Exploring an effective energy transition management framework for the South African Energy Sector

2020

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1 INTRODUCTION

According to the World Economic Forum's (WEF) Energy Transformation Index (ETI) report, the global energy transition slowed in 2019, with South Africa (SA) ranking 114th out of 115th nations assessed. [1]. The ETI contributes to a better knowledge of the historical and present situation of global energy transition, resulting in more informed energy transition policy and investment decisions [2]. South Africa performed poorly in both the energy system performance index and the readiness for energy transition.

According to the South African Government's Energy Integrated Resource Plan 2019 (IRP2019), the energy mix that is implemented must also achieve a just energy transition [3]. However, energy system transformation is a challenging problem for management, governments, and energy stakeholders, necessitating rigorous identification of energy transition barriers and problem-solving strategies.

Since the cabinet issued the 1998 Energy Policy White Paper, SA has faced energy transition challenges. The challenges are worsened by the contentious nature of power policy planning in South Africa, with some stakeholders opposing policy direction, technology choices, and the privatization of the Electricity Supply Industry (ESI). The South African government, under the National Development Plan (NDP2030), envisions an energy sector that supplies a secured and reliable energy services at affordable prices while also protecting the environment through reduced environmental degradation.

The stakeholders' vested interest in SA's energy policy path is a detriment to South Africa's energy transition. The fossil fuel industry has a strong incentive to keep coal as the primary source of energy for power generation, and it actively resists a fundamental process of energy transition [4]. Another factor to consider is the impact of energy on the political economy, as the South African industrial model is founded on a strong Mineral Energy Complex (MEC), which has historically been able to offer low-cost baseload coal-fired electricity to both domestic and foreign clients [5]. Furthermore, the effects of the energy political economy on South African energy policies, as well as the realities of energy access, sustainability, security, and affordability, are becoming increasingly relevant.

Renewable energy also has a negative impact on workers and communities that rely significantly on the fossil fuel industry and [6] believed that the decarbonization of the fossil fuel energy system would be detrimental to workers and communities. Therefore, the energy transition should take into account the possibly negative effects of the political, socioeconomic, and energy systems [7].

These issues are contributing to energy policy uncertainty, a dearth of future planning, an inadequate regulatory framework, and a lack of acceptable market regulations, with the government hesitating to pursue its energy policy stances since 1998.

2 RESEARCH OBJECTIVES

This study aims to add to the body of knowledge by offering a transition management framework for a decarbonized, secure, affordable, and just energy system in South Africa at the rate needed to mitigate climate change. This study adhered to the interpretivism paradigm: it is better suited to a qualitative research method, such as a case study with small samples. This interpretivism paradigm research necessitates an inductive approach in order to provide interpretive phenomena within a given context. Document analysis and semi-structured interviews are used in this study, with interview questionnaires serving as primary data and documents serving as secondary data.

Case study research data analysis entails reducing data, displaying data, drawing conclusions, and validating those conclusions. It is quite useful to employ qualitative data analysis software; the tool used to analyze the primary data for this study is Atlas.ti, which is used in managing the analysis of large amounts of unstructured qualitative data. Dr. Pittaway (Atlas.ti Professional) conducted the qualitative analysis, and the primary data is coded according to the research proposition.

3 LITERATURE REVIEW

3.1 South African Energy Policy Context

The Department of Minerals, Resources, and Energy (DMRE) is actively seeking solutions to ensure energy stability, promote universal access, change the energy sector, and optimize energy resource utilization. Table 1 depicts some of the government's energy policy and regulatory measures since 1998. Although there is agreement that the electrical sector need restructuring, the final status remains unresolved [8]. The IRP2019, published by the Minister of DMRE in October 2019,

included important factors that required attention, beginning with immediate supply security.

Table 1: Key South Africa Energy Policies and Legislations

Year	Energy Policies and Legislations
1998	White Paper on Energy Policy of the Republic of South Africa
2003	White Paper on Renewable Energy Policy for South Africa
2004	National Energy Regulator Act (No 40 of 2004)
2008	Nuclear Energy Policy
2008	National Energy Act (No 34 of 2008)
2010	Draft Revised White Paper on Renewable Energy
2011	Integrated Resource Plan (IRP) 2010-30
2016	Integrated Energy Planning Report
2019	Integrated Resource Plan 2010-30 (IRP2019)

Source: *Researcher's Construct (2020)*

The IRP2019 is an electricity infrastructure planning strategy that focuses on the least cost of supply and demand equilibrium while also considering supply security and environmental concerns, as well as minimizing negative pollution and water use [9]. The plan also called for the development of a consistent strategy to promote a just transition plan and to keep the existing renewable built limitations in place until a just plan was finalized. Furthermore, modern coal-fired power plants must prioritize high performance, low emission, and cleaner coal technologies.

In conclusion, the NPD2030, SDGs, UNCCC, Energy Policy WP, and IRP2019 have established common objectives to ensure access to an affordable, secure, and sustainable energy system. Achieving these shared goals would open up a whole new world of opportunities for many people, including increased income and employment opportunities for women, children, and youth, expanded health and education, more sustainable and inclusive communities, and improved forms of climate protection and resilience.

3.2 TRANSITION MANAGEMENT FRAMEWORK (APPROACH)

The aim of this section is to discuss the main research objective and research questions in order to understand the transition management framework from a broad

perspective and the appropriateness of its approach to achieving an effective energy transition in South Africa. The research question is: How can the transition management concept be framed for the implementation and management of energy transition in South Africa.

In industries such as energy and water, transitional management concept has emerged as an attractive technique for proactively addressing and driving transitions [10]. To address such recurring challenges in energy transition, a transition management model has been proposed as a management strategy.

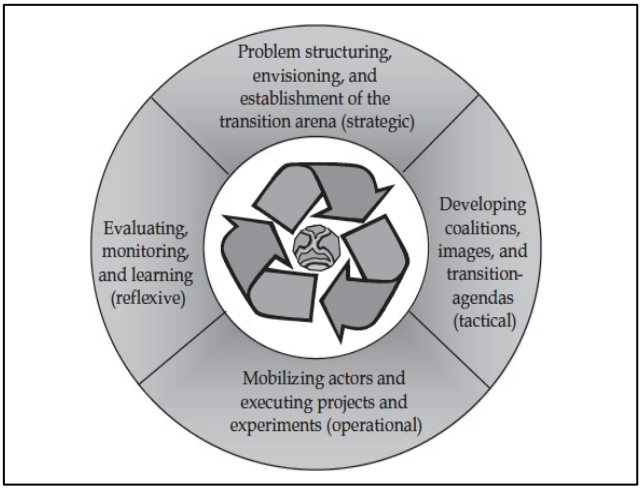

Figure 1: Transition Management Cycle, Source: [11]

3.2.1 The Transition Management Cycle

3.2.2 The foundation for the operational management of multi-level governance is put down by structural instruments in a cyclical process model. Transitional management is conceptually a cyclical and iterative process [12] and defined by the so-called transitional management cycle. The governance model on which transitional management is based is the process of organizing, strategizing, exploring, formulating policy, enforcing, and adapting challenges [13], [14]. These are very general basic principles already translated into an operational model for implementation and are the so-called transitional management cycle [13], as shown in Figure 1.

Problem structuring and envisioning (Strategic Level)

Problem structuring is an important part of transition management that leads to a deliberate, holistic solution to the problem [11]. The transition manager, who brings together the many stakeholders and is in charge of overall coordination in the transition

arena. The transition manager must ensure a balanced representation of stakeholders from businesses, governments, non-governmental organizations, information institutions, and the general public.

Coalition building, developing transition agendas (Tactical Level)

Creating a framework for long-term sustainability is a difficult task. Long-term sustainable visions will serve as a guideline for structuring policies and programs, as well as setting short- and long-term goals. These concepts must be appealing and unique in order to be backed by a wide range of actors. Inspiring final concepts are beneficial for mobilizing social participants, but they must be practical in terms of innovation. Long-term sustainable visions will operate as a guide for the design of policies and initiatives.

Mobilising actors and implementing transition experiments (Operational Level)

Operational transition management attempts to develop social niches for all sorts of innovation. It aims to connect and inspire developing niches and innovators in order to improve their chances of success [11]. The strategy includes a wide range of stakeholders and groups, including citizens in general. The goal is to create a portfolio of transition experiments that can complement one other and contribute to significant and measurable progress toward long-term goals [12]. The functional application of the large new body of thought is extremely difficult, and there are numerous people involved, each with their own point of view.

Evaluation and adaptation: closing the cycle

Transition monitoring is based on progress and (social) learning in the context of transition management [11]. It is a continual task that can be supported by means of various approaches and practices. Tracking the transition process frequently requires multiple stages in order to govern the slow-moving macro transitions, swiftly increasing and declining specialized improvements, and individual and collective stakeholders at the regime level.

3.3 ENERGY TRANSITION MANAGEMENT THEORETICAL FRAMEWORK

The propositions in this case study both lead the study and narrow its scope. The dependent concepts are identified as the *perceived success of an effective energy transition policy framework in South Africa (*Figure 2).

3.3.1 Participatory Governance

The energy sector in South Africa demands a shift in the total energy system, which will effect a variety of energy resources, carriers, and end-use applications. By increasing the number of citizens active in making or influencing government choices, participatory governance broadens and deepens democracy [15]. Participatory governance has also been shown to promote information flow, transparency, and accountability.

3.3.2 Energy Justice ed

Transition management has the ability to contribute in the achievement of energy justice [10]. According to the authors, transition management has a high potential for achieving energy justice by involving communities who have been excluded from energy decision-making processes. Energy justice is the goal of creating equity in both social and economic participation in the energy system, as well as resolving social, economic, and health burdens on marginalized communities [16].

3.3.3 Energy Governance

The transition management method offers a governance framework for governance structure, policy descriptive and governance theories, models, and tools that can be implemented into an operational transition management model [11]. This governance method comprises regulations governing the usage of energy infrastructure, as well as rules governing the architecture of the energy market and how energy is bought and sold. It also comprises government departments, energy regulators, network companies, system operators, and suppliers as energy system institutions.

3.3.4 Political Commitment

The gap between the top performers in the energy transition and the remainder has increasingly narrowed, owing mostly to increased political commitment and improved access to capital for investment in emerging economies [17]. Political commitment entails campaigning for change, developing institutions, implementing policies, mobilizing resources, and coordinating responses within and outside of government, across sectors, and from national to local levels for as long as is required to secure long-term results [18].

3.3.5 Business Innovation

The goal of energy innovation is to investigate the challenges and opportunities for the energy, transport, and industrial sectors that arise from the transition to a low-carbon energy future. Carbon capture and storage, underground coal gasification, and other cleaner coal technology are critical components that will allow SA to continue to use its coal resources in an environmentally friendly manner. Carbon Capture and Storage (CCS) systems are another example of technological fixes.

3.3.6 Infrastructure Investment

Infrastructure investment is the utilization of capital resources by businesses and private equity funds to profitably invest in existing and new infrastructure. The International Energy Agency estimates that between 2016 and 2050, the average annual investment required to reach the Intergovernmental Panel on Climate Change's 2°C scenario will be $3.7 trillion.

3.4 CONCEPTUAL MODEL OF EFFECTIVE ENERGY TRANSITION IN SA

There were six independent variables found that could potentially have a positive influence on the dependent variable: I Participatory governance, ii) energy justice, iii) energy governance, iv) political commitment, v) business innovation, and vi) infrastructure investment as shown in figure 2.

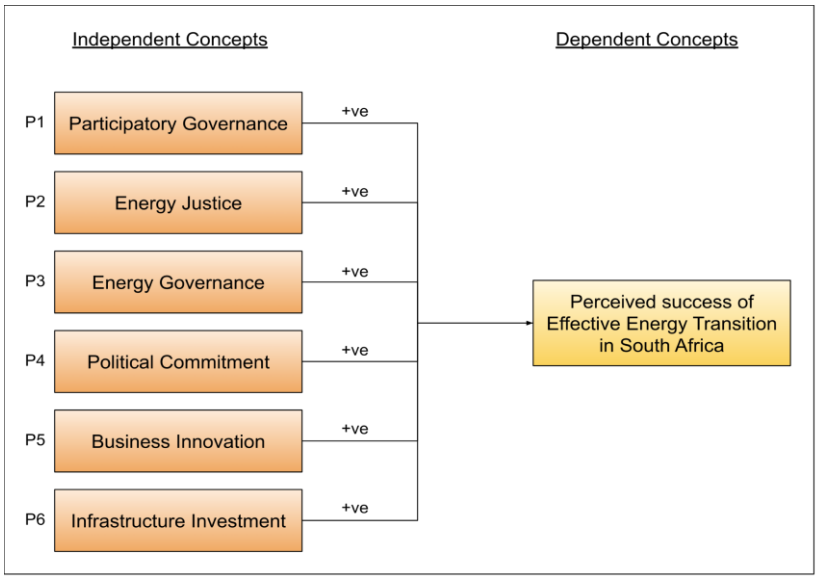

Figure 2: Proposition for Effective Energy Transition, Source: [19]

4. SUMMARY OF THE RESEARCH FINDINGS

The limited research on developing a transition management framework for the implementation and management of an effective energy transition for SA represented the basis of the research gap. The following section provides a discussion of noteworthy findings, with explanations and observations for each finding described in the context of the research problem, as well as supporting research questions.

1. The research proved that there is a positive relationship between a participatory governance regulatory framework and success of effective energy transition in South Africa.
2. The research proved that there is a positive relationship between energy justice and success of effective energy transition in South Africa.
3. It was found during the research that there is a positive relationship between an energy governance regulatory framework and success of effective energy transition in South Africa.
4. It was proven during the research that there is a positive relationship between political commitment and success of effective energy transition in South Africa.
5. It was proven during the research that there is a positive relationship between business innovation and the success of effective energy transition in South Africa.
6. It was found during the research that there is a positive relationship between infrastructure investment and the success of effective energy transition in South Africa.

The study's primary research objective was to create a transition management framework for the implementation and management of an effective energy transition in South Africa. Effective energy transition was defined in the literature as a timely transition toward a more inclusive, sustainable, affordable, and secure global energy system that provides solutions to global energy-related challenges while creating value for businesses and society without compromising the energy triangle's balance. The case study research effort discovered that the following factors influence the perceived success of an effective energy transition in the South African energy sector: participatory governance, energy justice, energy governance, political commitment, business innovation, and infrastructure investment.

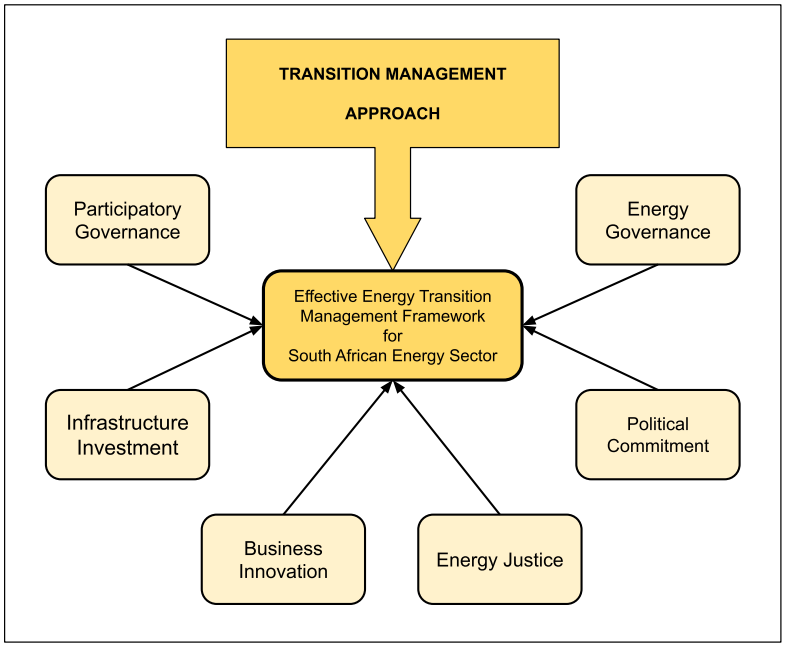

Figure 3: Effective Energy Transition Management Framework for South African Energy Sector, Source: [19]

Transition management and research propositions as conceptualised in Figure 3 are theoretical concepts that management could use to positively influence the energy transition in South African energy sector and therefore address the case study primary research objective.

5 CONCLUSIONS

Study has dealt research objectives, while the results of the research in the context of the study were interpreted and evaluated by using both empirical data and secondary sources. The research study was then summarised, and the results were presented against the backdrop of the first research problem and the research objectives. Participatory governance, energy justice, energy governance, political commitment, corporate innovation, and infrastructure investment were found to influence the perceived success of an effective energy transition in the South African energy sector by the case study research effort.

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