fifteen largest emitters. These findings are also in agreement with Tyler and Mgoduso (2022), who indicated that the major impact of South Africa on global emissions makes South Africa a relevant case study to research the relevance of the Just Energy Transition Framework in reducing the effects of load shedding.

The 10 articles reviewed to investigate the impact of global energy transition in various countries that are part of the Just Energy Transition Framework indicated that South

Africa's energy transition will also be influenced by its underlying economic development and future energy demand. It also emerged from the study that, unlike European nations such as Germany and Italy, with commitments to phasing out coal generation but declining population trends, South Africa has a growing population, intensifying its future energy demand. The study, based on empirical evidence, established that given long-term contracts committing coal supplies to Eskom, nationwide coal dependency could be sustained for decades to come. It also emerged from the study that, accounting for techno-economic factors such as existing coal reserves and the influence of the mining sector on Gross Domestic Product (GDP), Ohlendorf et al. (2023) reported that energy experts anticipate South Africa's operating coal capacity will be maintained until at least 2040.

The study's findings also indicated a lack of an institutional standing that restricted the development of the Just Energy Transition Partnership (JETP) locally and internationally. Because South Africa's energy transition is highly politicized, progress was undermined by resistance to the transition itself. Internationally, we did not have a mandate to progress the JTT work, making it more difficult.

Davies et al. (2013) concur that the launch of the \$8.5 billion Just Energy Transition Partnership (JETP) for South Africa in 2021 signified this. A further announcement of a \$20 billion JETP for Indonesia in 2022 at the Group of 20 (G20) Leaders' Summit in Bali, Indonesia, provided much-needed momentum for just energy transition. Both partnerships were launched with support from the International Partners Group (IPG), which committed to accelerating financial and technical resources through appropriate instruments in collaboration with Multilateral Development banks (MDBs) and other development finance or green finance institutions, the private sector, and other partners. These results implied that the JET framework was set to rejuvenate South Africa's electricity sector through strategic partnerships with other countries across the globe.

From a global standpoint, it is acknowledged that some countries with low to mid-range incomes have a significant ability to move towards a decarbonized growth path that is driven by cost-effective renewable energy. This is due to their high carbon intensity and demand growth or pent-up demand. However, such countries are also at high risk

of carbon lock-in and a potentially significant carbon footprint. Achieving this transformation requires long-term and comprehensive support for the entire economy to manage the process, along with the risks and challenges that come with it.

Echoing the previous indications, 6 of the 20 selected articles on Scopus search indicated that, to support the effective implementation of the JET framework aimed at easy load shedding in South Africa, a JET partnership has been formed for value maximization. It emerged from empirical studies that the JETPs for Indonesia and South Africa, though in their initial stages of implementation, have also been aimed at easing the impact of energy supply shortages. Nonetheless, a lot of preparatory work has been undertaken ahead of their launch. As the priority investments progress, they promise to offer rare insights into this complex and ambitious endeavour to move away from coal in large economies entirely.

Tait and Wlokas (2022) revealed that coal is a bedrock of both economies, with Indonesia ranked globally as the first and South Africa as the fifth largest seaborne coal exporter. According to the study, their power sectors rely heavily on domestic coal, with more than 60 percent and 90 percent of electricity generated from coal. With the support of the IPG, South Africa aims to decommission nearly 60 percent of its installed coal-fired power plants (CFPPs) by 2035 and replace them with the equivalent renewable energy capacity.

4.10 Discussion

The fundamental objective of the study was to assess the potential of the JET framework as a solution to resolve load shedding; the second objective was to significantly reduce the use of coal and ultimately address climate change by generating electricity through sustainable energy outputs while in the same process taking cognizance of the human dimension during the transitioning process. Findings from the data revealed that the purpose of the JET framework across various economies is to significantly reduce greenhouse gas emissions causing climate change, which stems from the Electricity, Transportation, and Green Hydrogen Sectors. However, the transition process is therefore influenced by the interdependencies within each sector. In the study's focal point, the electricity sector,

the countries assessed pursue the Just Energy Transition Framework to address climate change while considering unique economic, social, and resource constraints.

In the South African context, major causes of load shedding were significantly attributed to the infrastructure and capacity deficit issues, ranging from the aged and unmaintained coal-powered plants, with many units continuously out of operation, graft, lack of funding to increase electricity generation capacity, and limited distribution and transmission lines to diffuse renewable energy initiatives, amongst others. As a result, there has been a decline in the Electricity Availability Factor (EAF), which is the percentage of time a power plant generates electricity over a certain period.

Considering the need for planned maintenance and unforeseen shutdowns, a good EAF would be around 80% to achieve optimal performance. However, Eskom's current EAF is below 53%, which indicates that the fleet is operating just over half the time. This means there is an opportunity for Eskom, in partnership with NECOM and the Ministry of Electricity, Department of Minerals, Resources, and Energy, to improve the EAF by implementing measures to reduce the number of out-of-service units and enhance planned maintenance schedules. Thus, the JET investment in repurposing coal power plants significantly addresses infrastructure challenges that lead to continuous national power outages.

4.11 Conclusion

The chapter presented the findings that emerged from the study. The findings obtained from empirical literature were evident that the JET framework is a suitable approach to resolve load shedding in South Africa as it was found to promote a shift from fossil fuels and coal by decommissioning the aged coal plants in line with the IRP and the generation of electricity from renewable energy at a proportionate pace and capacity. It also emerged that, the Energy Action plan (EAP) initiatives to resolve load shedding through the National Energy Crisis Committee has been a success since its inception, however it is not without challenges. The next chapter presented the conclusions and recommendations that emanated the study together with the focus of further future research studies.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter discussed the study's numerous findings and conclusions from the empirical literature on the suitability of the JET framework to solve load-shedding problems in South Africa. The practical relevance of the findings was thoroughly discussed as well. In this chapter, the study's primary findings and the inferences from the data gathered were all clearly and briefly summarized. The chapter also presented several conclusions and recommendations that were made and served as the foundation for additional future studies, as well as suggestions for improvements in the implementation of the projects and or initiatives aimed at resolving load-shedding challenges in South Africa.

5.2 Summary of the Study

The study sought to explore the concept of Just Energy Transition as an initiative to resolve load-shedding challenges in South Africa. This was done using a desk research method philosophically informed by an interpretivism research paradigm and a qualitative approach. A purposive sampling design was used for selecting documents that answered research questions and achieved research objectives. The study examined 20 report publications available on online platforms as units of analysis. The fourth chapter presented the results and a discussion of the findings, and the last chapter focused on the conclusions and recommendations that emerged from the study.

The study has shown that the JET framework has the potential to minimize the adverse effects of load-shedding on the South African economy. It is expected to continue to improve the economy by eliminating the economic disadvantage caused by load-shedding by the year 2027. The framework includes key interventions and investments that have the potential to transform South Africa's energy sector from a high carbon footprint to an energy-efficient one. This means that the JET approach is one of the initiatives that can also add to improving generation capacity and improvements in the electricity grid infrastructure.

5.3 Summary of primary findings

The first objective aimed to investigate whether the Just Energy Transition Framework is a suitable approach to resolve load shedding in South Africa, amongst other initiatives proposed by the National Energy Crisis Committee, the Integrated Resource Plan, and the Energy Action Plan, and this was comprehensively indicated under themes and sub-themes below.

5.3.1 The suitability of the Just Energy Transition Framework approach to resolve load shedding in South Africa

The finding of the study based on empirical literature indicated that the JET framework is a suitable approach to resolve load shedding in South Africa as it was found to enhance the management of deactivation of the aged coal plants by the IRP and in alignment with the generation of electricity from renewable energy at a proportionate pace and capacity. The JET framework was also found to continuously spur the use of renewable energy sources in the national power grid systems and adopt new systems and processes to generate and distribute electricity since its inception as part of the National Development Plan (NDP) Vision 2020.

5.3.2 The implementation of the Just Energy Transition (JET) framework in the South African Context

The study's findings indicated that to mobilize its energy transition, the South African government instigated its flagship renewable energy policy, the so-called REIPPP project (the Renewable Energy Independent Power Producer Procurement Project). the JET framework was derived from South Africa's National Development Plan (NDP) 2030 to address several socio-economic challenges such as poverty, low employment, and inequality.

The second objective aimed to track progress on implementing the National Energy Crisis Committee and the Energy Action Plan initiatives developed to resolve load shedding as comprehensively indicated below.

5.3.3 Implementing Energy Action Plan (EAP) initiatives to resolve load shedding through the National Energy Crisis Committee.

The Energy Action Plan (EAP) initiatives to resolve load shedding through the National Energy Crisis Committee have been a success since its inception. However, it is not without challenges. The Energy Action Plan is one of the initiatives operating besides the JET framework aimed to resolve load-shedding constraints in South Africa through the generation of over 6000 MW capacity needed to meet electricity demand. Power generation projects have since been implemented with a 5-year plan, and results toward reducing load shedding have been recorded, with some lagging behind the estimated completion stage. The JET framework, as well as the Energy Action Plan (EAP), objects to enabling and accelerating private investment in generation capacity and fast-track procurement of new capacity from renewables, gas, and battery storage through several strategies and initiatives such as Importing power capacity ranging from 300MW to 1625MW from neighboring partner countries implemented from 2023 to Facilitate market reforms to generate a power capacity of over 9000MW of large-scale private sector investment in 2024.

5.3.4 Implementing Integrated Resource Plan (IRP) initiatives to resolve load shedding.

Integrated Resource Plan initiatives are also used alongside the JET framework to improve capacity generation and to resolve load shedding in South Africa. Integrated Resource Plan objects to rejuvenate Eskom plant performance and Shutdown Plan as well as counter-attacking the new build challenges, developing of the Koeberg power plant long-term operational plan, compliance with minimum emission standard, timing and rollout of new capacity generation, development of the transmission grid. By so doing these initiatives together with the JET framework will resolve the load shedding challenges crippling the economy and societies of South Africa through frequent power cuts.

5.3.5 The Impact of Global Energy Transition in Various Countries that are Part of The Just Energy Transition Framework

Results found that Nigeria sees the just energy transition as more than a shift from fossils to cleaner sources that harm the environment. However, the country also views

the framework as an opportunity to harness potential economic benefits and improve energy access through modular renewable energy technologies. The global fight against climate change has called for cleaner use of energy resources, which could be used to address the electricity supply deficit.

In addition, the economic challenges faced by South Africa during its transition are similar to those of Nigeria, both of which heavily rely on revenue generated from the sale of coal, oil, and gas in the global market. These sectors generate income for both countries and businesses that control the market. Ultimately, moving away from coal, oil, and gas could lead to economic and social problems for both countries, including a decline in poverty reduction efforts and an increased dependence on foreign technology. To mitigate these adverse effects, it must invest in its abundant clean energy resources, mitigating any negative occurrences that may impact its energy independence and economic development.

Spain encountered an electricity supply deficit and used the transition framework to switch to alternative clean technologies while scaling up generation capacity and related infrastructure.

The South African government has not reported the challenges of all the implemented initiatives to increase generation capacity from various approaches in addressing load shedding. However, in the quest to increase capacity generation, sources of electricity production from various programs, including the private sector and neighbouring countries, were not specified.

It also emerged from the study JET framework and its implementation in different countries globally are based on the belief that tackling the social and economic issues faced by nations, such as load shedding, requires simultaneous efforts towards climate action and sustainable development and has yielded positive results from its implementation.

The study, based on empirical evidence, established that energy transition is extremely relevant on the African continent, considering that the combination of population and economic growth is expected to increase the continent's energy demand significantly. The findings also indicated that, within the African continent, South Africa is

responsible for 42% of the continent's emissions. Globally, South Africa is ranked thirteenth out of the top fifteen largest emitters. It also emerged from the study that unlike European nations such as Germany and Italy, with commitments to phasing out coal but declining population trends, South Africa has a growing population, intensifying its future energy demand.

5.3.6 Just Energy Transition Challenges

Despite the JET framework's aim to resolve load-shedding challenges, it has its own challenges that were also deliberated by the study. The study's findings indicated that the successful implementation of the JET as a measure against the detriments of load-shedding had been constrained by compromised power generation sources and resources such as maximum utilization of coal. In support of this deliberation, the United Nations Office for Project Services (2023) reported that South Africa's main mining region, Mpumalanga, is underperforming across several economic indicators compared to the national average, underlining the need for an energy transformation. The geographical concentration of coal plants and mines in one single region could result in negative multiplier impacts from the decommissioning of plants, and this was also found to be a barrier to the effective implementation of the JET framework aimed to alleviate the adverse effects of load shedding in South Africa.

In liaison with these findings, Business Tech (2023) also indicated that estimates currently suggest that 88% of South Africa's electricity generation stems from coal. Two important players in the energy domain in South Africa are Eskom and Sasol. Eskom is a state-owned company that produces over 90% of the country's electricity primarily through coal combustion. It is thereby responsible for 45% of the country's emissions.

The critical appraisal of the Just Energy Transition Framework by the Minister of Electricity provided a different outlook on the electricity crisis, suggesting that the electricity sector's focus should be directed toward retaining coal power stations instead of accelerating the renewable energy from the Just Energy Transition framework.

5.3.7 The Underlying reasons of load shedding

According to the Daily Investor (2023), the ANC government is primarily responsible for the electricity crisis in South Africa. The electricity crisis in South Africa has been caused by the ANC government's mismanagement of the country's electricity network for several years. The ANC's policies and practices, including cadre deployment and looting of state institutions, have had a significant impact on the country's institutions, leading to tremendous devastation. The ANC has been fully responsible for this crisis in the last 17 years. On the other hand, the power utility has been accused of mismanaging its power stations, intentionally sabotaging plant operating units, engaging in graft, and incurring excessive expenditure on the maintenance of coal plants and procurement of goods and services. Other contributing factors include an electricity supply deficit, theft and vandalism, and increasing municipal debt from non-payment of electricity usage. The study also revealed that Eskom is facing staggering debts of \$26 billion, as reported by the BBC in 2023.

This finding can also be interpreted as applicable to many African nations, not excluding South Africa; solar and wind power technologies are readily available, relevant and becoming more affordable. They are segmental and so scale-able and highly suited to distributed energy applications. The concomitant growth of energy storage technologies considerably assists their application. This conclusion is, therefore, not a surprise, as globally, the energy transition is accelerating the growth of renewable energy, delivering innovation, and providing economies of scale. The study concluded that the reasons for the limited take-up of renewable energy to support the JET framework in South Africa must lie in the non-technological areas rather than technological issues. The practical implication of this conclusion is also to enhance understanding of the gaps between the successes and failures of power generation projects in South Africa, which need to be more technical.

5.4 The implications of transitioning to renewable energy in South Africa

- The study projected that the energy- and labour-intensive coal power industry would face employment pressures.
- Transition goals are primarily directed toward supporting the economic transition of coal-dependent locations. In the case of South Africa, Mpumalanga was identified as the central point of interest to transition the coal sector. In contrast, transition goals should be extended to the rest of the country.

- Bearing the balance sheet outlook of South Africa, implementing all the JET projects and employment costs related to the transition will be difficult as the country has only raised \$8.5 billion in concessional loans from the \$43 billion needed to transition the electricity sector.

5.5 Recommendations

Based on the findings of the study, the following recommendations were made:

- The National Energy Crisis Committee, in its progress tracking, should engage in frequent monitoring and evaluation of the implementation of several initiatives such as JET, EAP, and IRP aimed to minimize causes of electricity crisis in South Africa since the findings have indicated and concluded that, in many African nations not excluding South Africa, technologies of both solar and wind power are readily accessible, applicable, and becoming ever more inexpensive. The reasons for the inadequate uptake of renewable energy to support the JET, EAP, and IRP frameworks and initiatives in South Africa must lie in the non-technological spheres rather than technological issues. This implies that many power generation projects in South Africa aligned with the NDP Vision 2030 are compromised due to non-technological problems such as mismanagement, amongst other factors.
- The study also recommended comprehensive leveraging of the Just Energy Transition Partnership (JETP) for South Africa with other international players. This recommendation is in line with the National Energy Crisis Committee and other relevant board's NDP 2023 aligned vision to fundamentally transform the electricity sector to achieve long-term energy security through implementing 238MW of Just Energy Transition projects along with the second phase of the Battery Energy Storage System, facilitation of market reforms to produce a power capacity of over 9000MW of large-scale private sector investment and allow capacity generation of 1597MW from more private sector-led projects. These objectives aimed to end loadshedding can be alleviated through the Just Energy Transition Partnership (JETP).

- The study also recommends the development of an institutional platform to support the development of the Just Energy Transition Partnership both domestically and internationally. Because South Africa's energy transition is politically influenced, progress was undermined by resistance to the transition itself, as indicated by McEwan (2023).
- Constructing new transmission lines and substations, particularly in regions like the Eastern Cape, Northern Cape, and Western Cape, will lead to a significant surge in power supply to the grid in the long term.
- The fundamental goal of the JET IP is to enhance and expand the national grid, which is linked to creating a state-owned independent transmission company. The JET-IP must specify how the financing and execution of the grid improvements will be done as quickly as possible.
- In light of the current energy crisis, the program of public and private investment in renewable energy and battery storage, both for the national grid and embedded generation, must be scaled up and implemented at speed. As well as repurposing of existing coal mining and industrial land to pave the way for renewable generation capacity and storage projects.
- To connect the JET-IP with an execution plan, it is necessary to have a precise understanding of the projects involved, a clear financing strategy, incorporation into the national budget processes, resolution of any systemic issues, and enhancement of institutional capacity.

5.6 Practical Contributions of the Study

The conducted research played a significant role in contributing to the existing body of literature on the JET framework, which is a tool that aims to address the load-shedding crisis in South Africa. The study provided an in-depth understanding of the underlying reasons behind load shedding. It also analysed the impact of the global energy transition in different countries that are part of the Just Energy Transition Framework. The primary objective behind examining the JET framework and its implementation in

different countries was to acknowledge that addressing social and economic issues that nations face, such as load shedding, requires simultaneous efforts toward climate action and sustainable development. The study highlighted how load shedding has contributed to the economic downturn in South Africa and how energy initiatives under the JET framework can help mitigate its impact.

5.7 Conclusion

The study concluded that South Africa still faces a major challenge in improving energy security and achieving its decarbonization goals amidst a significant load-shedding crisis. It is crucial to avoid any obstacles or delays arising due to a lack of consensus in the Just Energy Transition dispensation. To address this challenge, the country must move forward in the national interest based on scientific insights and economic analysis. In this context, it is essential to have sufficient consensus and push ahead with a cohesive approach to energy policy. This approach is paramount in dealing with the ongoing energy transition challenge facing South Africa. However, the Energy Action Plan initiatives have shown progress on projects developed to source over 6000 MW capacity needed to meet electricity demand. Thus far, projects in the private sector have unlocked about 1,009 MW in commercial close (of which 784MW is already in construction), and a further 300 MW are anticipated to reach close and proceed to construction by the end of September 2023.

5.8 Nomination of a Potential Journal

This study has identified the Journal of Energy in Southern Africa as a suitable target for publication, aiming to contribute to the existing body of energy research.

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