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UNIVERSITY OF CAPE TOWN



**A VIABILITY STUDY OF INDEPENDENT POWER PRODUCERS IN THE
SOUTH AFRICAN ELECTRICITY SUPPLY MARKET -
A CASE STUDY OF NORTHERN CAPE PROVINCE**

by

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Date: 01 February 2019

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Acknowledgement

I would like to express my gratitude and thanks to the following people:

- My supervisor, Dr. Corrinne Shaw, for her patience and support along this master's degree journey. Her invaluable inputs and suggestions have helped me reach this milestone.
- My two beautiful children, Angel and Thando – my inspirations. Thinking about them gave me the strength to work harder.
- My family, especially my mother and grandmother, for the unconditional love and support they have shown me over the years.

Abbreviations

BW	Bid Window
CO ₂	Carbon Dioxide
CSP	Concentrated Solar Power
DBSA	Development Bank of South Africa
DME	Department of Minerals and Energy
DoE	Department of Energy
EPC	Engineering Procurement and Construction
GAU	Grid Access Unit
GW	Gigawatts
IA	Implementation Agreement
IDP	Integrated Development Plan
IEA	International Energy Agency
IEP	Integrated Energy Plan
IR	Integrated Report
IPP	Independent Power Producer
IRP	Integrated Resource Plan
MW	Megawatts
NDP	Network Development Plan
NERSA	National Energy Regulator of South Africa
NT	National Treasury
O and M	Operations and Maintenance
PPA	Power Purchase Agreement
PV	Photovoltaic
REFIT	Renewable Energy Feed-in Tariff
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RFP	Request for Proposal
SED	Socio-economic Development

SIPOC	Suppliers, Inputs, Processes, Outputs, Customers
SMMEs	Small-, Medium-, and Micro-sized Enterprises
VSD	Viable System Diagnosis
VSM	Viable System Model

Glossary

Term	Description
Buyer	This term refers to Eskom, as the sole buyer of electricity generated by independent power producers.
Clean energy	Electricity generated from renewable energy sources: solar, wind, biomass, etc.
Developer	A private company or consultant contracted by an IPP to develop and/or construct a renewable energy plant.
Independent power producer	A private electricity-generating company using renewable energy sources.
Load shedding	The sharing of available energy among customers during high energy demand (i.e., peak time).
Programme	The renewable energy independent power producer procurement programme established by the Department of Energy in South Africa.
Seller	This term refers to renewable energy independent power producers.
Utility	The South African electricity-supply company Eskom.

Abstract

The purpose of this study was to understand the factors impacting on South Africa's Renewable Energy Independent Power Producers Procurement Programme (REIPPPP). At its inception in 2011, the programme received support from the government, the private sector, and renewable energy investors. The programme was considered a success for having secured agreements with independent power producers (IPP) and for having procured much-needed electricity.

As the programme matured, some concerns were raised by different stakeholders and interested parties regarding the programme's design and its capacity to continue facilitating the procurement of energy. Some stakeholders argued that the programme should be institutionalised as a way to increase the stability, continuation, and relevance to Eskom (South Africa's national power utility company). The sustainability of the programme was also questioned by renewable energy experts who claimed that Eskom was holding the programme back due to its different roles within the programme.

The debate around the viability of the REIPPPP formed the basis for this research study, which sought to investigate the factors affecting the programme, as well as how these factors can best be managed to ensure the viability of independent power producers in the South African renewable energy market. The following ten factors were identified using empirical data drawn from interviews and an online survey:

1. Poor programme design
2. Slow renewable energy growth
3. Poor renewable energy demand and technology
4. Lack of competitive and profitable tariffs
5. Insecure programme funding
6. Poor policy implementation
7. Lack of expertise and skills
8. Lack of development in local communities
9. A high rate of project implementation
10. Poor management of economic development criteria

The question of how these factors can be managed for the viability of IPPs in the South African renewable energy market was addressed using Beer's viable system model (VSM). The VSM was used in both the diagnostic (descriptive) and the design (prescriptive) modes. The REIPPPP's institutional setting was diagnosed to identify deficiencies within the programme. The diagnostic mode of the VSM identified the

lack of interaction amongst IPPs in their operating environment, the single-buyer arrangement, low access to capital among IPPs, competitive and profitable tariffs, poor policy implementation, and poor programme funding to be the programme's main shortcomings, which threatens its viability for long-term survival.

Given the deficiencies within the programme, the VSM model was further used to propose a REIPPPP model that would improve the programme's efficiency and effectiveness, and ensure its survival in a highly competitive environment. The model promotes the collaboration between IPPs, as a means for improving stakeholders' engagement and communication within the programme, enabling faster decision-making on the part of local programme management, and reducing the concerns being escalated to local control. The study also proposes that provincial REIPPPP offices assist in increasing the requisite variety of the programme.

Finally, the validity and transferability of the research findings were discussed, and conclusions were drawn. Recommendations for further studies were made based on the limitations of the presented research study.

Table of Contents

Plagiarism Declaration	1
Acknowledgement	2
Abbreviations	3
Glossary	5
Abstract	6
Table of Contents	8
List of Figures	12
List of Tables	13
Chapter 1: Introduction	14
1.1 Introduction	14
1.2 Problem statement	15
1.3 The case of the Northern Cape	16
1.4 Research objectives	18
1.5 Research questions	18
1.6 Importance of the study	18
1.7 Report structure	19
Chapter 2: Literature Review	20
2.1 Introduction	20
2.2 Renewable energy perspective	20
2.3 Renewable energy development challenges	21
2.4 The South African electricity market	22
2.4.1 The market arrangement	22
2.4.2 Renewable energy policy development roadmap	23
2.4.3 The introduction of IPPs in South Africa	24
2.5 Organisational cybernetics and viability	33
2.5.1 Organisational cybernetics	33
2.5.2 Cybernetics laws and principles	34
2.5.3 Organisational viability	34
2.6 Summary	38

Chapter 3: Research Design, Methods and Methodology	39
3.1 Introduction	39
3.2 Research design	39
3.2.1 Goals.....	40
3.2.2 Conceptual framework	40
3.2.3 Research questions.....	41
3.2.4 Methods.....	41
3.2.5 Validity	41
3.3 Data collection	41
3.3.1 Systematic literature review	41
3.3.2 Coding of factors	42
3.3.3 Web-based survey	42
3.3.4 Semi-structured interviews	43
3.4 Methodology	44
3.4.1 Case study as a strategy of inquiry.....	44
3.4.2 The Northern Cape case	45
3.5 Qualitative content analysis	45
3.6 Validity and trustworthiness	46
3.6.1 Credibility	47
3.6.2 Dependability.....	47
3.6.3 Transferability	47
3.6.4 Conformability.....	48
3.7 Ethical implications	48
3.8 Summary	48
Chapter 4: Data Analysis and Findings	49
4.1 Introduction	49
4.2 Analysis of literature	49
4.2.1 Level 1 coding	49
4.2.2 Level 2 coding.....	51
4.4 Analysis of survey data	52
4.4.1 Programme design factors	53
4.4.2 Renewable energy market in South Africa	54
4.5 Analysis of interview data	58
4.6 Summary	61
Chapter 5: REIPPPP Diagnosis and Modelling	62

5.1 Introduction	62
5.2 Defining REIPPPP level of recursion	62
5.3 REIPPPP diagnosis	65
5.3.1 Description of the REIPPPP using VSM.....	65
5.3.2 REIPPPP operations (System 1).....	66
5.3.3 Programme coordination and conflict resolution (System 2).....	67
5.3.4 Programme optimisation and synergy (System 3)	68
5.3.5 Programme internal regulation and audit (System 3*)	69
5.3.6 Programme adaptation and planning (System 4)	69
5.3.7 Programme authority and policy (System 5).....	69
5.4 Modelling the REIPPPP as a viable system	70
5.4.1 REIPPPP operations (System 1).....	72
5.4.2 Programme coordination and conflict resolution (System 2).....	75
5.4.3 Programme optimisation and synergy (System 3)	76
5.4.4 Programme adaptation and planning (System 4)	77
5.4.5 Programme authority and policy (System 5).....	80
5.5 Summary	81
Chapter 6: Recommendations and Conclusion	82
6.1 Introduction	82
6.2 Validity and transferability	82
6.2.1 Validity of this research	82
6.2.2 Transferability of research findings.....	82
6.3 Future studies	82
6.4 Conclusion	83
REFERENCES	86
APPENDIX A: RESEARCH CONSENT FORM.....	91
APPENDIX B: INTERVIEWS INTRODUCTORY SCRIPT.....	94
APPENDIX C: INTERVIEWS QUESTIONNAIRE.....	95
APPENDIX D: ONLINE SURVEY QUESTIONNAIRE	98
APPENDIX E: ETHICS APPLICATION FORM	102
APPENDIX F: NORTHERN CAPE IPP PROJECTS.....	104
APPENDIX G: CODED FACTORS FROM LITERATURE.....	106

APPENDIX H: VSD RENEWABLE ENERGY IPP PROCUREMENT PROGRAMME 108

APPENDIX I: SUMMARY OF SURVEY FACTORS 109

APPENDIX J: PARTICIPANTS' PERCEIVED FACTORS 111

List of Figures

Figure 1: Sales of electricity per category of customers (Eskom, 2014).	17
Figure 2: Average electricity tariff increase over the years (Eskom, 2013).....	23
Figure 3: Energy Triangle (IPP Projects, 2015).	25
Figure 4: Provincial RE distribution (DoE, 2015).	28
Figure 5: Capacity allocated per technology (Eskom, 2014).....	30
Figure 6: Viable system model (Pérez Ríos, 2010: pp1532).....	37
Figure 7: An interactive model of research design (Maxwell, 2009: pp. 217).	39
Figure 8: Content analysis process (Mayring ,2014).....	46
Figure 9: Number of factors per category.....	51
Figure 10: Participants' REIPPPP knowledge.	52
Figure 11: Major factors driving renewable energy development in South Africa?	55
Figure 12: The factors that attract investors in South Africa's renewable energy market?	56
Figure 13: Participants' perceptions about IPPs in South Africa.....	57
Figure 14: Recursion levels of the system-in-focus (DoE, 2016).	63
Figure 15: Indicative regulatory requirements for participation (DoE, 2015).....	64
Figure 16: The REIPPPP as system-in-focus.....	65
Figure 17: Collaboration within the system-in-focus at Operational Level.....	74
Figure 18: Coordination and conflict resolution design for System 2.....	75
Figure 19: Programme optimisation and synergy (System 3).	77
Figure 20: Programme adaptation and planning (System 4).	79
Figure 21: Programme authority and policy (System 5).....	81

List of Tables

Table 1: Regional distribution of economic activities in 2010 (Bouwer, 2011: pp. 13).	17
Table 2: Round 1, 2 and 3 outcomes of REIPPPP (Eberhard, Leigland and Kolker, 2014).	28
Table 3: Capacity (MW) approved from Round 1 to Round 4 (Eberhard, Leigland and Kolker, 2014).	29
Table 4: Renewable energy allocation by province (Eskom, 2015).....	31
Table 5: Jobs per technology over the project life cycle (DoE, 2013).	31
Table 6: ED criteria and targets (Eberhard, Leigland and Kolker, 2014: pp. 68).....	32
Table 7: Interviewee role and experience.	44
Table 8: 10 literature category factors.	49
Table 9: Seven Level 2 coded factors.	51
Table 10: 10 factors impacting on REIPPPP	58
Table 11: REIPPPP SIPOC.	66
Table 12: Summary of factors based on a viable system diagnosis of the REIPPPP.	71

Chapter 1: Introduction

1.1 Introduction

South Africa's economy is driven by the mining, manufacturing, agricultural, wholesale and financial sectors, with most of these sectors having a high demand for electricity (Bouwer, 2011). According to Eskom (2013), South Africa's national power utility company, the increase in rural electrification without an attendant increase in generation capacity since 1994 has contributed to a constrained power system in South Africa. In addition, Eskom's aging generating fleet, which requires frequent maintenance and intensive refurbishment, puts even greater pressure on the power system (Eskom, 2013).

After the 2008 period of load shedding (planned reduction of electrical power) in South Africa, the government called for independent power producers (IPPs) to participate in the country's energy sector, thus introducing renewable energies into the sector (DME, 2003). The long-term resolutions are to solve the power crisis and lower carbon emissions, in compliance with the environmental requirements set by South Africa and as a contribution to sustainable development (DME, 2003). The introduction of renewable energies was initially explored in South Africa through the Renewable Energy Feed-In Tariff (REFIT) programme, and in support of this notion, a REFIT policy was approved in 2009 by the National Energy Regulation of South Africa (NERSA) (Montmasson-Clair and Ryan, 2014). However, uncertainties about the procurement programme's policies and the legality of feed-in tariffs within South Africa's procurement framework remained a concern for developers. At the time (in 2009), the public procurement framework was unclear. Montmasson-Clair and Ryan (2014) argue that the feed-in tariffs resulted in non-competitive procurement, which was prohibited by government public finance and procurement regulations. The National Energy Regulator of South Africa (NERSA) then cancelled the REFIT programme in 2011. As a result, no further projects were implemented under the REFIT programme (Montmasson-Clair and Ryan, 2014).

According to the Department of Mineral and Energy (DME), the South African government has worked consistently on increasing renewable energy sources within the electricity-generation mix. One of the government's primary goals is to increase the share of renewable energy sources in electricity generation (DoE, 2013). Like many other developing countries, South Africa produces an Integrated Resource Plan (IRP), which clearly defines the government's long-term energy plan and implementation strategy. The Department of Minerals and Energy confirmed that a substantial increase in the renewable energy share of electricity generation will contribute to firm supply and guarantee sustainable development (DME, 2003). The White Paper on Renewable Energy Policy stipulates that the South African government intends to develop renewable energy resources strategically in the future. However, the government recognises the challenge of providing sufficient incentives for renewable energy developers to develop, grow and be sustainable in the long term (DME, 2003).

The provision of energy by IPPs will have a direct, positive impact on the economy, social development and the environment.

1.2 Problem statement

In 2011, the South African government established the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) to facilitate the implementation of competitive clean energy procurement from Independent Power Producers (IPP). The implementation of this programme came after the REFIT programme did not produce a single IPP (Montmasson-Clair and Ryan, 2014).

As stated above, the South African government aims to use renewable energy sources as a way to diversify electricity generation and assist Eskom in meeting the energy demand while curbing the impact of greenhouse gas emissions on the environment. According to the Department of Energy (DoE), the government has already committed an estimated R193 billion (as of December 2015) through the REIPPPP, an amount envisioned to increase to R255 billion with the earmarked REIPPPP's fifth bid window (DoE, 2015). The bid window is a round of bids IPP's submit for renewable energy projects such as for onshore wind and solar photovoltaic (PV).

The complexity of the programme (including the management of the REIPPPP) saw several concerns raised about the programme as more bid windows introduced. According to Eberhard, Leigland and Kolker (2014), one of the concerns was the sharp decrease in energy selling prices – from R3.29 per kilowatt hour (kWh) in Bid Window 1 to R0.72 per kWh in Bid Window 4.5. Eskom's failure to approve power purchase agreements (PPAs) for Bid Window 5 threatened the continuation of the REIPPPP. Another risk was the lack of an adequate structure for monitoring IPPs' compliance levels with economic development requirements, a risk that could result in PPA termination before the 20-year contract period is up.

This risk exposes some loopholes in the way the REIPPPP is currently being administered. In an article titled "South Africa's renewable energy plan needs a close eye", Lucy Backer (2015) argues that the failure of IPPs to meet economic and community development criteria could result in their PPAs being terminated. Eskom's failure to evacuate the electricity generated by IPPs could result in penalties being levied at the power utility, having a negative impact on the programme as a whole (Baker, 2015). The development of renewable energy by IPPs requires an integrated and well-managed arrangement that will ensure the full realisation of the programme's intended benefits (i.e. economic development, community co-ownership and supply security).

Eskom's Network Development Plan (NDP) shows that the Northern Cape's electricity infrastructure is underdeveloped, mainly because – apart from some mining activity in the areas of Kathu, Kuruman and Postmasburg – there are no major production companies in the province, especially in comparison with other provinces. However, according to the 2014 Northern Cape Integrated Development Plan (IDP), 54% of IPP

projects are earmarked for development in the Northern Cape, with 40% of REIPPPP projects already developed in the province. This means that a huge amount of power needs to be evacuated to other regions, such as KwaZulu-Natal, Gauteng and the Western Cape, where there is a high demand for electricity. The Northern Cape is crucial to the success of the REIPPPP since a high share of renewable energy is allocated to the province (IPP Projects, 2015). However, concerns that arise include the adequacy of existing Eskom electricity infrastructure, the effectiveness of renewable energy policy implementation, the efficiency of stakeholder engagement processes and the long-term profitability of tariffs, as well as matters of political influence. The following section offers some perspective in regards to the Northern Cape's economic activities and the perceived impact of the REIPPPP on the province's economy.

1.3 The case of the Northern Cape

The Northern Cape is the biggest physiographic province in South Africa, yet it has a small population. The capital city, Kimberley, is situated on the eastern border of the province. Upington, located at the centre of the province, and Springbok, situated in the Namaqualand area, are the second and third biggest cities in the province, respectively. The Northern Cape is dominated by agricultural, forestry and fishing activities, with grape production being the primary economic contributor (Table 1). The Orange River plays a significant role in the province's grape production, and grapes produced in the region are exported mainly to Europe (IDP, 2014). Farming is also a big economic contributor, with livestock farming leading. There are more than 1 000 game farms registered in the province (IDP, 2014). The Northern Cape has low annual rainfall (202 mm on average) in comparison with the national rainfall (464 mm) (IDP, 2014). Nonetheless, farming contributes significantly to job creation and economic development in the Northern Cape. In addition, the province attracts a significant number of foreign and domestic tourists each year. Flower season in Springbok brings tourists to the province, as do the Kgalagadi Transfrontier Park and the Augrabies Falls National Park. The Northern Cape's mining sector includes the mining of iron ore, manganese, diamond, copper, zinc and salt resources, found along large tracts of the province (IDP, 2014). As Table 1 shows, the mining sector contributes more to the South African economy than other economic activities in the Northern Cape. The mining sector relies heavily on a dependable power supply from Eskom in order to maintain productivity. The mining companies use the Transnet railway to transport the raw material to the main harbour for export.

Table 1: Regional distribution of economic activities in 2010 (Bouwer, 2011: pp. 13).

Industry	WC	EC	NC	FS	KZN	NW	GP	MP	L	SA
Agriculture, forestry and fishing	22,6	5	6,1	10,3	26,8	6,2	6	9	8,1	100
Mining and quarrying	0,4	0,2	6,8	7,9	3,4	24,8	12,8	20	23,7	100
Manufacturing	14,6	8	0,4	3,9	21,6	2,5	40,5	7,1	1,5	100
Electricity, gas and water	11,2	4,1	2,7	6,4	15,9	3,6	33	15,1	8,1	100
Construction	17,9	4,7	1,1	3,1	13,6	4,8	43,3	6,8	5,1	100
Wholesale, retail and motor trade; catering and accommodation	17,4	8	1,6	4,7	17,6	4,4	35,5	5,2	5,5	100
Transport, storage and communication	15,4	7,1	2,1	4,5	22,4	4,8	34,2	4,9	4,6	100
Finance, real estate and business services	19,7	7,3	1,4	3,9	13,6	3,8	41,1	4	5,2	100
Personal services	13,7	12,9	3,4	10,1	17,3	8,5	23,5	5,7	5	100
General government services	9,8	11,2	1,9	5,2	14,2	5,3	39,7	5	7,7	100

Table 1 above shows that the Northern Cape's electricity, gas and water sector contributed only 2.7% to South Africa's GDP in 2010. According to Bouwer (2011), the Northern Cape had a growth rate of 1.9% for the period 2001-2010. This limited growth can be attributed to the province's heavy dependence on two sectors (namely mining and quarrying, and agriculture, forestry, and fishing) for its economic development.

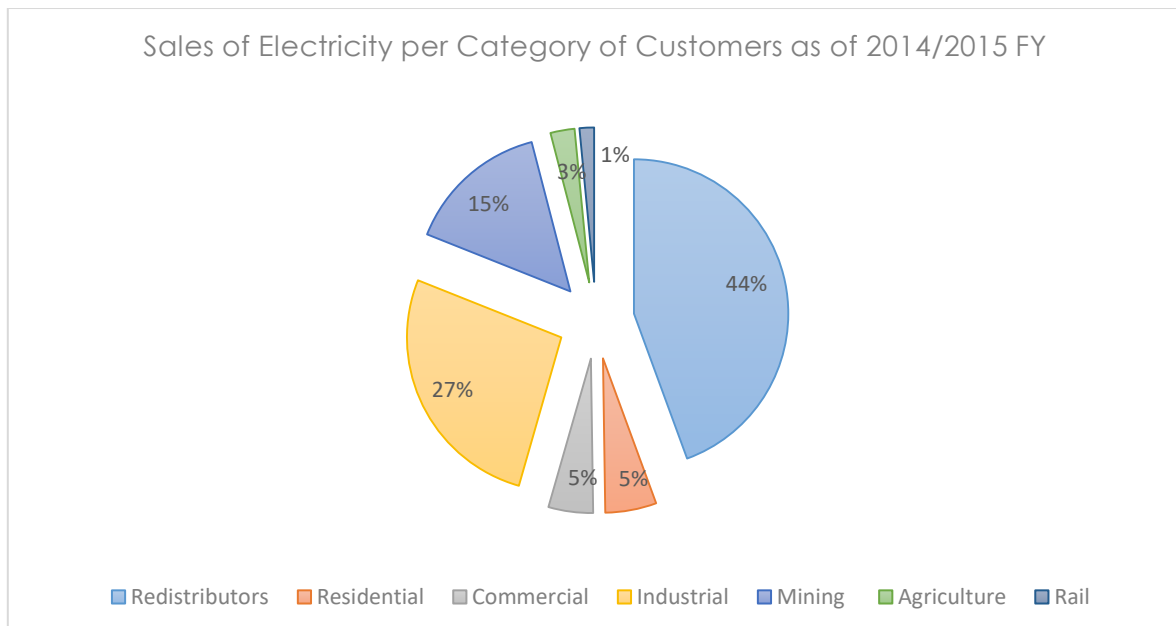


Figure 1: Sales of electricity per category of customers (Eskom, 2014).

According to the Eskom's integrated report of 2014, the dominant economic sector in the Northern Cape (i.e. agriculture and mining) contributes a low percentage to Eskom electricity sales. Eskom electricity sales are dominated by redistributors and industrial customers, who are found mainly in Gauteng, the Western Cape and KwaZulu-Natal (Bouwer, 2011). The development of IPP projects in the Northern Cape is intended to increase the province's GDP and improve the standard of living for local communities' if these projects create jobs to an extent commensurate with projections. However, the high number of jobs created during the construction phase of these projects subsequently drops to less than 20 people required for the maintenance and operation of the plants. The low number of jobs available on the plants has the potential to create conflict between local communities and IPPs. The following sections aim to clarify how the above concerns could be addressed to ensure that IPPs are sustainable in South Africa. The research objectives were formulated to guide the research strategy and yield plausible findings, while the study sought to answer two principal research questions.

1.4 Research objectives

- The primary research objective was to understand the factors that impact on the delivery of the South African government's Renewable Energy IPP Procurement Programme (REIPPPP).
- The secondary objective of this study was to use the viable system model (VSM) to conduct an institutional setting diagnosis, identifying the factors that impact on the REIPPPP and that need to be managed efficiently to ensure the programme's viability.

1.5 Research questions

This study sought to answer the following research questions:

1. What factors impact on the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in the Northern Cape?
2. How can these factors be managed to guarantee the viability of independent power producers (IPPs) in the Northern Cape's renewable energy market?

1.6 Importance of the study

This study is most relevant to the South African government, the major stakeholder in the REIPPPP and the major energy policymaker in South Africa. The study is also significant for Eskom, the sole buyer of power produced by IPPs in the country. Finally, the study might be useful to renewable energy researchers who want to develop programmes to manage the renewable energy market in South Africa.

1.7 Report structure

This dissertation is organised as six chapters. Each chapter is briefly described below:

Chapter 1 – Introduction containing the background to the research study, the problem statement, the research objectives and the research questions.

Chapter 2 – Literature review presenting the literature on renewable energy development and the challenges that come with the process.

Chapter 3 – Discussion of research design and methodology, including Maxwell's iterative qualitative research model.

Chapter 4 – Presentation of research findings, followed by a discussion.

Chapter 5 – Overview of Beer's viable system model, used to diagnose the institutional setting of the REIPPPP.

Chapter 6 – Presentation of recommendations, conclusions, and suggestions for further research.

The literature review chapter that follows expands upon the topics of renewable energy and the South African electricity market. In addition, conceptual ideas pertaining to organisational viability are discussed.

Chapter 2: Literature Review

2.1 Introduction

Renewable energy sources have been identified as an attractive alternative for generating electricity, owing to their low impact on the environment and sustainability (Evans, Strezov and Evans, 2009). In the literature on renewable energy, it is evident that renewable energy is the future and preferred source of energy. The benefits associated with the use of renewable energy sources, include a reduction in carbon emissions and a more cost-effective energy model (Polzin *et al*, 2015). This chapter discusses both the global prospects of renewable energy and its opportunities in South Africa as a developing country. The discussion a background of the South African electricity market and the history of electricity generation and distribution in the country.

The introduction of independent power producers (IPPs) into the South African electricity market is outlined and, the development and implementation of the country's renewable energy policy, which enabled IPPs to become pivotal players in the electricity-generation landscape in South Africa. In the process of introducing IPPs, the nation has learned some valuable lessons, which are discussed in comparison with developed countries.

The chapter ends with a discussion of organisational cybernetics and viability theory. Cybernetics theory provides a framework for systemic problem-solving through the application of cybernetics laws and principles. The aim is to address deficiencies that exist in organisations as well as the processes that these involve. The cybernetics model allows the viable system model (VSM) developed by Stafford Beer to be used as a way of improving organisational effectiveness.

2.2 Renewable energy perspective

In 2009, the International Energy Agency (IEA) predicted that energy consumption would increase by 53% by 2030, with 70% of the growth attributable to increased demand from developing countries (Oh, Pang and Chua, 2010). In their research paper, Oh, Pang and Chua (2010) explain that most developing countries make use of fossils fuels, which produce unwanted waste products that pollute water, produce greenhouse gases and contribute to global warming. The IEA's predictions and forecasts were valuable in the sense that they enhanced the planning and preparation of the introduction of renewable energy in the most developing countries (IEA, 2015). Energy planners recognised the increase in energy consumption and demand, an increase that countries could harness for their renewable energy planning.

According to the IEA's statistical report, green technologies (renewable energy technologies) have become a practical solution for addressing the security of supply, climate change and environmental concerns (IEA, 2015). Developed and developing

countries have set up programmes to expand renewable energy sources and achieve the shared goals of energy security and sustainable development. Increases in economic advancement and population size have forced governments to invest in and prioritise energy issues and challenges.

2.3 Renewable energy development challenges

It is well known that many countries face similar challenges when it comes to renewable energy development. Emodi and Boo (2015) argue that the lack of comprehensive and well-defined energy policies has contributed to the slow development of renewable energy in both developed and developing countries around the globe. Malaysia is an example of a country that, like South Africa, is heavily dependent on fossil fuel for generating its required electricity supply. Oh, Pang and Chua (2010) claim that Malaysia relies almost entirely on depleting resources that contribute to climate change and harm the environment. Like most developing countries, Malaysia needs a reliable energy supply in order to grow its economy.

In 1999, the Malaysian government developed what it called the five-fuel diversification policy, with renewable energy intended to contribute 5% of the country's electricity demand by the year 2005 (Oh, Pang and Chua 2010). The government established the Small Renewable Energy Programme (SREP) to help facilitate the development of renewable energy sources in the country. However, the country managed to reach a contribution of only 0.3% for renewable energy under the SREP (Oh, Pang and Chua, 2010).

In African countries, the accessibility and affordability of coal are among the driving factors in the continued excessive use of fossil fuels. In their research, Emodi and Boo (2015) offer a series of recommendations for the Nigerian government, including the development and implementation of renewable energy policies that would support the renewable energy sector in Nigeria. However, like other developing countries, Nigeria also needs assistance from foreign investors in order to develop its renewable energy supply. Emodi and Boo (2015) further debate that financial shortfall is a major contributing factor in developing countries, explaining that policies alone will not guarantee renewable energy development, though they do boost investor confidence. According to Polzin *et al* (2015), many countries have redefined their renewable energy policies to allow the participation of IPPs in the building of solar, wind, biomass and hydro power plants, thus benefiting the energy mix.

The South African government has followed this trend in recent years, introducing renewable energy as a way of ensuring firm electricity supply and support economic development. The South African government has subsequently invested substantially in developing renewable energy to address the issues of security, reliability and the diversification of electricity-generating energy resources (Oh, Pang and Chua, 2010).

2.4 The South African electricity market

2.4.1 The market arrangement

The South African electricity market is known for having one organisation that generates, transmits and distributes electricity. Eskom, a state-owned power utility, produces 95% of the country's electricity supply, using coal as the primary source of energy (Findt and Scott, 2014). This electricity supply amounts to 45% of the total electricity used on the African continent (Findt and Scott, 2014; Eskom, 2014). The utility company owns and controls the electricity generation, transmission and distribution infrastructures in South Africa, which are among the most advanced in Africa. Eskom's integrated report of 2014 states that 45% of the total electricity generated is sold to the redistributors (i.e. metros and municipalities), who then redistribute it to businesses and residential customers within their areas of supply.

The state-owned utility is building additional power-generation stations and high-voltage lines to meet the increasing energy demand in South Africa. The utility calls this process, which is expected to be finished in the 2020/2021 financial year, a 'capacity expansion programme' (Eskom, 2014). The capacity expansion programme is important to IPPs because it will ensure that the energy produced by IPPs is transmitted where it is needed the most. IPPs' efficient operation relies heavily on the ability of Eskom's infrastructure to evacuate the energy produced by IPPs. However, if it does not improve, Eskom's current financial turmoil will have a negative impact on the IPPs' expansion programme, which is meant to complement the electricity generated by the state-owned utility. According to the integrated report of 2014, Eskom's financial health has deteriorated over the years. This is attributed to a business-inappropriate return on assets, linked mainly to substantial cost increases. The situation has resulted in the business struggling to support its operations and growth. The company's security of supply is threatened, and in response Eskom has embarked on its capacity expansion programme, spending an anticipated R385 billion to double its capacity to 80 000 megawatts (MW). The programme will include the construction of the Medupi, Kusile and Ingula plants, and the expansion of the utility's transmission network (Eberhard, Leigland and Kolker, 2014).

The delays in the programme have constrained the business's financial health. In response, the company has developed plans that will ensure its financial sustainability (Eskom, 2014). In September 2014, the Cabinet of South Africa approved a financial package in a bid to support Eskom (Eskom, 2014). Eskom's 'integrated report' of the same year highlighted the details of this support, which included the following: government's endorsement of an application to increase Eskom's tariffs; equity of around R20 billion (to be raised through the sale of non-strategic government assets); the refinement of energy policy and regulatory governance mechanisms; and the expansion of the IPP programme as a complement to Eskom's build programme (Eskom, 2014).

According to Eskom's integrated report of 2014, the National Energy Regulation of South Africa (NERSA) approved Eskom's application to raise tariffs by 13% for the 2015/2016 financial year, a significant increase from the previously approved limit of 8%. This tariff adjustment was estimated to generate roughly R7.8 billion for the 2015/2016 financial year. Eskom once had the lowest electricity tariffs in Africa, and one of the cheapest in the world (Eskom, 2014). Figure 2 below shows Eskom's tariff trends between 1988 and 2012. Before 2008, the highest tariff increase was just under 15% (in 1990). During the country's power crisis in 2008, tariffs rose by 27.5%.

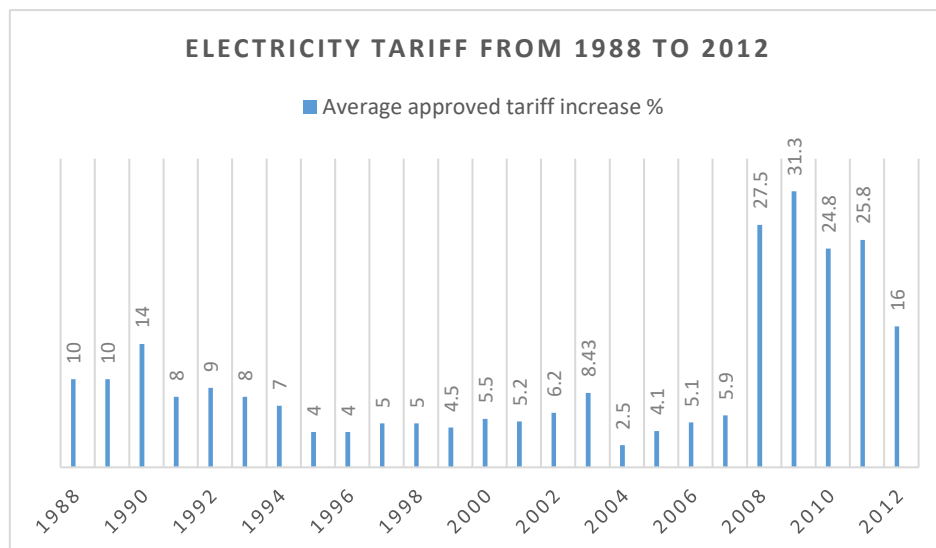


Figure 2: Average electricity tariff increase over the years (Eskom, 2013).

The increase in electricity tariffs contradicts what the government is aiming to achieve by introducing IPPs into the energy mix. The aim was to decrease the cost of electricity in South Africa in the medium- to long-term (Eberhard, Leigland and Kolker, 2014), but the utility has instead decided to increase electricity tariffs to fund its expansion programme.

2.4.2 Renewable energy policy development roadmap

Over the past several years, the South African government has been instrumental in developing policies that would increase the diversification of primary energy sources, thus reducing the country's reliance on fossil fuels for energy generation (DME, 2003). The White Paper on Energy Policy encourages the participation of multiple developers in a power-generation market, with the national regulator having jurisdiction over the entire industry by way of the Electricity Act (Act no 41 of 1987).

One of the South African government's primary goals is to increase the share of renewable energy sources in electricity generation in order to contribute to the security of the country's electricity supply and guarantee the country's sustainable development (DME, 2003).

The White Paper on Renewable Energy Policy stipulates that the South African government intends to develop its renewable energy resources strategically in the future. The government needs to have strong renewable energy policies in place that will ensure that investors receive steady returns on their investments. The government has an intensive policy framework that supports the development of renewable energy generation in the country.

In 2003, the government set a target of 4% of the total energy supply to be generated from renewable energy sources, further recommending the use of biomass, landfills and hydro and solar water heaters (Eberhard, Leigland and Kolker, 2014). There have since been some policy adjustments aimed at incorporating other government objectives, which include affordable electricity, carbon mitigation, the reduction of water consumption, the diversification of electricity generation and the denationalisation of the electricity sector in South Africa (DoE, 2013).

According to the White Paper on Renewable Energy, the South African government applies various levels of policy principles (DME, 2003). These principles incorporate full-cost accounting, in which the pricing policy is based on an assessment of the full economic, social and environmental costs and benefits of the policies, plans, programmes and projects activities behind energy production and consumption (DME, 2003). The 'equity' principle requires that there be equitable access to basic services across the population so that the needs and wellbeing of current and future generations are taken into account. The 'global and international cooperation and responsibility' principle compels the government to recognise its shared responsibility for global and regional issues and to act with due regard for the principles contained in the relevant regional and international policies and agreements. The 'allocation of functions' principle ensures that the government allocates functions to the institutions and spheres of government that can most effectively execute those functions within the context of energy policy. The 'participation' principle of the policy, meanwhile, encourages the inclusion of all stakeholders in energy governance, with the aim of achieving equitable and active participation.

The government uses these fundamental principles to make informed decisions and provide regulatory instructions. The Integrated Energy Plan (IEP) was developed according to these principles with the aim of improving the security of energy supply and diversifying energy sources. The first attempt by government at introducing renewable energy sources involved a Renewable Energy Feed-In Tariff (REFIT) policy structure, which is also used in Germany.

2.4.3 The introduction of IPPs in South Africa

The generation of electricity-using renewable energy sources presents an opportunity for decreasing carbon emissions, increasing energy supply security and supporting sustainable development within low-income communities in South Africa (Montmasson-Clair and Ryan, 2014). In its pursuit of the above-mentioned objectives,

the South African government opened the renewable energy market to private investors. Hence, the development of renewable energy in South Africa has been driven by the introduction of IPPs into the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

The South African government has contributed greatly to the number of renewable energy sources in the integrated resource plan (DoE, 2013). Government commitments have opened up opportunities for the private sector to participate in electricity generation using the abundant renewable energy sources in South Africa – in particular, those sources in the Northern Cape. The government ministry has stipulated that by 2030, Eskom will contribute only 70% of electricity generation while IPPs are expected to contribute 30% (DME, 2003). The implementation of the above-mentioned policy will enhance the electricity-generation mix and increase the security of electricity supply, boosting the country's economy. Figure 3 below shows the Energy Triangle.

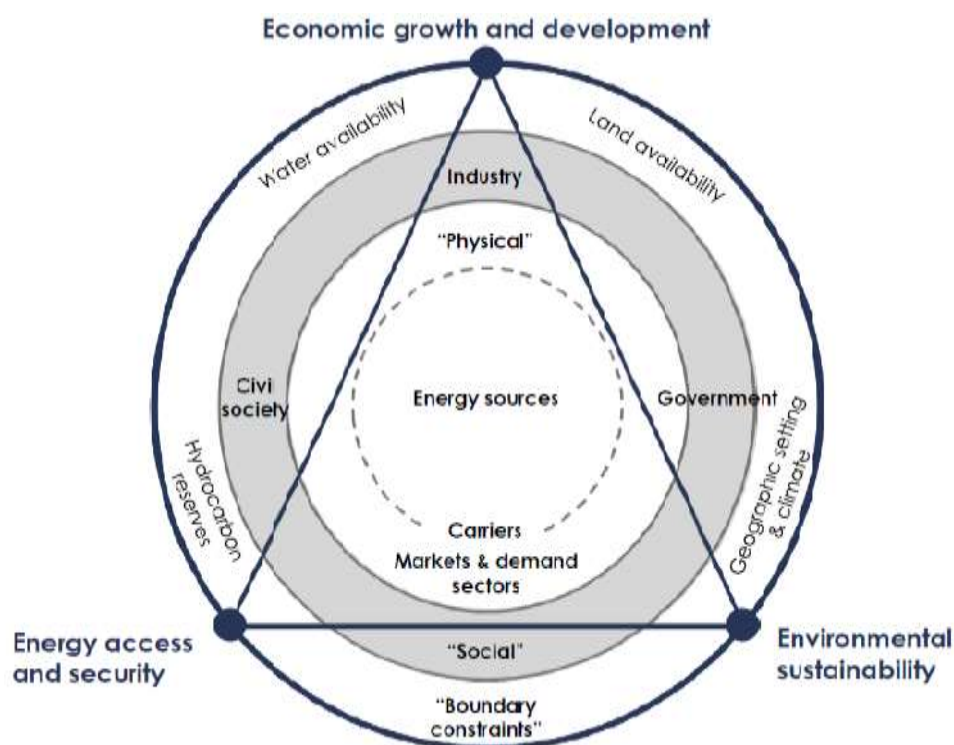


Figure 3: Energy Triangle (IPP Projects, 2015).

In the last two decades, the demand for electricity in South Africa has grown substantially, driven by the country's economic growth and rural development – a joint effort of the government and private sector. South Africa's only utility company, Eskom, has been under pressure to keep up with the increasing demand for electricity from industries and residential customers. After the 2008 electricity crisis, Eskom could meet the demand only by delaying maintenance to their generation fleet, which led

to a decrease in the projected average availability of electricity from 86% to 80% (DoE, 2013). The above action is now catching up with the utility, as the generators are starting to fail and the silos are collapsing. These issues are the symptoms of Eskom's aging generation fleet.

The government recognised how unreliable Eskom's power supply was and started engaging other stakeholders as a means of introducing IPPs into the energy mix for the purpose of supporting the increasing demand for electricity. The development of renewable energy sources in South Africa's electricity market is driven by IPPs, who use different types of renewable energy technologies, which are perceived as being the appropriate solutions. Grid-connected renewable energy offered by IPPs has become more dominant around the globe, with debates intensifying over the most effective policy instruments needed to accelerate and sustain private investment in renewable-energy electricity-generating technologies (Eberhard, Leigland and Kolker, 2014).

In response to the challenge of implementing the renewable energy programme in South Africa, the South African government engaged the private sector and international stakeholders. The aim was to seek advice and guidance on how best to implement the REIPPPP, which was established in 2011. The Department of Energy (DoE) and the National Treasury's Public Private Partnership (PPP) Unit was mandated by the South African government to facilitate the process and manage the programme. The task team operated outside of the government structure as an independent unit focused on improving the collaboration between the government and the private sector.

According to Eberhard, Leigland and Kolker (2014), in August 2011, the request for proposal (RFP) was issued before the bidder's conference, which was meant to clarify the bid requirements, such as the power purchase agreement (PPA). IPPs were envisioned to be conservative in their bidding owing to the many uncertainties that existed at the time. Only 3 625 MW was expected to be procured over a period of five years (Eberhard, Leigland and Kolker, 2014). The bids were required to contain information regarding land qualification, as well as environmental, financial and economic development (Eberhard, Leigland and Kolker, 2014). The programme attracted a high number of IPPs from across the world, resulting in a highly competitive environment and an intensive process (Eberhard, Leigland and Kolker, 2014).

After several consultations and discussions, the REIPPPP finally began operating. The first round of the REIPPPP proved a success with 53 bids for 2 128 MW made by November 2011. However, only 28 bidders were approved, totalling 1 416 MW (Eberhard, Leigland and Kolker, 2014). This figure is the result of the combination of renewable energy technologies, namely photovoltaic (PV) technology (which has a capacity of 634 MW), concentrated solar power (CSP) (150 MW) and wind technology (634 MW). According to Eberhard, Leigland and Kolker (2014), in the second round, the amount of power was reduced in an attempt to increase the competition among bidders.

It was noted that the number of bidders increased by 50% with the decrease in the capacity offered. Round 1 of the REIPPPP proved to the investors that the programme was working and that it could achieve tangible results. In Round 2, the prices offered for all renewable energy technologies dropped – wind from 1.14 R/kWh to 0.9 R/kWh, PV from 2.76 R/kWh to 1.65 R/kWh and CSP from 2.69 R/kWh to 2.51 R/kWh. In Round 3, the prices offered for all renewable energy technologies dropped even further. The price for wind technology dropped from 0.9 R/kWh to 0.74 R/kWh, PV from 1.65 R/kWh to 0.99 R/kWh and CSP from 2.51 R/kWh to 1.64 R/kWh (Eberhard, Leigland and Kolker 2014). The programme also introduced hydro technology, the price of which peaked at 1.03 R/kWh; however, hydro technology was not included in the third round. In Round 3, land-fill technology was introduced, the price of which peaked at 0.94 R/kWh.

The total investment that resulted from the first round of the programme was R48 million, with most of the funds coming from South African banks (Eberhard, Leigland and Kolker 2014). However, the total investment dropped to R28 million in the second round. This drop was a result of the reduction in both the capacity offered and the number of approved projects. As a result of the increase in approved capacity in the third round, the total investment increased to R43 million. [Table 2](#) below summarises the bid outcomes. The investors remained concerned about the number of projects that would be ready in time since the construction industry was constrained and suppliers witnessed a sudden increase in the demand for wind towers, steel and PV modules.



Figure 4: Provincial RE distribution (DoE, 2015).

Table 2: Round 1, 2 and 3 outcomes of REIPPPP (Eberhard, Leigland and Kolker, 2014).

	Wind	PV	CSP	Hydro	Landfill	Total
Round 1						
Capacity Awarded	634	632	150	0		1 416
Average Tariff R/kWh	1.14	2.76	2.69	0		N/A
Total Investment (ZAR mill)	R 13 312	R 23 115	R 11 365	R 0		R 47 792
Round 2						
Capacity Awarded	563	417	50	14.3		1 044.3
Average Tariff R/kWh	0.9	1.65	2.51	1.03		N/A
Total Investment (ZAR mill)	R 10 897	R 12 048	R 4 483	R 631		R 28 059
Round 3						
Capacity Awarded	787	435	200	0	18	1 440
Average Tariff R/kWh	0.74	0.99	1.64	0	0.94	N/A
Total Investment (ZAR mill)	R 16 969	R 8 145	R 17 949	0	R 288	R 43 351

Toward the end of the third round, delays in the close-out of the REIPPPP caused further instability in the industries charged with manufacturing renewable energy technology components. Local and international companies invested millions in the expansion of factories over the past four years in order to accommodate the increased demand. The local companies that manufacture PV modules are supplying internationally as well. This international supply is said to be posing a risk to developers who thus might not meet their orders by the date set for their completion, meaning IPPs will not meet their grid-connection target dates and consequently face penalties. In general, REIPPPP has achieved several objectives, the result of which has been a considerable contribution to renewable energy generation since the programme was instituted. [Table 3](#) below shows the amount of energy allocated to each renewable energy technology from Round 1 to Round 4B of REIPPPP (i.e. Procurement of renewable energy).

Table 3: Capacity (MW) approved from Round 1 to Round 4 (Eberhard, Leigland and Kolker, 2014).

Technology	Eskom	Other	RE IPP 1	RE IPP 2	RE IPP 3	RE IPP 3.5	RE IPP 4	RE IPP 4B	Total
Biomass					16.5		25		41.5
Concentrated Solar Power			150	50	200	200			600
Landfill Gas					22.7				22.7
Onshore Wind	103.1	5	633.9	562.5	787.1		676.4	686.3	3454.5
Photovoltaic Crystalline-Single Axis							415	397.9	812.9
Small Hydro				14.3			4.7		19
Solar Photovoltaic			631.5	417.4	435				1483.9
Grand Total	103.1	5	1 415.5	1 044.2	1 461.3	200	1 121.1	1 084.2	6 434.5

Solar photovoltaic energy technology is the most dominant among the technologies used currently in South Africa. Furthermore, South Africa has a total surface area with high levels of radiation of 194 000 km², with the Northern Cape offering the best resources for solar energy in the world (DME, 2003). This fact puts the province in a good position when it comes to benefiting from solar energy generation.

In South Africa, the generation of electricity using solar radiation is estimated to be 64 gigawatts (GW), with the Northern Cape offering the most potential resources for the development of solar energy technology. The potential for growth in solar energy

development in South Africa is significant. Technology that might contribute to its development in South Africa has not been developed adequately on a global scale. Onshore wind energy dominated allocation for the approved and allocated capacity for renewable energy in 2014, a fact that can be associated with the lengthy period that renewable wind energy has been in the renewable energy market, as well as its sizeable contribution to renewable energy generation in South Africa.

In 2002, Eskom commissioned the construction of a demonstration wind farm, Klipheuwel Wind Farm, which generates 3.2 MW. At present, South Africa has roughly 500 wind turbines, which have been installed throughout coastal areas (DoE, 2013). Figure 5 below shows that onshore wind contributes about 54% of the already committed and approved capacity under the REIPPPP. These technologies have contributed to the creation of jobs and financial benefits in South Africa. CSIR research (2015) shows that wind and PV technologies contributed R4.6 billion in financial benefits in the first six months of 2015 (CSIR, 2015).

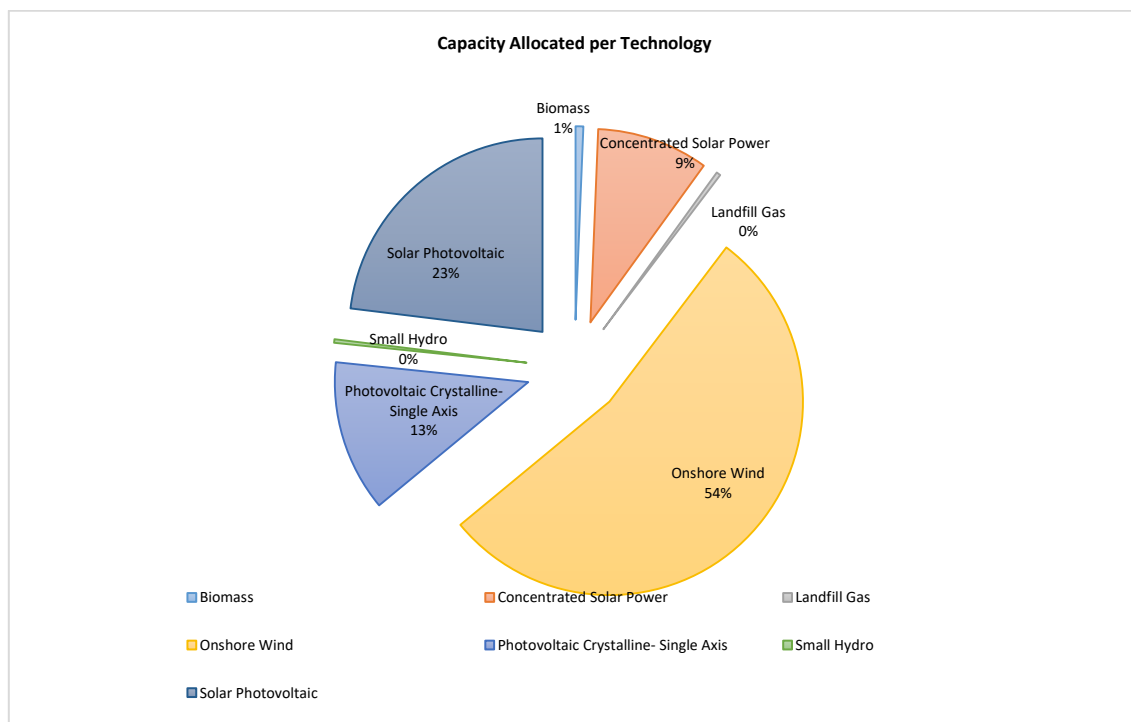


Figure 5: Capacity allocated per technology (Eskom, 2014).

Since the launch of the REIPPPP, a high capacity has been allocated to IPPs that are developing plants in the Northern Cape. [Table 4](#) below shows the capacity allocation of the REIPPPP from Round 1 to Round 4B.

Table 4: Renewable energy allocation by province (Eskom, 2015).

Province	Eskom	Other	RE IPP 1	RE IPP 2	RE IPP 3	RE IPP 3.5	RE IPP 4	RE IPP 4B	Total
EC			469.6	406.4	196.6		396.6	32.7	1501.9
FS			64	64.3	75		4.7		208
GP					22.7				22.7
KZN					16.5				16.5
L			58		60				118
MP							25		25
NW			6.76					267.9	274.6
NC			684.5	329.7	1 015.5	200	694.8	644.034	3 568.5
WC	103.1	5	132.59	243.8	75			139.661	699.2
Total	103.1	5	1 415.5	1 044.2	1 461.3	200	1 121.1	1 084.295	6 434.5

CSP technology has been allocated a lower capacity than that of wind and PV technologies. The allocation of a lower capacity may be the result of the development of this type of technology. Figure 5 above shows that only 9% was allocated to CSP (Eskom, 2014); consequently, the number of jobs created by this type of technology is very low. [Table 5](#) below shows the number of jobs created by PV, wind and CSP technologies (DoE, 2013). The number of jobs created contributes to the economic development criteria. The concern is that a high number of jobs is created during the period when the plants are under construction. The number of operations and maintenance (O and M) jobs maintained during the life of the plant is lower than the number created during the plant's development.

Table 5: Jobs per technology over the project life cycle (DoE, 2013).

Renewable Energy Technology	Round 1	Round 2	Round 3
PV	8 498	6 079	9 632
CSP	3 265	2 344	4 812
Wind	4 271	4 025	11 118

The main objectives of the REIPPPP are to ensure that South Africans benefit and that more jobs are created in the interest of sustainable economic development in South Africa. In this regard, the nature of the jobs created becomes integral to the programme, as does the technology pursued by developers to ensure that the programme achieves the objectives set initially.

Some developers are progressive when it comes to the economic development criteria because they have been in the country for some time – in particular, developers that use wind and PV technologies. Baker (2015) argues that the programme has some complexities, which pose a risk to economic development criteria and could result in shareholders selling their shares in a project after three years of operations. She further recommends that the lessons learned from the renewable energy programme of South Africa be extended to ensure that the socio-economic and environmental benefits of energy development are upheld at both local and international levels (Baker, 2015). These lessons include that of economic development, criteria for which are set during the bidding round. The components of the economic development criteria are shown in [Table 6](#) (below), along with the level-of-qualification threshold and percentage target.

Table 6: ED criteria and targets (Eberhard, Leigland and Kolker, 2014: pp. 68).

Economic Development Element	Description	Qualification Threshold	Target
Job Creation	Jobs for citizens	50%	80%
	Jobs for black citizens	30%	50%
	Jobs for skilled black citizens	18%	30%
	Jobs for local communities	12%	20%
Local Content	Value of local content as a percentage of total project value	40% or 45% depending on the technology	65%
Ownership	Shareholding by black people in the project company	12%	30%
	Shareholding by local communities in the project company	2.5%	5%
	Shareholding by black people in the Engineering procurement and construction (EPC) contractor	8%	20%
	Shareholding by black people in the operations contractor	8%	20%
Management Control	Black top management	N/A	40%
Preferential Procurement	Broad-based black economic empowerment procurement	N/A	60%
	QSE and EME Procurement (up to ZAR 35 million in turnover)	N/A	10%
	Women-owned vendor procurement (businesses +50% owned by women)	N/A	5%
Enterprise Development	Enterprise development contributions	N/A	0.6%
	Adjusted enterprise development contributions (local communities)	N/A	0.6%

Socio-economic Development	Socio-economic development contributions	1%	1.5%
	Adjusted socio-economic development contributions (local communities)	1%	1.5%

Economic development criteria account for 30% of the bid evaluation (Eberhard, Leigland and Kolker, 2014). In theory, this large percentage will support local development fully and contribute thus to job creation; however, monitoring these criteria during the technology life cycle will be the key to achieving the desired outcome. As it stands, this is a grey area, with many questions still unanswered, including who will monitor these qualifying criteria and how the IPPs would be made to comply with all the elements of the economic development criteria as shown in [Table 6](#) (above). With all these uncertainties, the viability of IPPs in the South African electricity market needs to be evaluated and, if need be, policies implemented to ensure the sustainable development of IPPs.

2.5 Organisational cybernetics and viability

Organisations exist in a dynamic and complex environment and necessitate that management make decisions that will assist the organisation in surviving over time. Models of organisation could contribute to improvement of the performance of those organisations and further support managers and policy-makers in making decisions that will ensure the organisation's viability in the complex environment. Clemson (1991) argues that cybernetics offers the framework for analysing organisations and their management; in a sense, they provide the set of laws, principles and theorems that defines organisations' boundaries and limits. He also claims that cybernetics enables the study of effective and ineffective organisational structures that emulate complex, dynamic, probabilistic, integral and open characteristics (Clemson, 1991). In theory, any organisation that obeys these cybernetics laws and principles is said to be viable in its environment of operation.

2.5.1 Organisational cybernetics

The term 'cybernetics' was originally defined by Wiener (1948) as the "science of control and communication in the animal and machine" environment. Since then, the concept of cybernetics has been used to redefine organisations and the way they are being managed in their operating environment. Stafford Beer has drawn on the cybernetics concept to break with traditional organisation management (Jackson, 2003). In his work on 'organisational cybernetics,' Beer redefines cybernetics as the "science of effective organisation" (Beer, 1979). This is a definition that gave birth to

his well-known 'viable system model,' which is used to diagnose areas in existing organisations that need improvement or to develop models for new organisations; the VSM is discussed further in Section 2.5.3 (below). Another insight drawn from cybernetics theory is that it allows us to study complex systems like organisations without breaking them down into interdependent sub-systems; instead, we should control their output to monitor and control their inputs (Jackson, 2003). VSM allows management to apply organisational cybernetics theory within organisations.

2.5.2 Cybernetics laws and principles

The cybernetics theory identifies three fundamental laws of nature to which dynamic and complex systems are subjected (Clemson, 1991). These laws are explained briefly in the following paragraph.

The first law is the Self-Organisation System Law. This law explains the characteristic structural and behavioural patterns in a complex system that are primarily a result of interactions between the system's parts (Clemson, 1991). In other words, complex systems organise themselves (that is, self-correct) in a situation where the system malfunctions. This phenomenon requires feedback coordination (Second law) to exist within a system. The system's continuous feedback, which provides the cause and effect, is accepted into all parts of the system to provide continuous steadiness. This steadiness is to be achieved through the positive feedback (reinforcing loop) and negative feedback (balancing loop). The third law is the Law of Requisite Variety, which explains that the amount of regulation attainable is limited by the variety of the regulator (Clemson, 1991). This law implies that the complex system can only be regulated by a regulator that can successfully handle the system's complexity. According to Pérez Ríos (2010), the term 'variety' refers to the number of possible states and actual potential the organisation has to contain the situation. This term is best described by Ashby's law of requisite variety, which states that "only variety can absorb variety" (Ashby, 1957).

2.5.3 Organisational viability

Organisational cybernetics is put into practice through the application of Beer's VSM, as the latter allows management to focus on the aspects of the organisation that are critical for viability (Jackson, 2003). The term 'viability' refers to the capacity of an organisation to maintain a separate existence and to survive regardless of changes in its environment, according to Pérez Ríos (2010). The implications of this term include the fact that the organisation as a system needs to fulfil the laws and principles of cybernetics, discussed in the preceding section. Having elaborated on the cybernetics laws in the previous section, I will now unpack Beer's VSM. In 1979, Beer developed a five-level hierarchy viable system model to be used in the process of organisations' diagnoses and design within their complex and changing environment.

The VSM is concerned with the behaviour and survival of the organisation in the changing and dynamic operating environment in which it must learn and adapt. For

them to be viable, organisations must achieve the requisite variety within their complex environment. The proper functioning of the five VSM sub-systems in Beer's model ensures that the organisation accomplishes the set objectives and that it is viable within its changing environment (Panagiotakopoulos, 2005). The VSM interaction diagram is shown in Figure 6 (below).

The model shows that the system-in-focus will have all five sub-systems working together to serve or accomplish an organisation's purpose while it is exposed to environmental changes. Shaw (2008) points out that a system is made to exist in a complex environment, which imposes emergent demands on it, including environmental requirements, socio-economic issues and technical requirements, all of which are cybernetics problems by nature. According to Jackson (1990), managers can employ sets of architectural, planning and operational strategies to reduce the variety of the external environment. The VSM developed by Beer is a rigorous application of cybernetics problems that involves management and organisational design (Vidgen, 1998). According to Espejo (1989), a viable organisation must always be able to do the following:

- make all rational decisions simply and efficiently;
- adapt to changes in the demands made by the world around it (customers, employees, competitors, suppliers and owners); and
- learn from experience.

Five management systems can be identified as essential to a viable organisation. System 1 consists of the operation of the system-in-focus. This system is more concerned with its implementation or operation than with its operating environment or its overall organisational environment. It concerns itself with the interaction of the various operating elements of the system-in-focus. The environments of the operation may overlap, as shown in Figure 6 (below), which reveals that these systems may share common resources – for example, their suppliers. The localised management receives all instructions for operation from levels higher up in the organisation, like System 3 of the system-in-focus. To ensure that System 1 has effective variety-reducing capabilities, each element of System 1 should be autonomous in its own right, enabling it to absorb the variety generated by the local environment it is subjected to. For the system to do this, each element must be viable, reflecting the VSM attributes.

Systems 2, 3, 4 and 5 form part of the management system of the system-in-focus, referred to by Beer as the "meta-system". Panagiotakopoulos (2005) notes that these systems are not concerned with the realisation of the purpose of the system-in-focus; they are more concerned with enabling the implementation of organisational goals.

According to Beer's VSM, the coordination and conflict management of the operation activities are handled by System 2's function within the system-in-focus. For System 2 to achieve its coordination and conflict management functions, it must be designed such that the organisation has clear communication channels and clear lines of responsibilities. Under normal conditions, the top management will issue instructions to operation elements that will require all System 1 elements to interact

with each other and, together with System 2's ability to coordinate and manage conflict, function in harmony to achieve the organisational goals.

The system-in-focus operational activities are monitored and managed by System 3 on a daily basis. System 3 is a control system, it guarantees that the operation achieves the purpose of the system-in-focus by ensuring that the procedures and policies developed by System 5 are implemented correctly. System 3 monitors the performance of the system-in-focus over time and takes the corresponding action to improve the performance of System 1 via its auditing capabilities through System 3*. The system helps management to respond quickly to issues emerging in System 1 rather than waiting for local management to report to System 3 of the system-in-focus. System 3 also observes the effects that result from the policy implementation in System 1. Should the organisational objectives not be met, the system will give feedback on the policy deficiencies to System 4 to report to System 5. System 5 will assess the impact of these deficiencies and co-operate with any changes that are necessary to the organisation's future planning through System 4.

System 4 concerns itself with the scanning of the external environment, identifies what is happening outside the organisation and establishes what impact it will have in the future that might threaten the organisation's viability. The insights yielded from the environment, in combination with the multiple possibilities of the future, inform decisions to be taken in the organisation in the present to deal with possible realities arising in the future. If the organisation is to be viable, it has to match the complexity and the variety that its environment presents to it, according to the variety engineering law (Beer, 1979). Hence, System 4 of the system-in-focus performs functions like marketing, financial planning, research and development in order to prepare the organisation for the future (Panagiotakopoulos, 2005). System 4 is regarded as a critical link between the bottom systems (Systems 1, 2 and 3) and the policy system, as well as between the internal operations and external environment.

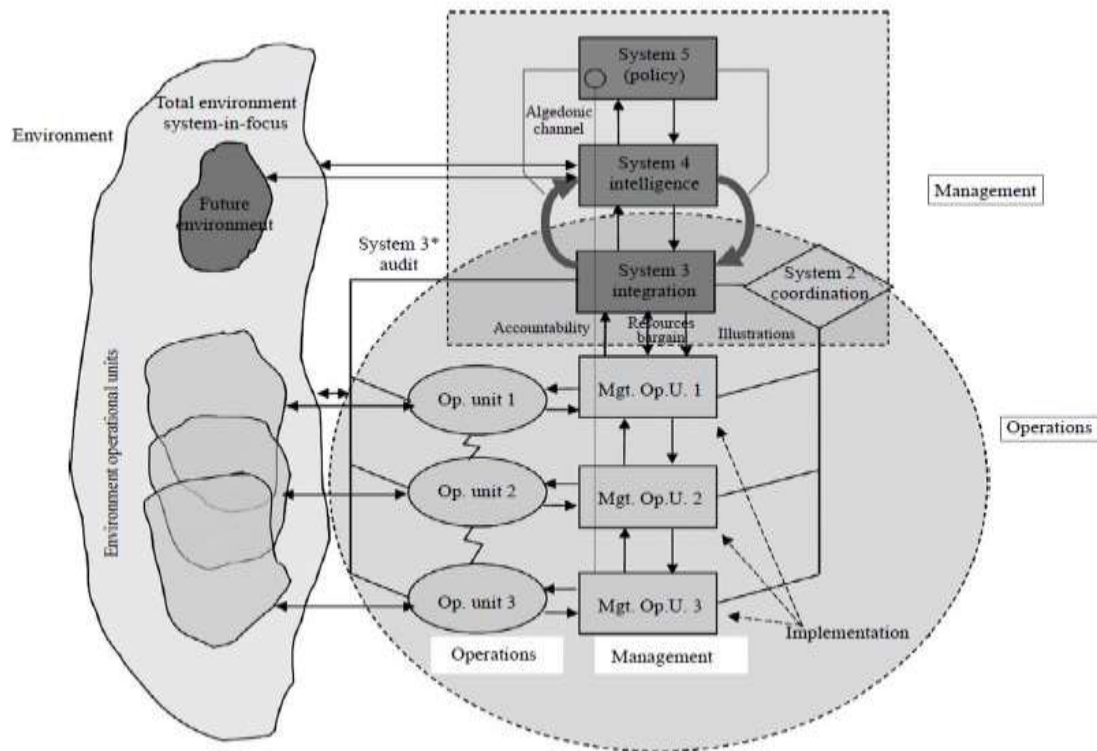


Figure 6: Viable system model (Pérez Ríos, 2010: pp1532).

Based on Stafford Beer (1979) viable system model, System 5 is the intelligence of the system-in-focus because it determines the purpose of the system-in-focus and devises strategies and policies to enable the organisation to accomplish its purpose. Information from the control system 3 and the planning and development system 4 is passed to System 5. System 5 then guides the decision process by creating limits and boundaries within which managers should act, thereby reducing the requisite variety and improving decision-making by managers in Systems 3 and 4. This guidance is important since these systems sometimes have conflicting interests: for instance, System 3 might oppose the changes while System 4 demands the changes within the system-in-focus.

According to Espejo (1989), the VSM can be used in two modes of analysis based on the purpose of the study or analysis and the organisation under consideration. These modes include the following:

Diagnostic Mode: This mode of analysis is **descriptive**, and it uses the organisation's effectiveness criteria with reference to the implicit and espoused identity (Espejo, 1989).

Design Mode: This mode of analysis is **prescriptive** and is applied when the purpose of the study is to design an effective organisational structure (Espejo, 1989).

As discussed in the previous section, the VSM includes the concept of systems variety, which Beer defines as "the number of states of whatever it is whose complexity we want to measure" (Beer, 1979). This statement plainly means that for a system to be viable, it should be able to deal with or respond to the changes in its environment,

even if the system was not designed for those unforeseen environment dynamics. Jackson (1987) discusses three variety engineering requirements that enable any organisation to achieve viability and survive in a complex and dynamic environment. These requirements include the following:

- The organisation should have the best possible model of the environment relevant to its purpose.
- The organisation's structure and information flows should reflect the nature of that environment so that the organisation is responsive.
- The variety balance achieved between the organisation and its environment must be matched by the appropriate variety balance between the managers and operations within the organisation.

For the organisation to be viable, it is vital that the sub-systems' variety balances, allowing the organisation to withstand changes in its environment. Hence, Systems 2, 3, 4 and 5 must have the variety needed to deal with developing demands in System 1.

2.6 Summary

In an attempt to understand renewable energy in the South African context, this chapter presented a review of the literature on the development of renewable energy and the perspectives of other countries when it comes to the development of renewable energy in support of climate change and economic growth. The chapter further explored literature documenting the progress that South Africa has made in introducing renewable energy into the electricity-generation market. Given the concern with the viability of the provision of renewable forms of energy, the literature on organisational viability (in particular, the viable systems model) was discussed. The following chapter details the research design and methodology employed to achieve the research objectives of this study.

3.1 Introduction

This chapter discusses the research design, methodology and methods used to address the research questions. The chapter also motivates the use of a qualitative approach in answering the research questions. It further explains the choice of the techniques used for data collection and analysis. The chapter ends with a discussion of the issues of trustworthiness and ethical implications of this research.

3.2 Research design

This study focuses on identifying the factors that have impacted on the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) since its inception in 2009. The study design is based on Maxwell's (2009) interactive model, which consists of five elements, namely the research question, research goals, a conceptual model, methods and validity, as shown in Figure 7 (below). All of these components contribute to the answering of the research questions and the coherence of the research study.

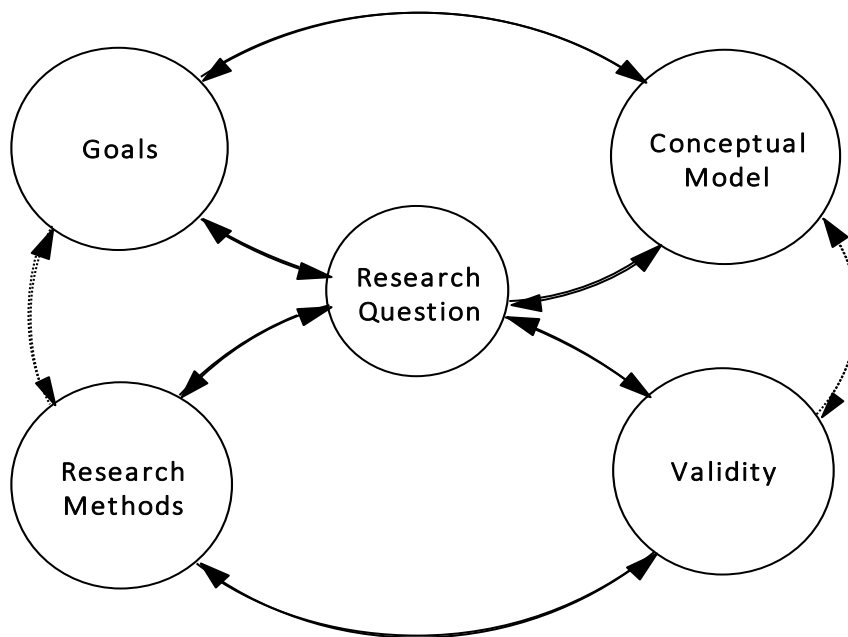


Figure 7: An interactive model of research design (Maxwell, 2009: pp. 217).

The research questions of this study were formulated based on what is already known about the REIPPPP in the Northern Cape, namely the theoretical concepts and models discussed in Chapter 2. Based on what is already known about the programme and its management in the Northern Cape, the researcher set the goals that need to be achieved by this study.

According to Maxwell (2009), there is a direct relationship between the components of the above model. This relationship links the goals of the study, which are aligned with the research question. The conceptual framework's assumptions, theories and expectations inform the study undertaken. Hence, the researcher adopted qualitative methods in an effort to adequately answer this study's research questions and deal with threats to its validity, as discussed in 3.9. The following sections deal in detail with the five elements of Maxwell's research model as applied in this study.

3.2.1 Goals

The goals of this research were dealt with in Chapter 1. To adequately interrogate the South African REIPPPP and its institutional setting, the researcher employed a qualitative research approach. According to Creswell (2003), a qualitative approach includes constructivist knowledge claims, ethnographic design and observation behaviour through which the researcher seeks to establish the meaning of the phenomenon using the views of participants. According to Maxwell (2009), the goals of qualitative research can be divided into three kinds, namely personal, practical and intellectual. The researcher considers the goals of this study to be intellectual since the study focuses on understanding and gaining insight into the factors that impact on the REIPPPP in the Northern Cape, as discussed in Chapter 1. The researcher is part of the natural settings in the Northern Cape, where forty six projects are being implemented.

The qualitative approach to this study was adopted since it promotes collaborative engagement and actions (Maxwell, 2009). Furthermore, the participants share their views about the behaviour of the programme as well as how they make sense of it. This was seen as an opportunity for the researcher to engage a relatively small number of individuals who are involved in the implementation and management of REIPPPP projects.

3.2.2 Conceptual framework

Chapter 2 dealt with the conceptual framework of this research. According to Maxwell (2009), the conceptual model includes the system of concepts, assumptions, expectations, beliefs and theories that supports and informs research. He further argues that such theories commonly include theories about what is happening or going on with regards to the subject of the study or the setting based on one's observations and engagement with the theories of previous studies in the form of a literature review. In Chapter 2, the researcher critically examined the literature on renewable energy development and drew on theories used in the drafting of renewable energy policies and the institutional setting of the REIPPPP in the Northern Cape.

In addition, Miles and Huberman (1994: p.18) state that the conceptual framework "explains, either graphical or in narrative form the main things that need to be studied". As stated above, the concerns and variables that impact on the implementation of renewable energy in general were discussed in Chapter 2 and led to the development of the research questions.

3.2.3 Research questions

The research questions were addressed in Chapter 1 of this report. They included the following:

1. What factors impact on the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in the Northern Cape?
2. How can these factors be managed to guarantee the viability of independent power producers (IPPs) in the Northern Cape's renewable energy market?

3.2.4 Methods

According to Maxwell (2009), research methods are the specific steps taken to collect and analyse data. The qualitative data collection and analysis methods were adopted in this study to address the questions adequately, and they are explained in 3.3.

3.2.5 Validity

The threats to this study's validity, the credibility of the sample, dependability, the confirmability of the data and transferability of the findings are discussed in 3.9.

3.3 Data collection

In this study, the researcher used a number of methods and techniques for collecting data, including a systematic literature review, a web-based survey and semi-structured interviews. These methods and techniques are explained below.

3.3.1 Systematic literature review

Jesson and Lacey (2006) define the systematic literature review as a comprehensive review of already-published articles that are selected in order to address a specific research question. A systematic method helps to identify relevant studies to minimise biases and errors. In this study, the researcher used the following keywords to search for relevant journals and documents: 'renewable energy development,' 'South African renewable energy policy,' 'government renewable energy programmes,' 'system viability' and 'organisational cybernetics.' This literature review method

allowed the researcher to consult relevant previous studies in the fields of renewable energy, the REIPPPP and organisational cybernetics.

3.3.2 Coding of factors

The coding process involves comparing and contrasting of data to enable the grouping of concepts that are theoretically important to the study. The process is said to be iterative because the data analysis begins after some data has been collected to help shape the next step in the data collection process. Richie and Spencer (2002) argue that this process involves making numerous judgments about the meaning and significance of the data collected, a task that makes the process subjective and open to differing interpretations. Davis (2014) argues that during data analysis, coding is done for each meaning unit.

In this study, the researcher employed the iterative coding approach during the data analysis process. The researcher started analysing data using the literature that was reviewed in Chapter 2. Several factors were identified and categorised per their relevance to the study to produce categories of factors impacting on the REIPPPP. The process was repeated for the data that was collected from interviews and surveys with the aim of comparing and adding more categories of factors. Frequency was used as an indicator of the importance of the factor. 'Frequency' refers to the number of times the factor was mentioned by participants in the interview and the survey. The categories were then ranked based on their frequency.

3.3.3 Web-based survey

The web-based survey was used to collect necessary data from participants who could not be reached for face-to-face interviews. According to Roztocki and Morgan (2002), a web-based survey is designed to help gain access to a broader range of potential study participants. The survey is perceived as a less time-consuming data collection method than others and is suitable for qualitative research.

A web-based survey was designed using the online survey platform SurveyMonkey. This survey platform allowed the researcher to develop a set of questions that were then emailed to the participants. A link was emailed to 30 potential participants, 20 of whom were involved in the planning and development of renewable energy projects in Eskom distribution in the Northern Cape. In addition, the link was sent to five potential participants who are involved in the design and operation of renewable energy projects. The link was emailed to all participants and included a cover email describing the study objectives, timelines and the study benefits to the management of the renewable energy projects. The web-based survey used in this research can be found in Appendix D.

3.3.4 Semi-structured interviews

The study used semi-structured interviews with participants who are involved in the development of the renewable energy projects. The participants included personnel from Eskom and private companies who were willing to participate in this study. The semi-structured interviews design is explained below.

The target potential participants were personnel with some experience in the development and management of the newly established programme for renewable energy projects in South Africa. The interviews targeted 15 potential participants, who were selected based on their experience and involvement in the development and management of IPP projects using a purposive sampling technique. Only 12 participants out of the 15 potential participants participated in face-to-face interviews. Out of the 12 participants interviewed, eight had more than seven years of experience, and five out of those eight participants had more than four years of renewable energy experience.

30 potential participants were identified for the web-based survey. Only 20 participants were emailed the survey. Only nine out of the 20 participants responded to the survey. These participants' contributions added value since their experience included more than three years of dealing with the IPPs or working for an IPP. The literature analysis, web-based survey and semi-structured interview methods are explained in detail in the following sections.

In this study, the researcher used purposive sampling to select participants for the interviews and the survey. The main aim was to achieve representativeness among the stakeholders involved in the REIPPPP in the Northern Cape. According to Tongco (2007), the purposive sampling technique is a non-probability form of sampling that is most effective when one needs to study a particular population whose attributes are known to the researcher. The researcher identified informants or participants that represented the sample of those involved in the planning and development of renewable energy in the Northern Cape. Maxwell (2009: 235) explains that for this type of sampling, a small sample that has been systematically selected provides more confidence that the conclusions adequately represent the average members of the population than a substantial random sample of the same size.

The experience and roles of the participants were the crucial attributes considered during the selection of the participants. Participants were selected from Eskom distribution, IPPs and developers in the Northern Cape. Junior engineers from the Network Planning department were considered because they deal with IPPs on a daily basis. This method of sampling allowed the researcher to purposefully select the critical participants for an the examination of the Northern Cape case, taking into account the feasibility and analysis of data collected as well as validity concerns. Table 7 (below) shows each interviewee's role and experience in years.

Table 7: Interviewee role and experience.

Interviewee	Company	Years of experience	Years of experience in renewable energy
1	IPP Solar PV 1	32	3
2	Eskom 1	12	5
3	Eskom 2	4	2
4	Eskom 3	6	2
5	Eskom 4	6	3
6	Eskom 5	4	2
7	IPP Solar PV 2	9	1
8	IPP Solar PV 3	10	3
9	IPP Solar PV 4	7	4
10	IPP Solar PV 5	15	5
11	IPP Solar PV 6	10	4
12	Eskom 6	9	4

3.4 Methodology

3.4.1 Case study as a strategy of inquiry

- **What is a case study method?**

Yin (1994, p.13) defines a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context. He points out that a case study method does not suggest the use of a particular type of evidence that can either be quantitative or qualitative. According to Green, Camilli and Elmore (2012), case study methods are used mainly in social science studies in order to study topics not easily covered using other research methods. They also note that the research might use multiple methods that include the case study.

The case study method is used to achieve a variety of study purposes. According to Yin (2009), it is useful when the study is aimed at addressing a descriptive or explanatory question, regardless of whether a quantitative or qualitative data form is used (Yin, 2009). The unique strength of a case study lies in its ability to deal with the variety of evidence emerging from different types of sources of information, like documents, articles, interviews and observations (Yin, 1981). Using a variety of sources of data can present some challenges to the researcher. The process of data collection is dependent on the researcher's skills – for example, the ability to ask questions while listening during interviews with participants (Easterby-Smith, Thorpe and Jackson, 2012). He further argues that the data presentation can be problematic as the researcher determines the prominence of the data collected. A high degree of research expertise is required by the researcher when using a wide variety of data sources (Easterby-Smith, Thorpe and Jackson, 2012).

- **Single vs multiple case study**

One of the critical steps in using a case study method is to decide whether to conduct a single case study or multiple case studies. Bromley (1986) notes that a 'case study'

can refer to either single or multiple case studies. In a single case study, one real-life case is studied, whereas in multiple cases, more than one real-life case are being studied (Yin, 2009). In this study, the researcher chose the single case study approach because he had access to data collected from the Northern Cape participants and he formed part of the phenomenon being studied. In addition, the researcher was motivated by the fact that performing the single case study would limit travel to other provinces in South Africa during data collection. In any event, the Northern Cape is rich in renewable energy sources, with the result that 60% of REIPPPP projects are implemented in the province. It was thus more beneficial to conduct a study there than in other provinces in South Africa.

- **Why is it used in this study?**

The researcher forms part of the natural setting of the REIPPPP in the Northern Cape. In endeavouring to understand the factors that are impacting on the REIPPPP in the Northern Cape, he chose to use a case study method for this study. According to Bromley (1986), the case study helps a researcher to conduct direct observations and collect data in a natural setting rather than relying on derived data such as test results and statistical data.

3.4.2 The Northern Cape case

In this research, a single case study method was selected to allow the researcher to focus on the REIPPPP in the Northern Cape. The single case study enables a researcher to investigate the phenomena in depth to provide a rich description and understanding (Walsham, 1995). The single case of the Northern Cape was selected for easy access to participants and the fact that most of the IPP projects in South Africa were developed in the province. In turn, the researcher would be able to carry out a detailed study of the REIPPPP focusing on the location where most of the projects are being implemented. The researcher had access to the identified participants with experience in the planning and implementation of renewable energy projects through the REIPPPP. Owing to the limitation of published material about the REIPPPP, the researcher leveraged the benefit of using a case study, which involves a variety of evidence emerging from different types of sources of information, like documents, articles, interviews and observations.

3.5 Qualitative content analysis

According to Berg (2004), to enable the analysis of qualitative data originating from sources like interviews, field notes or surveys, the information must be condensed and made systematically comparable. In qualitative research, data is collected through several methods, including unstructured interviews, online surveys and discussions. Richie and Spencer (2002) acknowledge the fact that data collected through qualitative methods are unstructured and cumbersome. As such, the researcher must use an appropriate data analysis method. Richie and Spencer (2002) further argue

that to enable the researcher to organise and make sense of data collected and to answer the research question(s), it is essential that the researcher employ credible qualitative data analysis methods. In this study, a qualitative content data analysis method was adopted to analyse data from literature, interviews and online surveys. Graneheim and Lundman (2004) define 'content analysis' as a method for describing the meaning of qualitative material in a systematic way, where a researcher assigns successive parts of the data to categories of the coding frame.

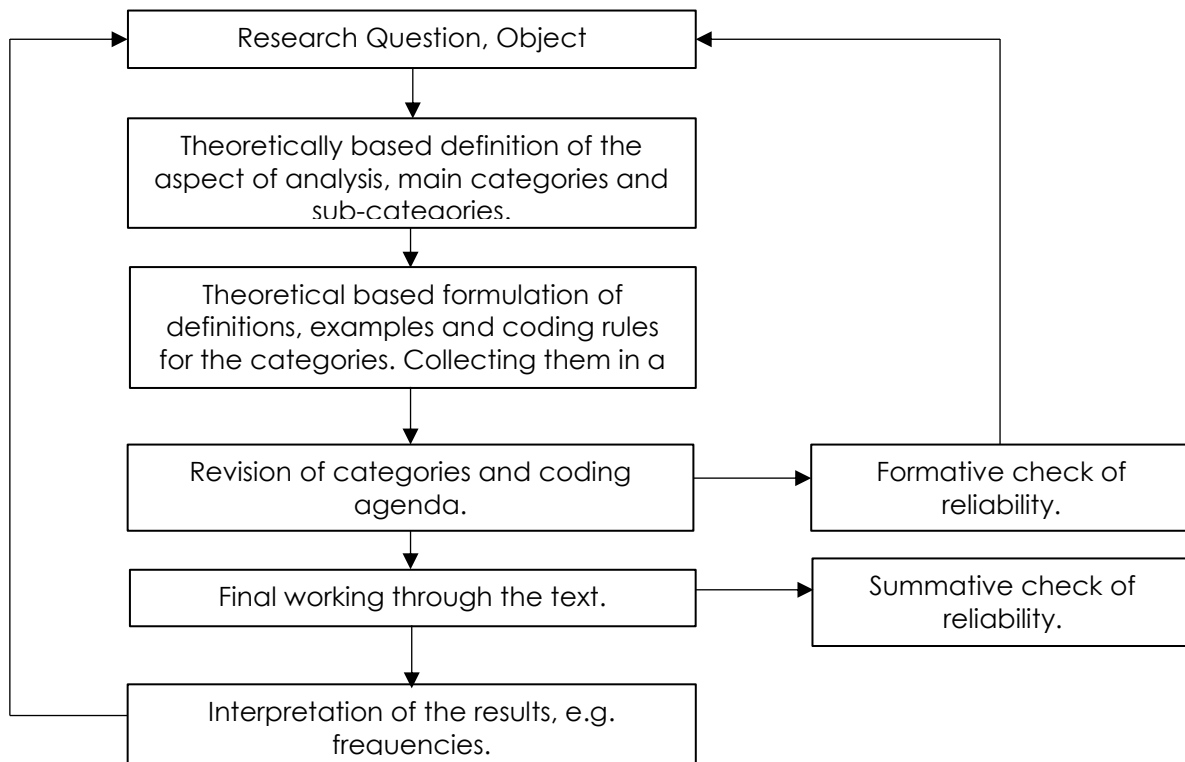


Figure 8: Content analysis process (Mayring ,2014).

3.6 Validity and trustworthiness

Carpenter and Streubert (2003) define 'trustworthiness' as the method of establishing validity and reliability in qualitative research. In dealing with trustworthiness in qualitative research, the researcher uses four criteria, namely credibility, dependability, transferability and conformability (Graneheim and Lundman, 2004). The researcher was cognisant of the validity and trustworthiness concerns that were associated with qualitative research and devised strategies to deal with them. According to Maxwell (2009), 'validity' is associated most with quantitative research in which the researcher designs controls that will deal with anticipated and unanticipated threats to validity; in qualitative research, on the other hand, the threat of validity is eliminated after the research has begun.

3.6.1 Credibility

Carpenter and Streubert (2003) claim that credibility is demonstrated when the researcher recognises the reported research findings as their own experience. Guba (1981) argues that establishing credibility is one of the essential steps in ensuring the trustworthiness of research. To ensure that the research would be credible, the researcher employed the following strategies in the collection of data, as proposed by Shenton (2004):

Triangulating: The researcher used different data collection methods (i.e. literature, web-based surveys and interviews), which inform the major data collection processes in the qualitative research.

Tactics to help ensure that the participants remain honest: Participants were given an opportunity to refuse to participate in the research. This option was presented at the beginning of all unstructured interviews during interview sessions. All participants were requested to be free and honest in their answers.

Iterative questioning: To avoid discrepancies in the data collected, the researcher employed iterative questioning and inquiry to elicit detailed data. These strategies allowed the participants to elaborate on the previous points in response to a follow-up question.

Frequent debriefing sessions: The researcher engaged the supervisor frequently during the study process to ensure that the supervisor was aware of all developing ideas and interpretations and to reduce flaws in the reporting of the research findings.

3.6.2 Dependability

Graneheim and Lundman (2004) define 'dependability' as the degree to which the data changed over time, including alterations that the researcher made during the analysis process. The time taken to collect data was three months. In those three months, six weeks were devoted to online surveys and two months to interviews. The survey consisted of the same questions for those six weeks. The interviews consisted of 16 questions. However, a particular participant's response to the question(s) prompted a follow-up question(s) that differed from other participants'. Asking questions consistently over 45 minutes increased the dependability of the study.

3.6.3 Transferability

Research findings are transferable only if they fit a context outside that of the initial study (Maxwell, 2009). The results and recommendations of this study are documented to ensure transferability concerning other provinces and countries with renewable energy market settings that are similar to South Africa's. The proposed model (viable system model) for managing the factors' impact on renewable energy development can then be replicated easily.

3.6.4 Conformability

Shenton (2004) acknowledges the presence of the researcher's biases in qualitative research, citing the fact that they are inevitable since research questionnaires themselves are developed by humans. Strategies need to be designed to ensure that the report of the findings represents the results of the experience and ideas of the participants (Shenton, 2004) adequately. In this study, the researcher employed the triangulation strategy explained in 3.5.1 to eliminate biases in the report on the findings of the study.

3.7 Ethical implications

The design, planning, and reporting must be conducted in such a manner that the ethical implications and possible consequences are addressed throughout the research. The researcher applied for ethics approval to the University of Cape Town Ethics Committee (Appendix D). In this study, the researcher ensured that the research took cognisance of the ethical implications highlighted by Sture (2009) as explained in the following paragraph.

The study objectives were communicated to each participant before the interview was conducted. The informed consent of all participants was obtained, and participants signed consent forms before their participation in the study (Appendix A). The informed consent form detailed the voluntary nature of the study, confidentiality and assurance that the participant could withdraw at any time. The privacy of all participants was assured, with the researcher promising not to publish any personal information or share it with other people. The names of private organisations were not published in the final report.

The data collected was used for the sole purpose of the study and was not shared with any employees or senior members. Using recognised data analysis methods and techniques avoided ambiguous reporting of the findings. Thus, the researcher made a substantial contribution to the field.

3.8 Summary

In this chapter, Maxwell's interactive model of research design was explained and shown to be the research approach employed in this study. The choice and design of three research methods – namely interviews, surveys and relevant documents – used during data collection were discussed. Qualitative data analysis employed in this research was explained. Special consideration was also given to an explanation of the ethics, validity and trustworthiness involved in this study, as well as the study's limitations.

Chapter 4: Data Analysis and Findings

4.1 Introduction

The previous chapter presented a design for this study. This chapter will present the data analysis and findings of the data from the literature, interviews and the survey.

4.2 Analysis of literature

Chapter 2 identified the factors impacting the development and management of renewable energy. In this section, these factors are coded using a qualitative content method. The factor categories impacting on the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) are then analysed to ascertain their importance in the management of the REIPPPP by the Department of Energy (DoE).

4.2.1 Level 1 coding

One hundred and eleven (111) factors were initially identified using the systematic literature review. The qualitative approach method was used to condense these factors by using compare and contrasting technique. The categories were formed by grouping factors that carry similar ideas and have the same themes. The 10 category factors and their definitions are shown in Table 8 (below). The 111 factors can be found in Appendix H.

Table 8: 10 literature category factors.

Category	Definition
C1-01: Programme Management	<ul style="list-style-type: none">- Highly skilled people are involved in the programme to ensure right decisions are taken and implemented.- The programme required diverse expertise and experienced people to take the decision based on their experience in renewable energy contracts and the procurement framework or processes.
C1-02: Programme Design	<ul style="list-style-type: none">- An acceptable procurement process and big contracts management process are followed and/or implemented to a satisfactory standard.- Clearly defined programme requirements and expectations relating to the IPPs.

Category	Definition
C1-03: Electricity Market Structure	<ul style="list-style-type: none"> - The ability of the environment to accommodate the international investors and still comply with the local procurement process and policies governing electricity generation, transmission and distribution. - The ability of the South African electricity market to attract international renewable energy private investors.
C1-04: Programme Funding	<ul style="list-style-type: none"> - Reliable sources of funding that enables the REIPPPP to carry out its mandate and ensure successful IPP implementation.
C1-05: Competitive and Profitable Tariffs	<ul style="list-style-type: none"> - The viable energy cost per kWh that IPPs charge Eskom, regardless of the type of technology implemented by the IPP.
C1-06: Technology Options	<ul style="list-style-type: none"> - The selection of sustainable renewable energy technology that will be integrated into the existing power system and infrastructure easily. - The type of technology that will be easily accessible locally and easy to maintain. - The type of technology that will be profitable to the IPP in the South African context. - The type of technology that will be environmentally friendly given South Africa's environment and the South African context.
C1-07: Effective Policy Implementation	<ul style="list-style-type: none"> - The implementation of policies that support the REIPPPP in South Africa in the interest of ensuring the continuous running of the programme.
C1-08: Expertise and Skills	<ul style="list-style-type: none"> - The obtainability of skills needed to support the operations and maintenance of the plants developed in South Africa for the duration of the PPA and beyond.
C1-09: Renewable Energy Planning and Demand Forecasting	<ul style="list-style-type: none"> - The ability of South Africa to forecast the demand for renewable energy and the practicability thereof in South Africa in the interest of ensuring that cautious investment decisions are taken.
C1-10: International Investors Attraction	<ul style="list-style-type: none"> - The ability of the programme to attract international investors to participate in the REIPPPP.

Figure 9 below shows the number of factors that were identified and categorised during the Level 1 qualitative content analysis. Category C1-02 contains a high number of factors that are adequate for programme design. This category was given the following definition: "An acceptable procurement process and big contracts management process are followed and/or implemented to a satisfactory standard"

as well as "clearly defined programme requirements and expectations relating to the IPPs".

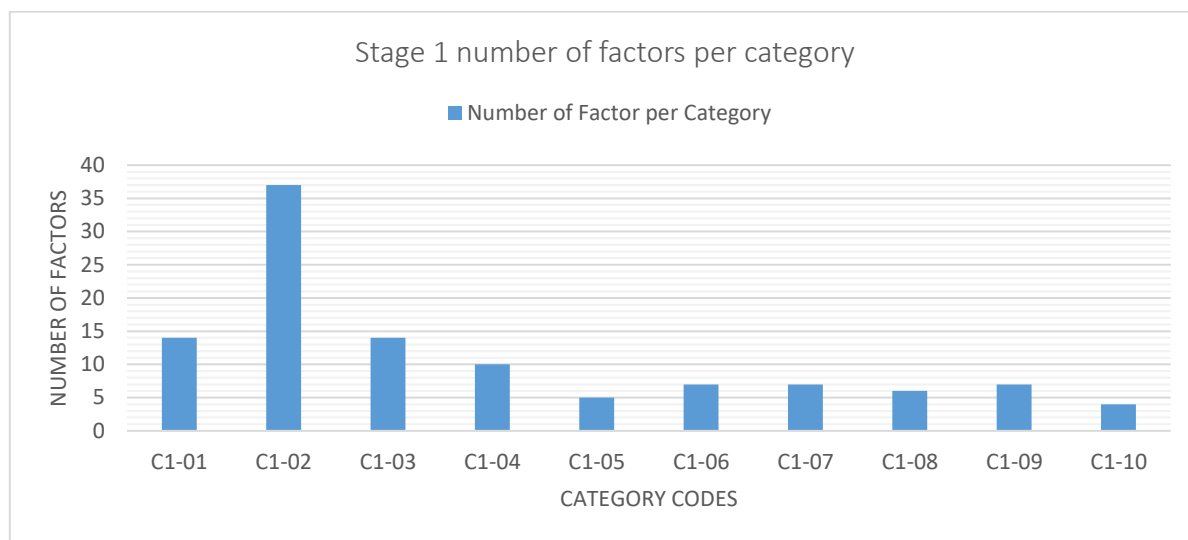


Figure 9: Number of factors per category.

5.2.2 Level 2 coding

Level 2 coding involved reducing the above 10 categories to seven categories. This process was undertaken using the qualitative content analysis approach by grouping together several of the Level 1 coded categories (Graneheim and Lundman, 2004). This process resulted in the merging of categories C1-01 and C1-02 (Programme Design and Programme Management) to form C2-01 (Poor Programme Design). Categories C1-03 and C1-10 were merged to produce a new category called 'Slow Renewable Energy Market Growth' (C2-02 category). Categories C1-06 and C1-09 were merged to produce the category 'Renewable Energy Demand and Technology' (C2-03). Categories C1-04, C1-05, C1-07 and C1-08 did not change; however, these were re-categorised as C2 category groups. Table 9 below shows the seven categories that resulted from the Level 2 qualitative content analysis process, as explained above.

Table 9: Seven Level 2 coded factors.

C2-01	Poor Programme Design
C1-01	Programme management
C1-02	Programme design
C2-03	Renewable Energy Demand and Technology
C1-09	Renewable energy demand
C1-08	Technology option
C2-05	Programme Funding
C00	Equity shareholders

C2-02	Slow Renewable Energy Market Growth
C1-10	International investors attraction
C1-03	Electricity market
C2-04	Lack of Competitive and Profitable Tariffs
C1-00	Competitive prices per megawatt
C1-01	Competitive tendering process
C1-02	Reasonable profit or return on investment
C1-03	Programme bid costs
C1-04	A reasonable level of profitability

C01	Corporate financing arrangement
C02	Long-term finance of projects
C03	Financial resources
C04	Reliance on bidder registration fees
C05	Government budget
C06	Capital investment requirement
C07	Sources of funding
C08	High transaction costs
C09	Risk insurance

C2-06	Poor Policy Implementation
C00	Preferential procurement policy framework
C01	Preferential procurement policy exemption
C02	Procurement framework
C03	Effective policy
C04	Carbon emission
C05	Renewable energy policy deficiencies
C06	Climate change policy alignment

C2-07	Expertise and Skills
C1-00	Legal and technical experts
C1-01	Technical
C1-02	Local capacity building
C1-03	Professionals
C1-04	Transfer of skills
C1-05	Transfer of experience

4.4 Analysis of survey data

The following section discusses the factors emanating from survey data in two main categories, namely the programme design and the renewable energy market in Northern Cape. Figure 10 below shows that 89% of the participants who took the survey understood the REIPPPP's function within the South African renewable energy market.

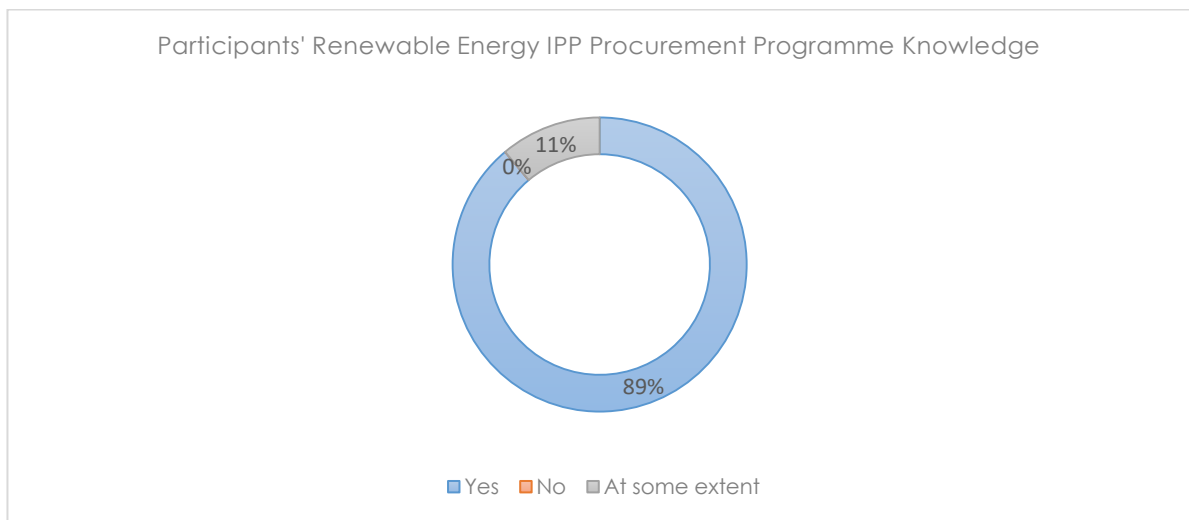


Figure 10: Participants' REIPPPP knowledge.

Only 11% of survey participants had some or little knowledge of the REIPPPP, while 89% knew the role and function of the programme.

4.4.1 Programme design factors

In the following section, the REIPPPP's strengths, weaknesses, programme risk and the renewable energy market in South Africa are discussed using the points of view expressed by the study survey participants.

The programme's success has been linked strongly to private capital investment in renewable energy projects in the South African electricity market. The programme has contributed significantly to job creation in communities in South Africa, assisting the government in increasing job opportunities in rural areas where the independent power producer (IPP) plants are operating. The involvement of experienced expertise has contributed to the efficiency of the programme, leading to project delivery being expedited and the meeting of operation target dates among most of the IPPs.

Political support is one of the strengths through which the programme has achieved its objectives in job creation and economic development. However, this strength is considered to be dynamic, as the political climate in South Africa is not stable. A change in leadership can have a significant impact in future especially if political power shifts to opposition parties.

Many of the weaknesses that emerged involve the lack of participation of South African IPPs owing to the high cost of capital requirements, as well as the scarcity of critical resources in the local renewable energy sector. The lack of experience and expertise in the local renewable energy sector emerges as a major contributing factor. The latter has benefited foreign companies more, enabling them to establish themselves in South Africa.

The high bidding cost, alongside low levels of success, is the result of strict timelines – namely, the opening and closing times of bidding rounds. The low-cost certainty of grid connections and multiple delays to bidder awards and financial closing dates are the most frustrating phenomena for bidders. The rules governing investments in local communities are not robust enough. As a result, local communities only receive the project benefits many years into the project's development, a phenomenon that can create poor relations between IPPs and communities. The difficulties that developers have passing the grid compliance test the first time without conditions and exemptions are also an issue. The failure of the government to properly synchronise the REIPPPP with Eskom infrastructure upgrade projects is a major institutional pitfall at programme-management level.

The REIPPPP's delays in approving IPPs for operation was highlighted as one of the risks because the more the approvals are delayed, the greater the costs incurred to IPPs' loans. As the programme matures to allow more and more investors to participate in the programme, the prices have begun falling sharply, causing concern to investors about the profitability of renewable energy plants in South Africa, as well as the uncertainty of IPP projects after 20 years of operation. The question of how the projects will be managed should investors decide not to continue with their operations arises.

As much as the programme aims to promote the participation of local IPPs, the programme has not yet registered a 100%-local IPP in the last four-and-half bidding rounds. This failure has been highlighted as a risk moving forward because it will make the programme seem as if it does not support local investors in the development of renewable energy plants in South Africa. This phenomenon has drawn the attention of other stakeholders closer to the programme, who are questioning the benefits of the programme in terms of local communities and the South African economy.

4.4.2 Renewable energy market in South Africa

The market and economic situation in any given country play a significant role in that country's development. The South African economy is indeed expected to play a crucial role in the development of the country's renewable energy market. While completing the online survey, participants were expected to rate how they thought the economic situation in South Africa would impact on the country's renewable energy programme. The results show that 45% of participants agree that the economic situation will impact on the REIPPPP. On the other hand, 33% strongly agree that economic dynamics played or will continue to play a huge role in the development of renewable energy in South Africa; they believe this simply because industries and residential loads will increase their demand according to the economic activity in the country. As a result, more people will be hired and contribute to economic activity in the country.

According to the survey conducted, 55% of participants strongly agree that climate change played and will continue to play a huge role in the development of renewable energy in South Africa. The programme's initial vision was welcomed because it addressed environmental concerns, including the reduction of carbon emissions (Montmasson-Clair and Ryan, 2014). Specific challenges remain in the case of programme policies that are not aligned with the national government's policies on addressing the issue of climate change directly. The respondents' views on this matter demonstrate that there is little integration of the development of renewable energy in South Africa and initiatives designed to address climate change issues; however, this lack of integration is not the subject of this study.

The programme is also viewed as a solution to the slow depletion of fossil fuel reserves, which South Africa is dependent on in generating much-needed electricity, a view that is shared by Pang and Chua (2010) with respect to Malaysia. However, participants did not regard fossil fuel depletion as one of the factors contributing to renewable energy development in South Africa. Participants were asked to respond to the following statement: "Fossil fuel depletion is one of the major factors positively impacting on the development of renewable energy sources in South Africa." About 33% strongly agree with the statement, and less than 30% agree. On the other hand, only 22% of participants strongly disagree with the statement. Only 11% of participants disagree.

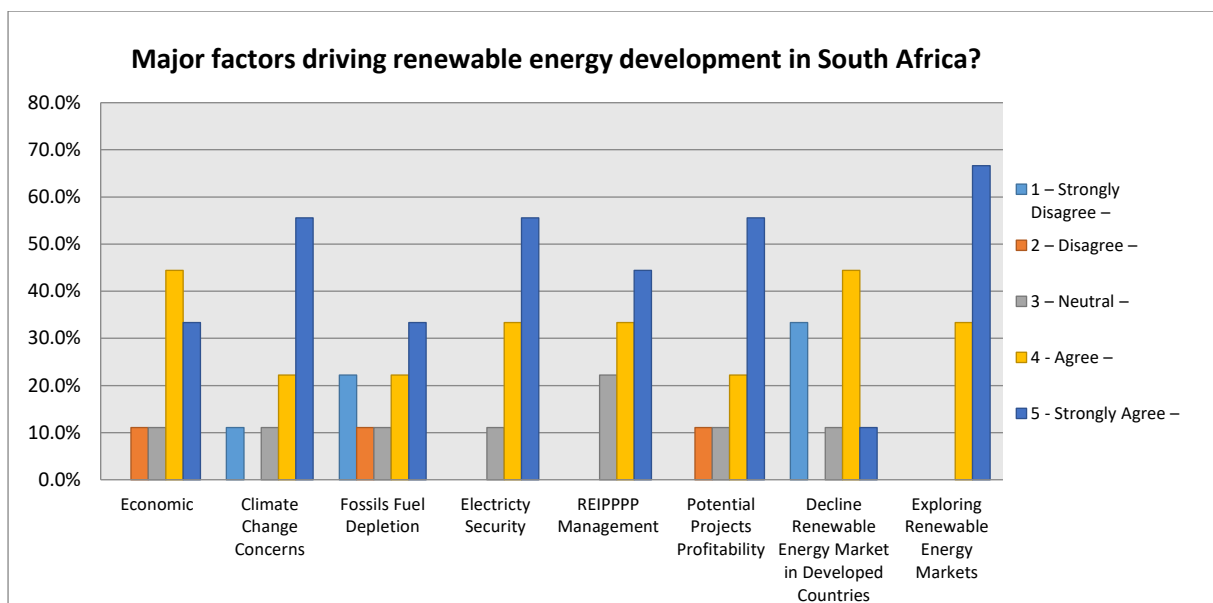


Figure 11: Major factors driving renewable energy development in South Africa?

The 2008 and 2014 countrywide blackouts are regarded as factors that triggered the development of renewable energy in South Africa, and the drive to increase the firm electricity supply to customers. The survey participants view electricity security as one of the major factors that contribute to the development of renewable energy in South Africa as outlined in DME (2003). According to the online survey, 55% of participants strongly agree that security of electricity supply was a major consideration within the programme. Some of the participants highlighted the point that, since the IPPs started injecting power into the main grid, South Africa has not experienced any load-shedding. This fact provides a strong argument for the drive among IPPs to develop more renewable energy in the country. However, the programme's sustainability would be crucial, in the sense that it requires an experienced management team to run it.

South Africa is known for its reliance on fossil fuels (Findt and Scott, 2014) and the procurement process followed in acquiring fossil fuel facilities is different from the one used in the REIPPPP. The programme requires experienced and knowledgeable people to administer it. The study sought to ascertain whether experienced people made a significant contribution and whether they will continue to do so. The study participants regard REIPPPP management as a major contributing factor in the development of renewable energy in South Africa. About 44% of participants felt that management and skills deployed in the running of the programme contributed to the process.

The focus of renewable energy development in South Africa has been the deployment of different renewable energy sources that are new to the local market. Investors are perceived as opportunists in the South African renewable energy industry. As a result of these two variables, the 'potential projects profitability' factor emerged as one of the major factors driving the success of the REIPPPP in the Northern Cape. About 56% of participants strongly agree that the investors considered the

profitability of the projects in the South African renewable energy market, as the industry is still new and no similar technology exists in the country. This belief is backed up by the number of international companies who show interest in the development of renewable energy in South Africa, in particular in the first bid windows (Bid Windows 1-4.5) of the REIPPPP; these companies were encouraged by the high tariffs the South African government offered to investors. The significant drop in tariffs did not reduce the interest of investors through the competitive series of Bid Windows 1-4.5. The projects are still more profitable than those in developed countries. However, concerns have been raised regarding future bidding windows within the programme as a result of the sharp drop in tariffs per megawatt of power.

One can also argue that the timing of the REIPPPP's implementation was right, taking place just as renewable energy markets in developed countries were declining due to the saturation of technology and completion. In the survey, about 44% of the participants agree that the decline of the renewable energy markets in developed countries helped the REIPPPP to perform well, as most IPPs are looking for emerging renewable energy markets. In South Africa, 99% of developers are foreign investors who are in the process of exploring emerging renewable energy markets.

It emerged in the survey that IPPs in the Northern Cape are corporates that are in the South African renewable energy market merely to make profit. About 33% of participants agree that most IPP projects in South Africa are developed by investors who are "exploring renewable energy markets". Furthermore, roughly 67% of survey participants strongly agree that investors are indeed exploring the South African renewable energy market and that this has given the REIPPPP support from across the world.

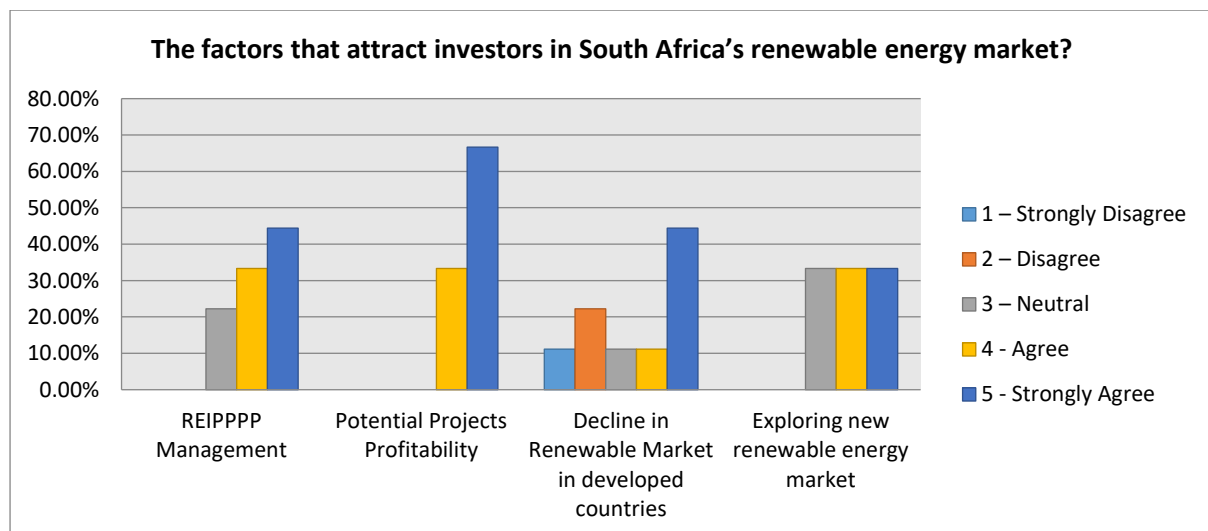


Figure 12: The factors that attract investors in South Africa's renewable energy market?

Potential project profitability was seen as one of the major factors that attracted investors to the South African renewable energy market. This factor is attributed to the

high level of skill and professionalism demonstrated by the management team that administers the REIPPPP.

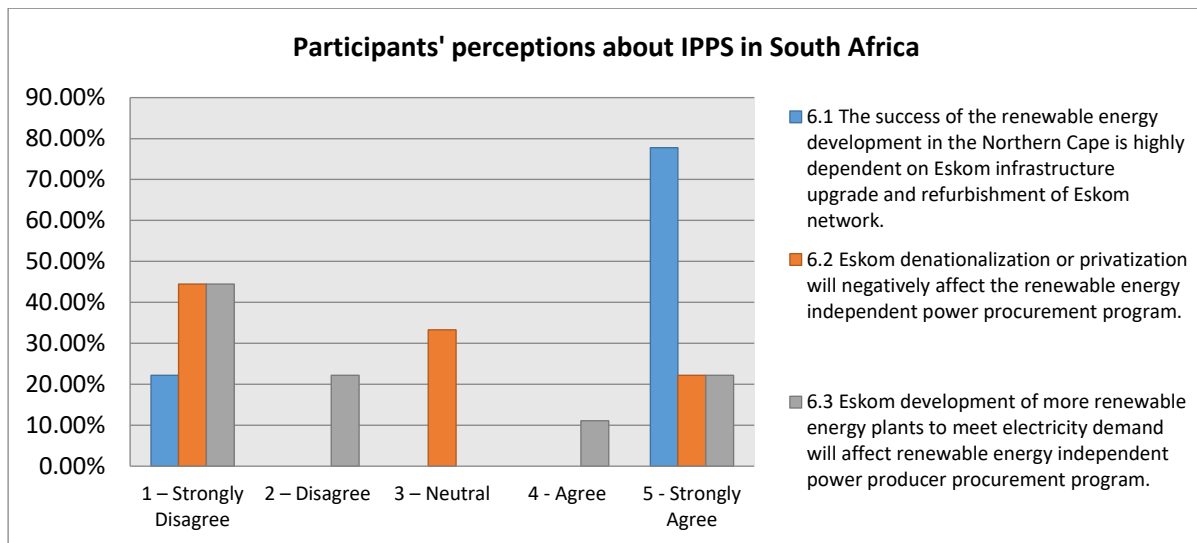


Figure 13: Participants' perceptions about IPPs in South Africa.

The old and constrained Eskom infrastructure is one of the factors that is perceived to be a challenge to the REIPPPP. In the survey, 77.8 % of participants strongly agree that the success of renewable energy in South Africa is highly dependent on Eskom's infrastructure upgrade. This upgrade is an infrastructure programme that is envisioned to enable Eskom to accommodate the additional energy to be produced by IPPs. The challenge is that the South African utility company (Eskom) is the only buyer of the energy produced by IPPs; as a result, the IPPs are limited to using or evacuating the power produced through Eskom infrastructure. On the contrary, 44% of participants strongly disagree with the point that Eskom's denationalisation will affect the REIPPPP. The generation division of Eskom will be a major competitor among IPPs in South Africa, giving them a competitive advantage over all other IPPs in the country; they will experience an advantage because they will have a large share of the generated capacity determining the tariffs of the energy sold to customers. If denationalisation does not happen, there is a possibility that Eskom will develop its fleet of renewable energy plants to diversify its electricity-generation mix. About 44% of participants strongly disagree with the point that, if Eskom develops more renewable energy plants, more private investors will not be attracted to the REIPPPP. The latter argument is based on South Africa's renewable energy policy, which mandates that private investors have a particular share of renewable energy in the total energy-generation mix, meaning the development of more renewable energy plants by Eskom will not affect REIPPPP targets.

4.5 Analysis of interview data

During the interviews, participants identified 42 factors that have the potential to impact on the REIPPPP. A qualitative content analysis was used in coding these factors into the seven general categories identified in 4.2. Three additional categories were developed using the interview data: 'Lack of Development in Local Communities', 'High Rate of Project Implementation' and 'Poor Management of Economic Development Criteria'. Table 10 below shows the final 10 category factors formed after interview data analysis.

Table 10: 10 factors impacting on REIPPPP

C2-01	Poor Programme Design
C1-01	Sole energy buyer from IPPs
C1-02	Restriction on customers
C1-03	Segmented and unclear reporting structures
C1-04	Institutional setting of REIPPPP programme

C2-02	Slow Renewable Energy Market Growth
C1-10	International investors attraction
C1-03	Renewable energy electricity market saturation
C1-04	Alternative electricity generation technologies
C1-05	Renewable energy technology development

C2-03	Renewable Energy Demand and Technology
C1-09	Poor renewable energy demand forecasting
C1-08	RE technology options and availability
C2-00	Strategic IPP planning

C2-04	Lack of Competitive and Profitable Tariffs
C1-00	Competitive prices per megawatt
C1-01	Competitive tendering
C1-02	Reasonable profit
C1-03	Bid cost
C1-04	A reasonable level of profitability
C2-00	IPPs to consider dropping prices of energy per kWh

C2-05	Insecure Programme Funding
C00	Equity shareholders
C01	Corporate financing arrangement
C02	Long-term finance of projects
C03	Financial resources
C04	Reliance of bidder registration fees
C05	Government budget
C06	Capital investment
C07	Sources of funding
C08	High transaction costs
C09	Risk insurance

C2-06	Poor Policy Implementation
C00	Preferential procurement policy framework
C01	Preferential procurement policy exemption
C02	Procurement framework
C03	Effective policy framework
C04	Carbon emission control
C05	Renewable energy policy deficiencies
C06	Climate change policy alignment

C2-07	Lack of Expertise and Skills
C1-00	Legal and technical experts
C1-01	Technical
C1-02	Local capacity building
C1-03	Professionals
C1-04	Transfer of skills
C1-05	Transfer of experience
C2-00	Dependency on the international skills market

C2-08	Lack of Development in Local Communities
C2-00	Job creation
C2-01	Public benefits realisation
C2-02	The lack of other departmental visibility at a provincial level
C2-03	Lack of coordination with other community development programmes
C2-04	Lack of basic services in the communities

C2-09	High Rate of Project Implementation	C2-10	Poor Management of Economic Development Criteria
C2-00	Congested distribution network	C2-00	DoE manages qualifying criteria
C2-01	New infrastructure development requirement	C2-01	Job creation
C2-02	Increase equipment supply demand	C2-02	Preferential procurement
C2-03	Eskom was not ready for the IPP influx in SA market as a single buyer	C2-03	Local communities company participation
C2-04	Eskom network flexibility to accommodate IPPs	C2-04	Local communities active roles

Poor Programme Design: Some participants acknowledged that the REIPPPP has managed to successfully drive the implementation of some IPP projects in South Africa. However, their concerns have to do with a specific factor that determines the viability of IPPs in South Africa, and that factor is the programme design. The participants' perspective is that the programme would be more effective were it a private institution operating outside of government policies and mandates. The fact that programmes launched by private advisors and other private professionals depend on the government mean that such programmes are vulnerable to political instability and unfavourable economic performance. A change in government will have a huge impact on the management of the programme and possibly the management of IPPs' economic development criteria, a result that might be favourable to new IPP applicants.

Slow Renewable Energy Market Growth: As discussed in the above section, the REIPPPP is exposed to the global renewable energy market. IPPs use the same supply of renewable energy technology as other companies around the world do. The slow growth in the renewable energy market will slow down the programme and impact on the output of the IPPs' project deliverables. The suppliers will rather react to the economic activities that drive their revenues than be worried about the South African renewable energy market, which probably has a small market share.

Renewable Energy Demand and Technology: Some participants stated that South Africa's demand for renewable energy was over-forecasted and that this gave the government misinformation on which to base its decision to implement renewable energy projects. These statements also included the matter of the type of technology used in South Africa: many argued that current types do not assist in periods when the demand for energy is high. Some believe that only mature technology should have been implemented in South Africa to leverage on the experience of other countries. This technology includes photovoltaic (PV) and wind technologies.

Lack of Competitive and Profitable Tariffs: Since the renewable energy programme began in South Africa, tariffs have fallen to below R1 per kWh of energy. This decrease drives the South African renewable energy climate to be less competitive and less profitable for most IPPs. This effect might see IPPs leaving the South African renewable energy market to pursue their business in other countries, developed or developing.

Insecure Programme Funding: The uncertainty of funds for the REIPPPP is one of the concerns that threaten IPP viability in the South African electricity market. The programme relies on IPPs' application fees. The low number of new IPPs that are interested in South African renewable energy will force the programme to depend on government support. This process will also contribute to the low rate at which the new infrastructure required to evacuate the power generated is developed. As a result, Eskom will be left with a backlog of infrastructure upgrade projects without funding. In the future, this backlog will limit the number of IPPs that are administered by the programme.

Poor Policy Implementation: The critical step in the realisation of policy goals lies in that policy's implementation. The South African government has developed a renewable energy policy that guides the development of renewable energy in South Africa's renewable energy market. The failure of the government to implement this policy will impact on the IPPs operating currently and in the future in South Africa. The integration of the renewable energy policy with other government policies will improve the success of the renewable energy policy's implementation. For example, if the renewable energy policy supports the environmental policy in all aspects, a collaboration between government departments responsible for the implementation of these policies will be enhanced. In South Africa, most IPPs are located in rural communities. The government policies aimed at rural development need to be aligned with the renewable energy policy.

Lack of Expertise and Skills: South Africa does not have the expertise needed (including skilled people with many years' experience) for renewable energy. The failure of the programme to develop and retain renewable energy experts will impact on the renewable energy programme of South Africa. According to the economic development criteria discussed in Chapter 2, the programme has a target of 30% black ownership (black South Africans, specifically). The lack of experienced and skilled people from South Africa will disadvantage the programme and prevent it from meeting its target. Some participants believe that the programme should have been rolled out slowly and that IPPs should be forced to hire local people to increase the number of skilled South Africans.

Lack of Development in Local Communities: Renewable energy projects in the Northern Cape are developed in the rural parts of the province. The locals view these projects as government projects aimed at developing the rural areas. If the local communities do not have other basic services, like clinics and proper roads, they might see IPP projects as a waste of money that should have been spent building clinics and schools for them. The development of IPP plants ought to align with other community development projects. Furthermore, the government should mandate the IPPs to contribute to these local communities.

High Rate of Project Implementation: The rate at which the IPPs were implemented in South Africa did not afford the chance to learn and improve the processes governing renewable energy development. Some participants believe that the implementation was rushed, further highlighting the challenges with the new power purchase

agreement (PPA), which Eskom is refusing to sign. The failure to approve the new PPA highlights the direction that the IPP projects are taking. This failure will, in turn, reduce investor interest in the South African renewable energy market.

Poor Management of Economic Development Criteria: The poor management of economic development criteria will cause a decrease in the perceived benefits of IPP projects in local communities. This changed perception has the potential to increase the rejection of IPP projects by the communities of South Africa. The government has a responsibility to be transparent and upfront in addressing any concerns about the role of local communities in IPP projects.

4.6 Summary

In this chapter, a qualitative research data analysis was conducted. The data that emerged from literature, online surveys and interviews was analysed to extract the critical factors that impact on the REIPPPP. The study identified 10 critical factors that addressed the primary question of this study. The following chapter looks at the diagnosis and modelling of the REIPPPP using Beer's viable system model.

5.1 Introduction

This chapter discusses the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) diagnosis and modelling using Beer's viable system model (VSM). The Department of Energy (DoE) is currently in the process of administering several programmes; hence, it is imperative to identify the level of recursion in which the REIPPPP resides, both within government structures and in the department itself.

5.2 Defining REIPPPP level of recursion

According to Beer's VSM, it is essential to determine the purpose of the study in order to assess the system required to achieve that purpose. The system-in-focus is the DoE's REIPPPP.

The DoE was mandated by the government to establish a programme in response to the country's power generation shortfall and the positive contribution of renewable energy sources in reducing carbon dioxide (CO₂) emissions. The REIPPPP's primary mandate is to procure electrical energy produced by independent power producers (IPPs) that use mainly renewable energy sources to generate electricity. According to the DoE, the programme is aimed at reducing the country's reliance on fossil fuels to generate electricity. To achieve this goal, the REIPPPP was designed by the DoE among other programmes to allow private investors to participate in the process of developing the renewable energy sector in South Africa.

The DoE's website (2016) outlines its vision, mission and legislator mandate as follows:

Vision: Improving our energy mix by having 30% clean energy by 2025.

Mission: To regulate and transform the sector for the provision of secure, sustainable and affordable energy.

Legislator Mandate: *To ensure the secure and sustainable provision of energy for socio-economic development.*

To support the DoE in achieving its vision and mission, and compliance with its legislator mandate, the REIPPPP was designed to provide the following (DoE, 2015):

- Professional advisory services to IPPs via private advisors
- Procurement management services
- Monitoring, evaluation and contract management services

One of the viable system diagnosis principles, according to Beer's VSM diagnosis, is the determination of the recursion level of the system-in-focus. Figure 14 below shows the recursion levels of the system-in-focus, i.e. the REIPPPP.

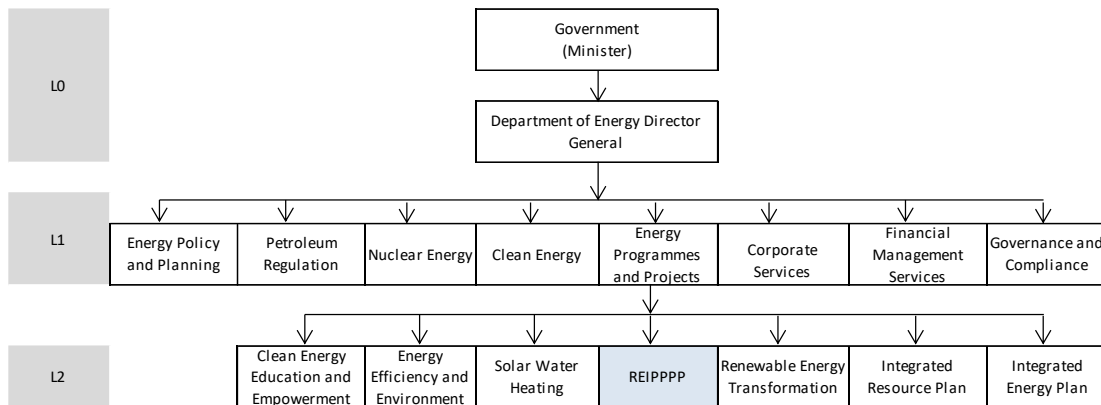


Figure 14: Recursion levels of the system-in-focus (DoE, 2016).

By looking at the whole system-in-focus, one notes that Recursion Level 0 (L0) is government, of which the Minister of Energy is part. Level 1 (L1) consists of all other DoE programmes that exist to fulfil its purposes. The system-in-focus is situated in Level 2 (L2), as shown in Figure 14 above. The system-in-focus forms part of the Energy Programmes and projects portfolio within the DoE.

The DoE and the Development Bank of South Africa (DBSA) developed a regulatory framework that is used by the REIPPPP participating entities. The framework is shown in Figure 15 below. The framework indicates that before the IPPs can start the bidding process, several requirements need to be put in place by other government departments and private organisations in preparation for the bidding rounds.

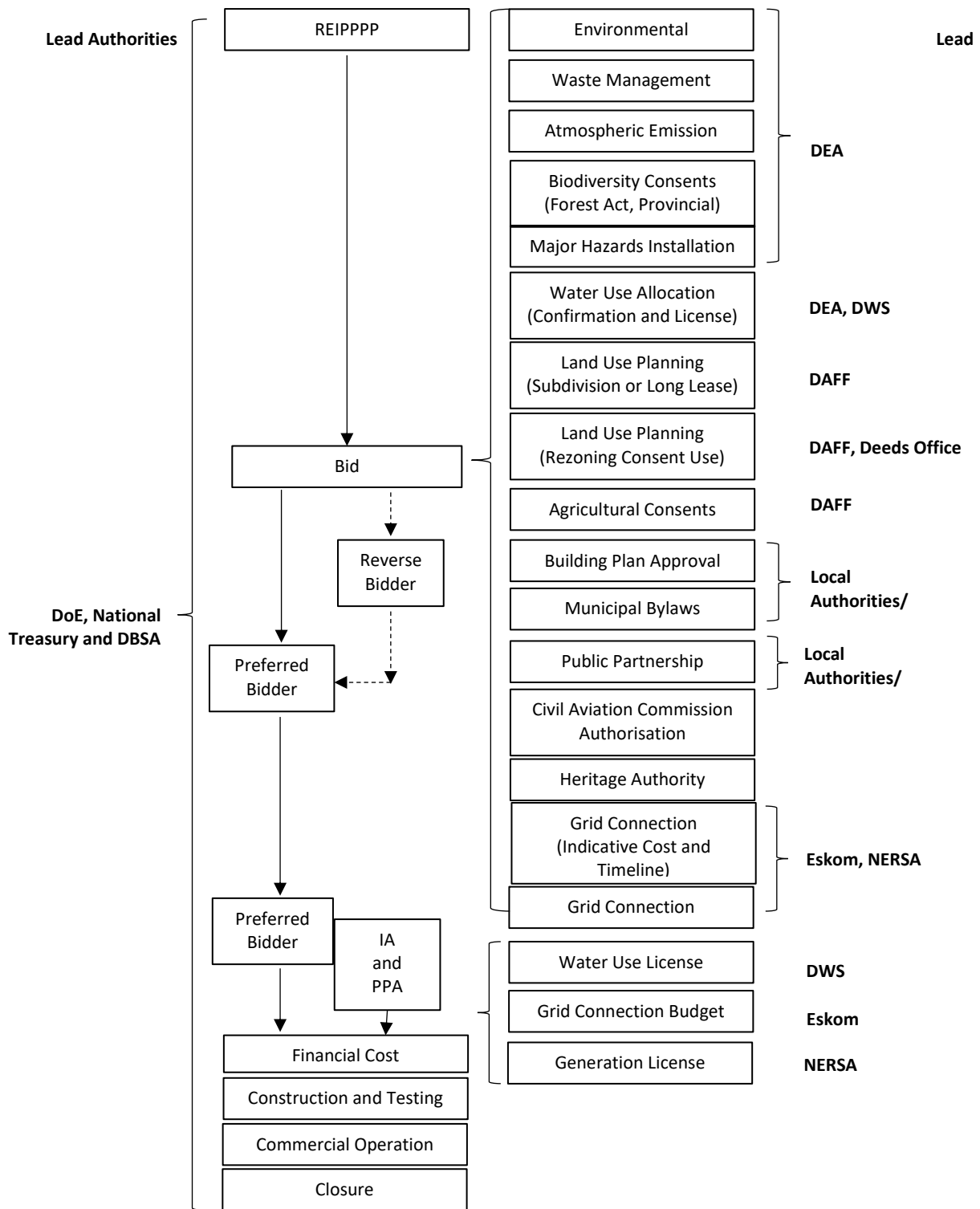


Figure 15: Indicative regulatory requirements for participation (DoE, 2015).

5.3 REIPPPP diagnosis

5.3.1 Description of the REIPPPP using VSM

Given the recursion level of the system-in-focus, as explained above, the South African REIPPPP can be used as a model of the viable system diagnosis, as depicted in Figure 16 below. The model consists of all three elements of Beer's VSM, namely the environment, meta-system and operations. The meta-system (including Systems 2-5) consists of government departments, including the DoE, the National Treasury, Eskom, the National Energy Regulation of South Africa (NERSA) and the DBSA. The external environment of the system-in-focus includes the economy and the market. The operations are regarded as the bidding process and the capacity allocation among IPPs to which the bidding process leads.

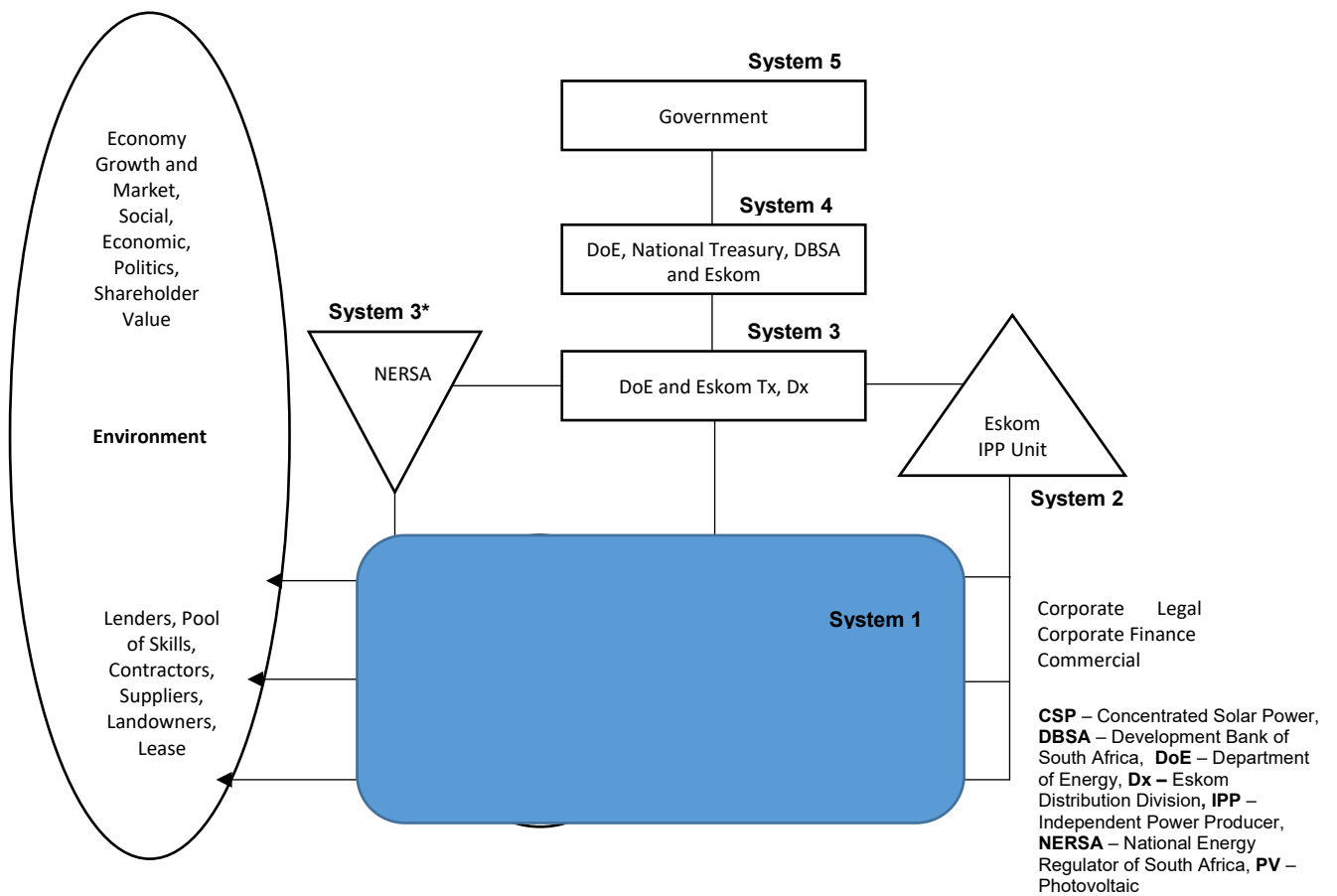


Figure 16: The REIPPPP as system-in-focus.

As discussed in the preceding paragraph, the REIPPPP facilitates the development of renewable energy infrastructure by providing the services highlighted above to the developers, allowing developers to produce the energy needed by South Africa. The suppliers, inputs, process, output and environment of the programme were identified.

Table 11 below shows the Suppliers, Inputs, Processes, Outputs and Customers (SIPOC) of the system-in-focus.

Table 11: REIPPPP SIPOC.

SIPOC	Wind Technology	Photovoltaic (PV) Technology	Concentrated Solar Power (CSP) Technology
Suppliers	Wind energy bidders and private investors	Photovoltaic (PV) bidders and private investors	Concentrated solar power (CSP) bidders and private investors
Inputs	The environmental authorisation, major hazard installations, water use allocation, land use planning, agricultural consents, building plan approval, municipal bylaws, public partnership agreement, civil aviation authorisation, heritage authority consent, grid connection (indicative cost and timeline), grid connection (traversal right)	The environmental authorisation, major hazard installations, water use allocation, land use planning, agricultural consents, building plan approval, municipal bylaws, public partnership agreement, civil aviation authorisation, heritage authority consent, grid connection (indicative cost and timeline), grid connection (traversal right)	The environmental authorisation, major hazard installations, water use allocation, land use planning, agricultural consents, building plan approval, municipal bylaws, public partnership agreement, civil aviation authorisation, heritage authority consent, grid connection (indicative cost and timeline), grid connection (traversal right)
Process	Application evaluation (bidding rounds)	Application evaluation (bidding rounds)	Application evaluation (bidding rounds)
Output	Implementation agreements, power purchase agreements, generation license, production of electricity	Implementation agreements, power purchase agreements, generation license, production of electricity	Implementation agreements, power purchase agreements, generation license, production of electricity
Customers	Independent power producers, private investors, developers	Independent power producers, private investors, developers	Independent power producers, private investors, developers

5.3.2 REIPPPP operations (System 1)

The environment in which the REIPPPP operates is perceived as the global renewable energy industry. It is viewed as such because the programme invites private sector investors from all over the globe to participate in the bidding and procurement processes of capacity allocation when it comes to different renewable energy technologies. During the REIPPPP bidding process, bids are requested from developers in competitive bidding rounds termed 'bid windows'. The developer is required to provide, among other things, a detailed structural diagram showing its debts, equity participants, contractors and the key equipment suppliers irrespective of their choice of technology. This process is said to measure the developers' readiness to deliver on their project(s) or the technology that they are bidding for.

Over and above the requisite organisational structure, bidders are required to indicate their acceptance of the power purchase agreement (PPA) with the South African utility (Eskom) as the single buyer of energy produced, and an implementation agreement (IA) with the DoE. Land and valid licenses must accompany their acceptance; in other words, the bidder is required to provide evidence that it has secured the project site and identified all the permits and licenses needed for the

project regarding land rezoning, subdivision and water use. These documents refer to both environmental authorisation and the required permission to establish their plant at the specific location.

The most critical requirement is the capital investment securities that the REIPPPP will use as a guarantee that the developers are ready to commit to the deliverables. They are also required to show and specify the selling price of the power to be produced, according to the technology that they are going to use and the method by which the project will be financed. Over and above these requirements, they must demonstrate beyond any doubt that they have secured enough funds for the project and provide proof as part of the application to be considered for a particular bid window. Once the developer has identified and secured the funding, it must specify what type of technology it is going to use to generate electricity in a report that needs to be submitted together with a grid connection estimate letter, which it receives from Eskom. The key driving factor has been the economic requirement of the REIPPPP. The IPPs need to show what percentage of the project local communities will own, as well as the share of jobs that are going to be created by the project and the extent to which the project will support socio-economic development in those communities.

In preparation for the procurement process, the IPPs are expected to comply with the requirements highlighted in Table 11 above. The DoE, together with the National Treasury and independent advisors (which include legal, technical, environmental and financial advisors), assists with the evaluation and selection of the preferred developers, who then enter into a PPA with Eskom (the single buyer). The developers then enter into an IA with the DoE.

5.3.3 Programme coordination and conflict resolution (System 2)

According to Beer's VSM, System 2 fulfils the coordination and stability functions in the organisation (1979) to ensure that the organisation is viable over time. The current state of the REIPPPP includes a provision that states that Eskom plays the coordination and conflict resolution role between the IPPs that are in System 1 of the programme. The DoE and other government departments are involved as the issues are escalated to higher levels. This arrangement has resulted in Eskom establishing a particular office (Independent Power Producer Office – Grid Unit) to provide the necessary support to the IPPs who are planning to develop renewable energy plants in South Africa. The private advisors are also listed on the Grid Access Unit website for easy access by IPPs. In all the provinces, Eskom has capacitated the unit to assist the IPPs with some support services (Eskom 2016) to coordinate and provide stability.

These services include the *Corporate Legal* service, in which the Eskom office assists with the drafting of all the contracts needed to manage the PPAs between Eskom and IPPs. The IPP also provides *Legal Advice* services regarding the interpretation of PPA clauses, dispute resolutions and lawsuits. The *Corporate Finance* division aids in the drafting of contracts, and it is responsible for ensuring that Eskom has adequate

funds to purchase energy produced by the IPPs. In addition, it ensures that cash flow is proper and makes actual payments to the IPPs in collaboration with the Eskom wholesaler division.

Eskom's Commercial division facilitates the registration of IPPs as Eskom vendors. It also plays a role in the drafting of the PPAs between Eskom and IPPs. The challenges to this setting arise when there is a dispute between the parties (namely, Eskom and the IPPs). Such a disagreement enables the unfair treatment of IPPs as well as poor governance.

The Pricing Department provides the pricing-of-network services, and thus the use of Eskom network infrastructure, to IPPs. It ensures that the agreement between Eskom and IPPs is kept as per PPA agreements and compensates the IPPs on the non-Eskom network utilisation via data from Eskom meters. The *Metering Division* manages the data from Eskom meters and IPP meters to ensure the correctness of data for payment and energy balancing purposes. The *Grid Access Unit* division facilitates the efficient operation of the metering process.

Over and above these various divisions within Eskom, the support services offered to IPPs by Eskom are also provided by the National Treasury, the Department of Public Enterprises, the Department of Water Affairs, the Department of Mineral Resources and the Department of Environmental Affairs.

Possible sources of oscillation within the REIPPPP include the following:

- Disputes between the parties or stakeholders involved, i.e. Eskom and the IPPs
- Eskom and other government departments, such as NERSA and the DoE, who resist the chance to support the programme
- IPPs who perceive unfair treatment
- Disputes between the DoE and IPPs
- Delays in the approval of PPAs by Eskom management
- Political instability in South Africa

5.3.4 Programme optimisation and synergy (System 3)

The function of System 3 is to provide proper control of the operations that take place in System 1 (Beer, 1979). In the REIPPPP, the DoE and Eskom serve the purpose of controlling System 1. The DoE ensures that the IPPs drive the realisation of the South African government's renewable energy policy by ensuring that the IPPs contribute a significant share of renewable energy to national electricity generation. The IPPs meet with the DoE to set and agree on the performance targets to be achieved by each IPP, which are in line with the PPA they have entered into with Eskom. Given their plant availability index, they set electricity generation targets that are achievable in their environment based on the technology that they are using. At their substations, Eskom has installed meters that are synchronised with IPPs' plants to record and monitor the energy generated by IPPs. This information is shared with IPP management and System 4 (DoE, NERSA and National Treasury) for future renewable energy target-setting and -planning under the REIPPPP.

In the current REIPPPP setting, optimisation and synergy are provided by different government entities. This setup affects the autonomy of System 3, making it difficult for the programme to maintain its internal stability and optimise performance within the established framework.

5.3.5 Programme internal regulation and audit (System 3*)

In the current REIPPPP setting, it is not clear who regulates the performance of operating units (System 1) to ensure better optimisation and synergy within the overall programme. The senior management of different government entities – including NERSA, DoE, Eskom and the National Treasury – serve the function of monitoring the operations of IPPs. Hence, there are some uncertainties regarding programme regulation.

5.3.6 Programme adaptation and planning (System 4)

System 4 of Beer's VSM is designed to deal with the more substantial future environment of an organisation (Beer, 1979). Its task is influenced by the information received from System 3 (Walker, 1998) of the system-in-focus, namely management's planning and development of working strategies for the organisation. The larger external environment of the REIPPPP is the global renewable energy sector and market. The South African REIPPPP needs to be abreast with what is happening in other countries with regards to renewable energy development; its ability to do so will determine the support the programme receives from renewable energy technology suppliers in the global market. Support from these global suppliers will assist the government in planning renewable energy rollout strategies for the country.

The dynamics that the South African REIPPPP is concerned with include the following:

- The development of renewable energy technologies suited to the South African market
- Skills availability in South Africa, especially those skills needed to operate and maintain renewable energy plants
- The integration of different electricity generation technologies into the existing electricity infrastructure
- Continuation of the process of attracting private investors to South Africa's renewable energy market
- The management of PPAs by Eskom over a period of 20 years
- Research and development in the renewable energy sector

5.3.7 Programme authority and policy (System 5)

The REIPPPP is driven by policies that are developed by the South African government to achieve clean energy (renewable energy sources) objectives. These objectives

include access to electricity for all, sustainable development and the reduction of greenhouse gas emission, as discussed in Chapter 2.

Three government policies form the basis of renewable energy development in South Africa's renewable energy sector. These are discussed in the following paragraph.

The White Paper on Energy Policy in South Africa set the direction regarding energy usage and access to energy for all South Africans (DME, 1998). This policy resulted in the government's commitment to support and promote renewable energy in South Africa (DoE, 2015). The above policy development involved an extensive public consultation process that was driven by the South African government. In other instances, the National Energy Summit is organised to obtain a consensus on the renewable energy objectives and goals. This process allows the international stakeholders to have input in the development of policies. To improve the above policy, the White Paper on Energy Policy was developed by the South African government, its mandate emanating from the South African Constitution, which commits the government to the reduction of energy-related emissions that are harmful to the environment and human health (DoE, 2015). The process of developing the renewable energy policy and its coordination is the responsibility of the DoE, which works with other government departments to create a suitable environment. This policy resulted in the adoption by the government of the Integrated Resource Plan. This policy's objectives are to increase the security of energy supply through the diversification of electricity generation and the involvement of private sector investors. Further supporting clean energy, the South African government developed a National Climate Change Response Policy White Paper, which was influenced by the South African government's commitment to reduce its total carbon emissions by 34% by 2020 (DoE, 2015).

5.4 Modelling the REIPPPP as a viable system

In the previous section, Beer's viable system diagnosis was applied in order to describe and diagnose the REIPPPP. The process revealed several factors that affect the programme at different levels of the REIPPPP. Table 12 below contains a summary of the factors affecting the programme at different levels of the organisation. The factors were defined in relation to the content of the renewable energy programme of South Africa.

Table 12: Summary of factors based on a viable system diagnosis of the REIPPPP.

System Level	Factors	Definition
System 1	Key equipment suppliers	- Renewable-energy-related technology suppliers
	Highly competitive environment	- The level of competition between IPPs for capacity approvals and plant positions
	Access to capital	- The availability of funding for the IPPs or developers secured to implement their renewable energy plants
	Intense land acquisition process	- A long land-acquisition process that IPPs have to follow before they can apply for capacity allocation or approvals
	Delays in local communities benefits	- The delays in share benefits that are received by local communities where IPPs develop their renewable energy plants
	Single buyer arrangement of generated electricity	- The arrangement that governs the power purchased from the IPPs
System 2	Lack of supporting programmes within REIPPPP structure	- The level of support and guidance required by IPPs in order to bid in the REIPPPP
	Eskom's conflicting roles and responsibilities in the programme	- The dual role that Eskom plays within the programme, as both a supporting structure and a single buyer of energy
	Independent power producers payment method	- The process followed in order to pay IPPs for the electricity produced for Eskom
System 3	High number of supporting programmes	- The number of other programmes that support the REIPPPP in South Africa
	Differences in performance target for IPPs	- The different key performance indicators that are used by IPPs and are not standardised in South Africa
	* IPPs' compliance with economic development requirements	- The level to which the IPPs comply with the economic development criteria applied during the bidding round

System 4	South African electricity market needs	- The electricity demand and needs of South Africa
	Localisation of technology supply	- The development of renewable energy in South Africa for supply to local IPPs
	Research and development availability	- The availability of renewable energy research and development to support the development of renewable energy technologies
	Skills availability in South Africa	- The availability of renewable energy skills needed to operate and maintain renewable energy plants in South Africa
System 5	Policy development and alignment with other related policies	- The development and integration of REIPPPP policy strategies aimed at reducing greenhouse gases to mitigate global warming in the region
	Public consultation	- The level of public consultation in the process of policy development and the implementation of the programme
	Private sector involvement	- The level of private sector involvement in the development of the REIPPPP

Some of the factors overlapped with the factors identified in the literature, as shown in the above table. In the following section, data from the online survey platform will be analysed.

5.4.1 REIPPPP operations (System 1)

In accordance with Beer's VSM, operations within the REIPPPP consist of different IPPs. In the renewable energy market of South Africa, local IPPs are thus competing with other IPPs (of which many are well-developed) in the global renewable energy market. Evidence of this contest is the fact that IPP plants developed in South Africa are owned mostly by international renewable energy developers. In any viable system, the operating elements are autonomous in their operating environment, at the same time as they are being regulated by the local management of the system-in-focus (System 3). The lack of localised control within the programme threatens the REIPPPP's ability to achieve its objective of promoting small-, medium- and micro-sized enterprises' (SMMEs) growth in South Africa, and helping these SMMEs to participate in renewable energy development in the country. The involvement of international developers creates a highly competitive environment where South African SMMEs

cannot compete fairly owing to the high capital requirement and environmental factors unless foreign private investors are involved or partner with them.

The current programme setting requires the IPPs to commit financial resources without having been guaranteed any capacity allocation or approval in an REIPPPP bidding round; this fact shows the lack of self-regulation and application of feedback principles, both of which are integral elements of a viable system. The environment in which the REIPPPP operates is the global renewable energy market, and it is highly competitive because IPPs compete for capacity allocation within the programme to establish their renewable energy plants in South Africa. Access to capital is the critical component for IPPs: the programme demands that the developers prove that they have secured the capital required for the project before they can even start the capacity allocation application process. The IPPs need to secure the land where they want to establish their plants in advance. And the cost to secure the land is included in the cost of the application.

Should the application been approved, then the IPP may proceed with other applications like the electricity generation license, water use license, and so on. This process presents an additional high risk to the IPPs as they make commitments to the programme regarding the dates of operation. Bearing in mind the technology the IPP will be implementing, the programme needs to have a relationship with the suppliers in order to be realistic in determining commitment dates and other deliverables. This relationship will enhance the way in which System 1 of the system-in-focus deals with its local environment. The programme needs to identify the minimum number of skills required for a particular project to help manage the pool of critical skills in the market that are needed for each renewable energy project.

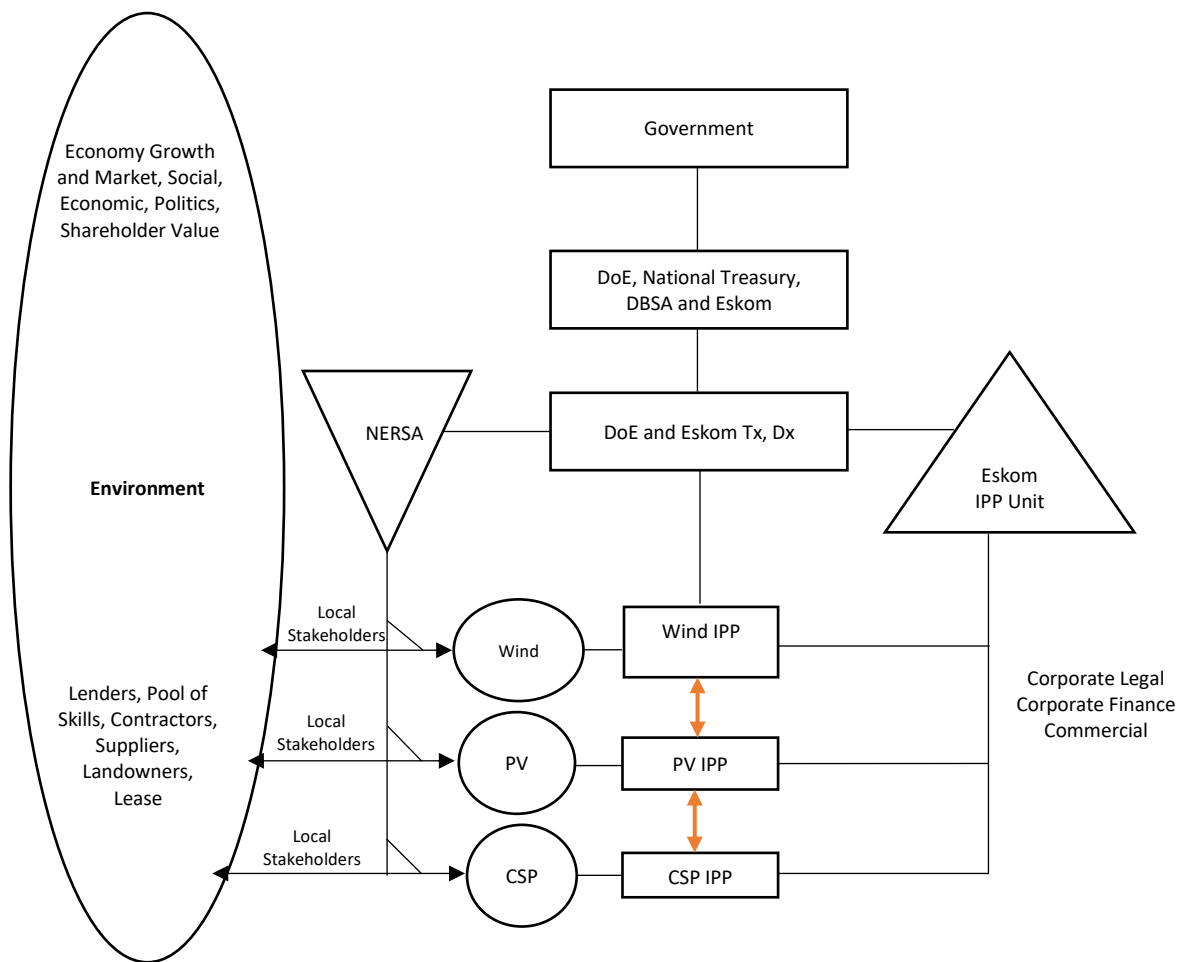


Figure 17: Collaboration within the system-in-focus at Operational Level.

The programme needs to create a platform through which developers may engage each other as competitors and have access to the same information regarding the strategic locations where renewable energy plants can be established. This platform will assist in the increase of collaboration between IPPs and Eskom (as a single buyer of power generated by the IPPs). The collaborative culture established between these stakeholders will improve the local environment and reduce the number of issues that escalate to the DoE. The infrastructure upgrade programmes will be better synchronised with the REIPPPP, ultimately benefiting the IPPs such that they may position their plants where they will be more profitable and technically viable. Nevertheless, the REIPPPP still needs to maintain a competitive and profitable environment; the programme could do this by allowing more players into the electricity generation sector rather than allowing the same IPPs to develop plants in different areas. IPPs will thus be forced to compete on the fair electricity tariffs determined by the programme and to remain profitable and viable. The REIPPPP conflict will always exist in a complex and dynamic environment and thus warrants a system that will ensure stability and control any potential oscillation. In Beer's VSM, this

function is served by System 2 of the system-in-focus, which is discussed in the following section.

5.4.2 Programme coordination and conflict resolution (System 2)

The coordination and conflict resolution functions are important when it comes to enabling the system-in-focus to achieve its objectives. System 2 of the REIPPPP was understood as being served by Eskom's Grid Unit during the diagnosis. This setup bore the potential to produce an unstable situation as Eskom forms part of the operations in System 1 as well as buying electricity generated by the IPPs. The programme needs to develop a well-structured unit within its ranks to coordinate and provide the services highlighted in Chapter 4. This unit will eliminate the sources of oscillation introduced by the different roles played by Eskom. The programme will coordinate the activities that take place in System 1, with Eskom seen as the System 1 unit.

A well-structured unit will improve the internal reporting about what is going on at various operational levels within the programme, thus enhancing the programme's viability. The REIPPPP must manage the legal, financial, metering and pricing activities independently to prevent unfairness from arising in relations between the IPPs and Eskom. This setup will also prevent Eskom from dictating when to sign the PPAs, since the REIPPPP will be in control.

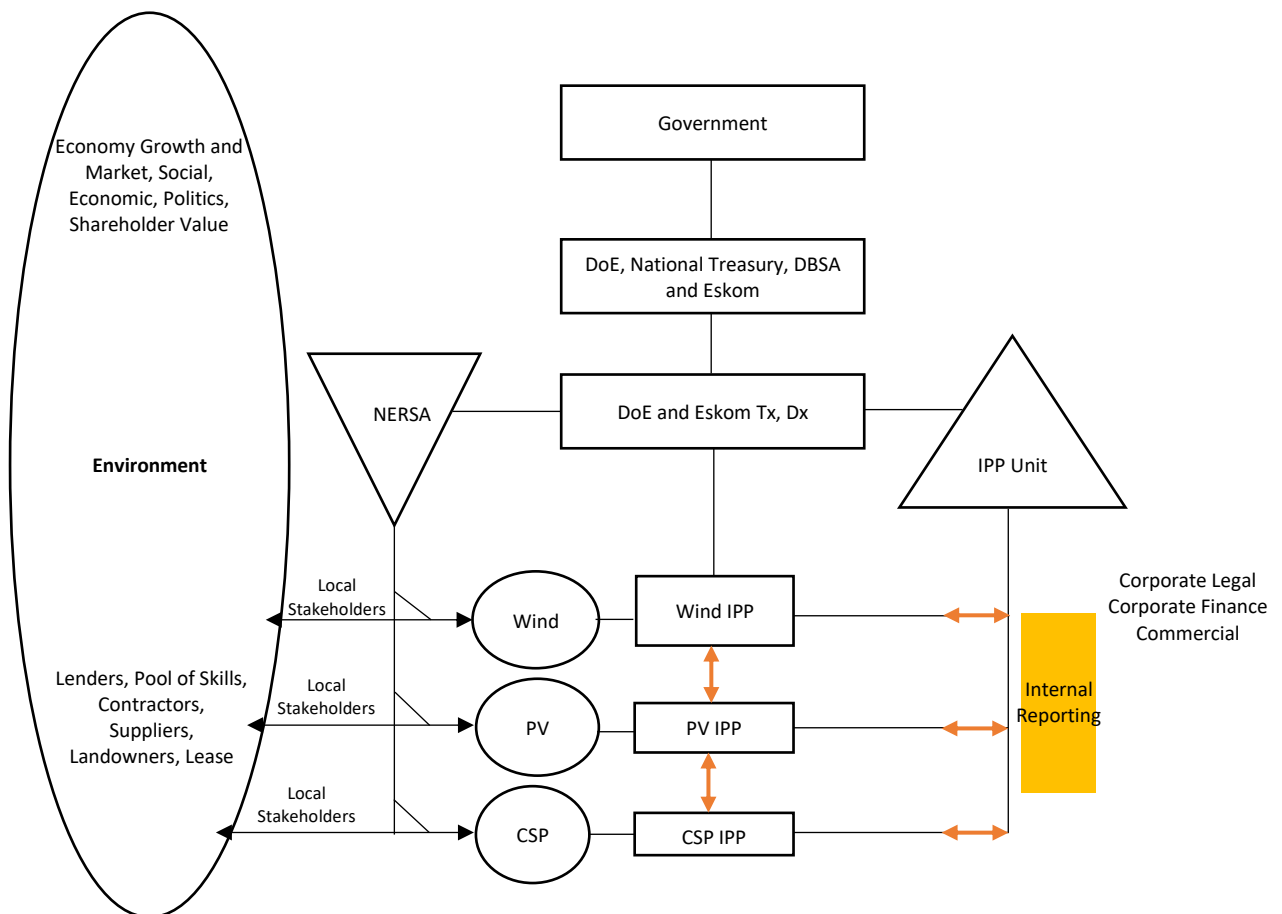


Figure 18: Coordination and conflict resolution design for System 2.

The challenge of managing IPPs that use different renewable energy technologies also introduces the complex issue of applying critical standardised performance indicators to all IPPs in System 1, regardless of the IPPs' locations. For the programme to manage and coordinate the activities of commerce and payment, its principal administrators must have the skills needed to deal with such issues, minimising conflict. IPPs will thus receive increased support at a provincial level during their operation.

5.4.3 Programme optimisation and synergy (System 3)

The VSM diagnosis of the REIPPPP revealed that the management of the programme includes management from both government departments and the private sector, including Eskom senior managers, DoE management, DBSA management and others. System 3 of the programme needs to include management that will represent the REIPPPP in each province (the Provincial REIPPPP Management Unit). Hence, the general managers of each IPP will be allowed to report to the local or provincial manager to improve feedback turnaround time and enhance the REIPPPP's collaboration with the IPPs, eliminating thus any potential conflicts of interest between government departments within the management of System 1 (IPPs). The programme will eliminate the instability that may arise due to political differences between national and provincial government departments. The programme design will be enhanced since provincial managers will be dealing with provincial stakeholders.

The provincial REIPPPP can then establish an audit unit (System 3*) that will visit sites regularly in order to monitor the operating process and report to the provincial REIPPPP unit. Community involvement can be monitored by this system as well, specifically to ensure that the communities are involved in the operation of the business as was committed during the bidding process (the economic development requirement). This unit can be further capacitated to deal with technical audits and compliance with NERSA electricity-generation requirements. Local management will thus be able to manage the system effectively.

Management meetings also need to include local leaders to ensure that the latter is involved in operations, given that local leaders own shares in the operating plant. It was not evident based on the diagnosis how the community receives updates and how their dividends are managed. Gaining the community's trust will involve including them in the decision-making process; in this way, moreover, locals will be enabled to learn more about the renewable energy technologies developed in the area, thus improving skills development and community empowerment in the communities where the plants operate.

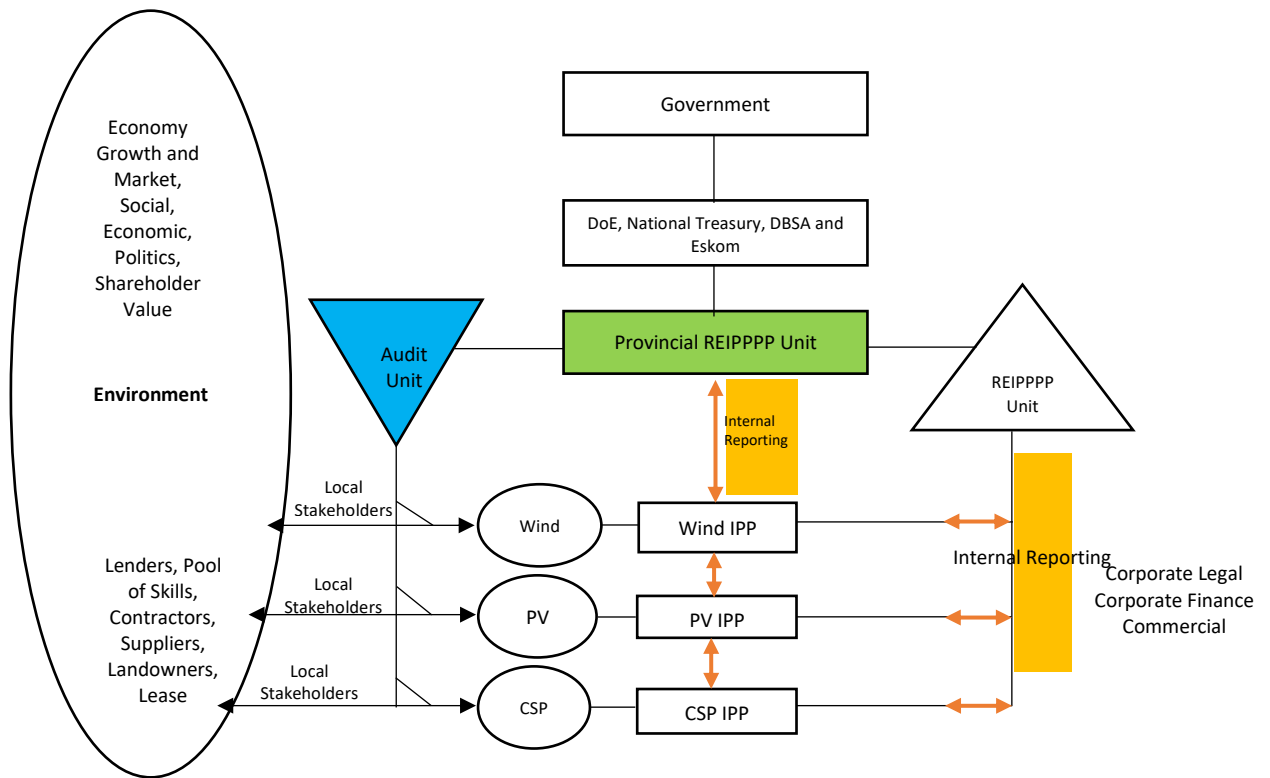


Figure 19: Programme optimisation and synergy (System 3).

The process will also enhance the ways in which the operation (IPPs) employs skilled workers, contractors, suppliers and landowners, among others, all of which need to be local people or companies, as per the programme requirements. The overall System 3 design will be sufficient if it allows the involvement of people with backgrounds in relevant technical expertise, the procurement management framework and legalities.

5.4.4 Programme adaptation and planning (System 4)

According to Beer's VSM, a system is viable if it is capable of responding to external environmental changes that happen during its existence, even if those changes were not predicted by management during the system-in-focus design (Beer, 1979). In the context of the REIPPPP, the external environment includes economic dynamics, market behaviour, politics, global renewable energy trends and demands and the creation of stakeholder value over time.

To continuously scan the external environment, the DoE (System 4) and the South African government need to search for new renewable energy opportunities, such as the localisation of renewable energy technologies. Initiatives like these need to be

aligned with the implementation of the South African government's long-term renewable energy planning and policy implementation. This practice will further enhance South Africa's renewable energy planning in line with advances in the global renewable energy market, helping thus to achieve the goals set by the government (System 5). Since the DoE is integral to the REIPPPP, it is essential that the DoE forms part of the renewable energy policy formation and implementation processes in government; it is essential because the DoE engages the external environment and stakeholders more often in the process of renewable energy development in South Africa.

The viability of the renewable energy programme of South Africa is also highly dependent on the global renewable energy market. It is critical that the programme aligns with the trends of renewable energy development across the world, as most of the technologies are being used in other countries. This alignment will assist in the development of mature technologies that have been tried and tested in other countries. As a result, South Africa will be in a position to align the development of these technologies with its own demand for electricity (for a time when more energy is required), as demand varies with weather patterns and time zoning.

The absence of research and development in the programme means that the REIPPPP risks not keeping up with changes in technology supply and the challenges posed by the existing market technology. There is a gap between national utility and the programme planning activities. Eskom infrastructures were not considered in the initial renewable energy planning, capacity allocation and approval decision processes, leading to an over-abundance of electricity, which Eskom infrastructure cannot accommodate, and the creation of surplus energy, which Eskom needs to buy, as per the PPA. Hence, the presence of the *Research and Development* unit within the REIPPPP is seen as a critical part of the programme. This unit will improve the speed with which the programme responds to the external environment, including technological changes and the slowing of market activity. Including the *Research and Development* unit in the programme will also improve the turnaround time of any necessary changes and developments in the renewable energy policy because the government will be continuously updated on current trends and demands in the renewable energy sector. In collaboration with the DBSA, moreover, the South African government will be able to source funds for any developments aimed at improving the programme's efficiency.

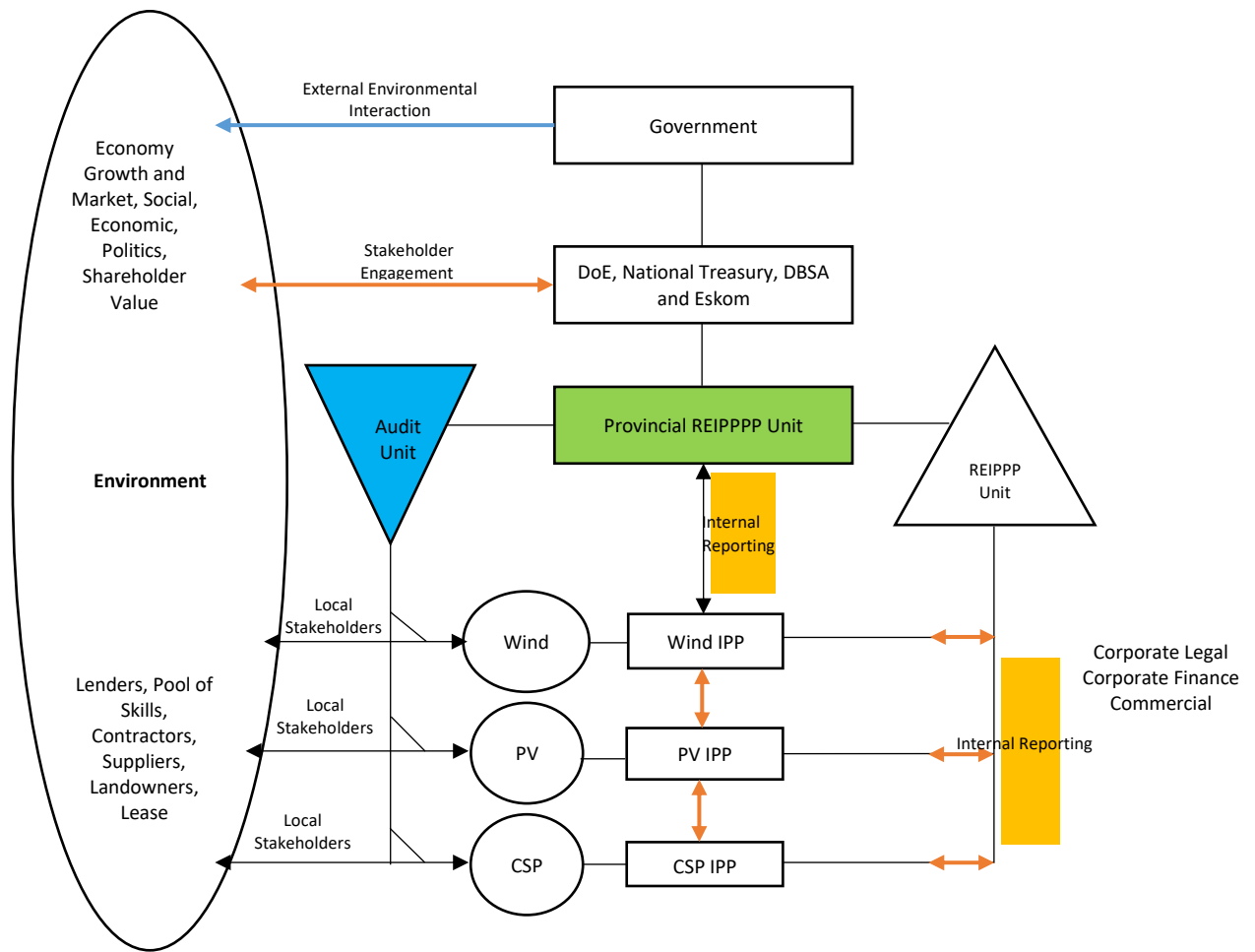


Figure 20: Programme adaptation and planning (System 4).

In fact, one of the critical factors is programme funding. It emerged that the REIPPPP relied on the bidders' application fees and government contributions in the running of the programme. In addition, to ensure the viability of a programme of this magnitude, a proper funding model must be developed. Through this model, the programme processes will be implemented pro-actively. One way to develop this model would be to allocate a certain percentage of the profit made by the IPPs to the programme funding. These funds will be allotted to the budget for the development of further infrastructure, which will allow more renewable energy to be developed. This funding model will increase the pressure on government and Eskom to fund IPPs' related projects using their budgets. The practice will further standardise the amount of energy to be procured per bidding window, as per the REIPPPP roll out plan.

The rate at which the South African REIPPPP has implemented the renewable energy programme has resulted in a bottleneck in the development of transmission and distribution infrastructure. It emerged that Eskom distribution networks are constrained and that this constraint forces the connection of IPPs to the transmission networks, a

process that requires more capital as transmission networks are more expensive to develop; this constraint also increases the application fees and other costs for developers at the same time as the prices per kilowatt hour of power are on the constant decline. The effect lowers the profitability of renewable energy plants still to be developed and threatens programme viability. In order to deal with this kind of problem, the rate at which the renewable energy plants are developed needs to be decreased; this decrease can be achieved by providing three to five years as a cooling period between REIPPPP bidding windows. Stakeholders will thus be able to reflect and learn from the previous bidding window and become better prepared for the following one. The developers will also have time to review their financial projections and estimates based on the new price per kilowatt hour of energy that will be offered for the specific technology.

5.4.5 Programme authority and policy (System 5)

Renewable energy policy development and implementation is the South African government's responsibility. As discussed in Chapter 4, the White Paper on Renewable Energy Policy forms the basis of the renewable energy policy of South Africa. Owing to the current programme setting, this responsibility will remain that of the government, while the Minister of Energy continues to oversee the REIPPPP and reports directly to the government. To further improve the development of the renewable energy policy and related policies (for instance, environmental management policy), learning that occurs at the provincial REIPPPP level (System 3) needs to be communicated by management to the DoE (System 4). These lessons will be incorporated in the feedback or external environmental scanning information, thus influencing the government's future policy development (System 5).

Public consultation needs to be strengthened in order to improve policy implementation. Private investors and other stakeholders can influence policy development only if public consultation is conducted systematically at all levels of society. Improved public consultation will in turn improve local communities' engagement with the programme and assist in identifying challenges that IPPs might face should the policy implementation not address them. In this sense, the programme will run smoothly, with local communities taking ownership, and will fully support the projects for years to come. What is needed is a two-way and continuous flow of information between the policy implementation agent (the Minister of Energy) and the provincial REIPPPP units.

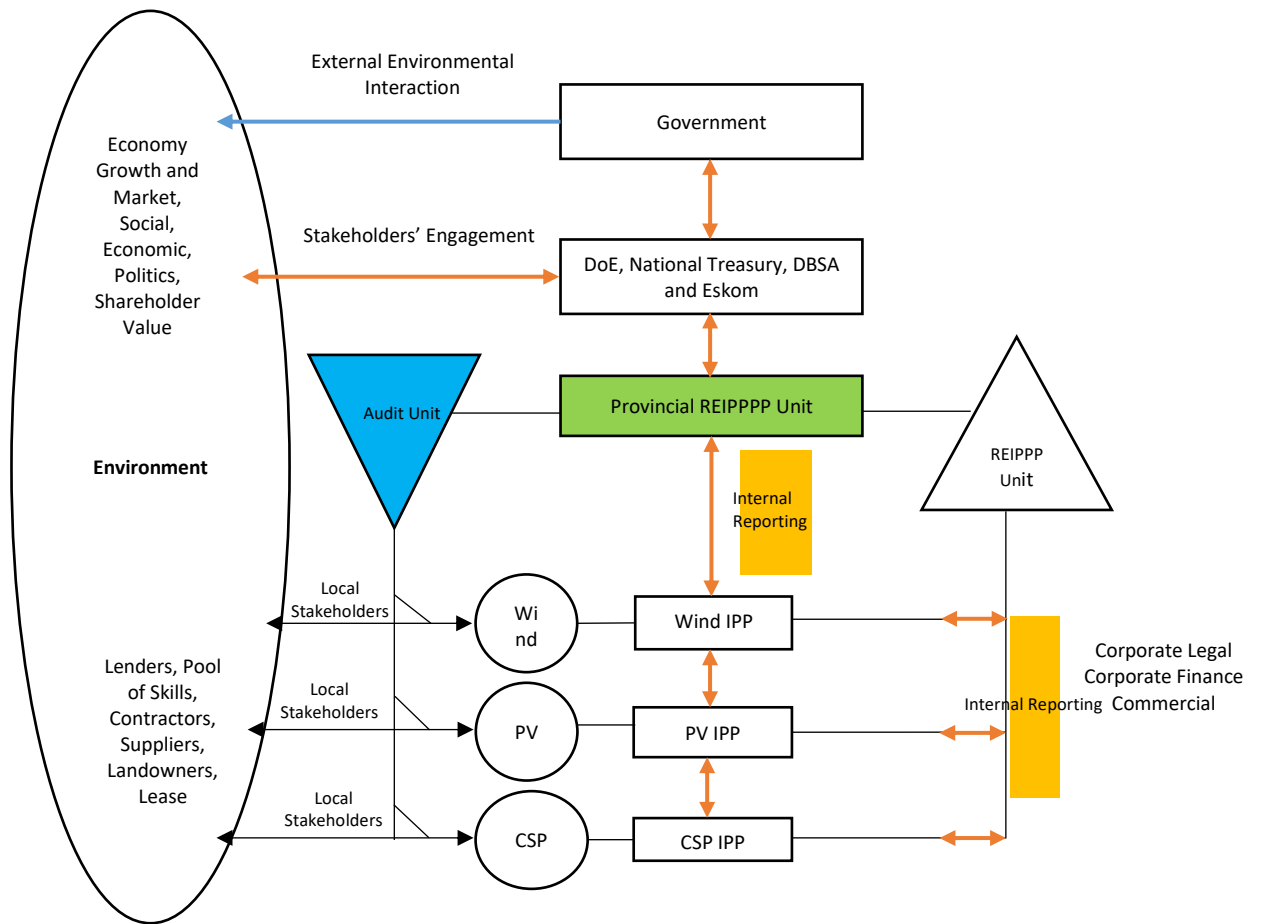


Figure 21: Programme authority and policy (System 5).

The South African procurement framework was identified as one of the challenges that IPPs are facing. During policy development, these issues need to be addressed and made clear to local and international investors. If IPPs are to be exempted from some South African procurement policy requirements, this fact needs to be addressed by policy-makers and renewable energy programme implementation agents. In essence, the implementation of the renewable energy policy will become more active and more transparent to the public and to investors.

5.5 Summary

In this chapter, REIPPPP institutional diagnosis and modelling was done using Beer's VSM in order to further understand the REIPPPP's operations and design shortcomings. The following chapter details recommendations for future studies by further unpacking and understanding the REIPPPP in South Africa.

6.1 Introduction

This chapter makes recommendations for future studies in the field of renewable energy development. The chapter also considers the issue of the validity and transferability of this study's findings, after which the conclusion of the study is drawn. This study's conclusion focuses primarily on the factors identified, as per its objectives.

6.2 Validity and transferability

6.2.1 Validity of this research

The adequacy of the cause for concern and the answer developed are discussed in this section in order to establish the legitimacy of the information presented. This research was undertaken to understand better the factors that impact on the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and thus threaten the viability of independent power producers (IPPs) in the South African renewable energy market. Factors were identified using a literature review, interviews and online surveys as data collection methods, thus substantiating the answer to the first research question. These methods were used to ensure that the triangulating strategy was implemented, thus validating the research findings. The second research question was dealt with using the viable system model (VSM), which suggested ways in which the factors identified could be managed at different levels of the programme (organisation) to ensure the IPPs' viability.

6.2.2 Transferability of research findings

Since the research was undertaken as a case study focused on the Northern Cape, and since only IPPs from this province were involved, the results of this research may also be applied to other provinces in South Africa, as well as to other developing countries in Africa, in the interest of addressing concerns around renewable energy development; for example, the issue of sustainable programme funding is a common issue in developing countries, and so these countries should first ensure that funds for such programmes are available or else develop a funding model for this kind of renewable energy programme. This point is made regardless of which technology is preferred by the specific country's authorities.

6.3 Future studies

The scope of this research was limited to an attempt to understand the factors impacting on the South African REIPPPP, and to establish the way in which these factors might be managed so that IPPs are a viable option in the South African renewable energy market. Therefore, future researchers will benefit greatly from

knowing the factors that impact on the programme, as identified by this research, and ways in which they could be managed.

Future studies could look deeper into the following issues, which were considered fundamental and which face the development of renewable energy infrastructures, especially in developing countries, where existing laws and policies are not accommodating:

- The development of a funding model for the renewable energy programmes of developing countries will ensure equal benefits for both investors and governments. These benefits could incorporate the cost recovery methods of IPP infrastructure and related projects that are developed by Eskom.
- The design of an adequate programme management process will ensure sustainable, competitive and profitable energy tariffs for the IPPs without passing the cost to consumers.
- In the literature, it emerged that poor policy implementation and the government's inability to manage a programme of that magnitude contribute to the failure of most countries to successfully develop a renewable energy sector. In the future, research could examine the impact poor renewable energy policy implementation has on the country's economic development and on other policies.

6.4 Conclusion

The primary aim of this research was to understand the factors that impact on the REIPPPP of South Africa, as mentioned in 1.3. The system approach to problem-solving was employed, providing the framework that shaped this research and enabling thus the achievement of its objectives. The following table contains a summary of the conclusions that were drawn and which pertain to the 10 factors identified, after which the VSM results are summarised.

- Poor programme design

The study identified poor programme design as one of the factors impacting on the renewable energy development process. The government needs to consider institutionalising the programmes in order to maintain the stability and continuity of such programmes. Institutionalising programmes will also enhance the viability of renewable energy development programmes.

- Slow renewable energy market growth

The success of the REIPPPP is highly dependent on the global renewable energy market's growth. This means that international economics have an impact on the rate at which renewable energy needs to be developed in South Africa. Ignoring this factor will result in a number of delays in the realisation of projects and IPPs will thus lose out on investment.

- Lack of competitive and profitable tariffs

It emerged that the maintenance of the competitive environment is crucial to end-product generation. Investors are in the business of making money and the lack of competitive tariffs might discourage them from entering the South African renewable energy market. As a result, tariffs must be kept profitable at all times, ensuring continuity in renewable energy development in South Africa.

- Insecure programme funding

Programme funding is crucial to the viability of the REIPPPP's continuity. The programme's dependence on IPP application fees threatens the continuity of the programme. The government must look for a funding model that will ensure sustainability.

- Poor policy implementation

Policy implementation will determine the lifespan of the programme. The renewable energy policy should be implemented in parallel with other policies, especially policies regarding greenhouse gas emissions, to justify the high cost of renewable energy implementation.

- Lack of expertise and skills

The programme needs to develop expertise in both decision-making and operations within the renewable energy sector. This development will assist South Africa in becoming less dependent on international experts for the management of a programme of this magnitude.

- Lack of development in local communities

South Africa still faces a high level of poverty, especially in rural areas. The lack of development in areas where IPPs establish their plants will lead communities to boycott the projects. This issue speaks directly to the trust that must be established between the REIPPPP and local communities. The proper administration of this trust and other government programmes will help alleviate this concern.

- The high rate of project implementation

The South African government needs to review the rate at which the IPP projects are being developed. South Africa is still a developing country, and so developing such projects at a very high rate will result in high capital cost, the funds for which could have been used to address other social issues. Development also puts great pressure on existing electrical infrastructure, which cannot be upgraded quickly, further increasing the capital requirement.

- Poor management of economic development criteria

Imperfect development of the economic development criteria will have a significant impact on future projects. If these criteria are not met by IPPs or are reported incorrectly, the wrong feedback might be sent to the owners of the programme.

The REIPPPP has successfully facilitated the implementation of IPP projects in South Africa between Rounds 1 and 4. As the programme matures, however, a number of constraints emerge and impact subsequently on the programme's operation. The VSM helped to identify the lines of reporting and responsibility in the programme and the level that the factors identified impact. Using the VSM, and taking into account the cybernetics laws and principles, a new model has been designed for the REIPPPP for the purpose of managing factors that introduce complexity and threaten the viability of the programme.

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APPENDIX A: RESEARCH CONSENT FORM

CONSENT TO PARTICIPATE IN RESEARCH

A VIABILITY STUDY OF INDEPENDENT POWER PRODUCERS IN THE NORTHERN CAPE ELECTRICITY SUPPLY MARKET: A CASE STUDY OF NORTHERN CAPE PROVINCE.

You are kindly requested to participate in a research study conducted by *Bongani Nyawo*, from the *Department of Mechanical Department at University of Cape Town*. The results of this research will contribute to a Master's dissertation.

1. PURPOSE OF THE STUDY

The study aims to assess the viability of the Independent Power Producers in the Northern Cape Province. The study is designed to establish influence of economic, social, environmental and technical factors have on the IPPs viability in the province.

2. PROCEDURES

If you volunteer to participate in this study, I will ask you to do the following things:

- I. Partake in a first voice-recorded interview or notes will be taken of approximately 40 - 60 minutes which will be a semi-structured conversation at your work institution (office).

3. POTENTIAL RISKS AND DISCOMFORTS

There are low foreseeable risks or discomforts in participating in this study.

4. POTENTIAL BENEFITS TO SUBJECTS

Effective management of IPPs and Contribute to Renewable Energy Policy

5. PAYMENT FOR PARTICIPATION

No payment will be received for participation.

6. CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of anonymity and safe-keeping of data in a personalized pass-word file to which only the researcher has access. The data will be stored on the researcher's password secure laptop. Each interview will be coded in a manner that no identification of institution and individual interviewed will be recognizable. Identities will only be known to the researcher. Only codes will be used for any publication of the data. Individual participants will have the opportunity to review analyzed data of their interviews.

7. PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study.

8. IDENTIFICATION OF RESEARCHER

If you have any questions or concerns about the research, please feel free to contact the researcher's supervisors Dr. Corrine Shaw Corrinne.Shaw@uct.ac.za.

9. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study.

SIGNATURE OF RESEARCH SUBJECT

The information above was described to *me* in *English* and *I am the participant* in command of this language. *I was* given the opportunity to ask questions and these questions were answered to satisfaction.

[I hereby consent voluntarily to participate in this study] I have been given a copy of this form.

Name of Participant

Signature of Participant

Date

SIGNATURE OF RESEARCHER

I declare that I explained the information given in this document to _____. [He/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in *English and no translator was used.*

Signature of Researcher

Date

APPENDIX B: INTERVIEWS INTRODUCTORY SCRIPT

Introductory and Closing Script

Opening Remarks

Good Morning/Afternoon/ Evening (**Participants Name**)

Thank you very much for availing yourself for this interview today to participate in my Master's research study. My name is Bongani Nyawo; I'm currently a master's student at the University of Cape Town.

The purpose of this study is to *understand* the factors that affect renewable energy independent power producer procurement Programme (REIPPPP) since its inception to date with the intentions to develop a viable system model of how these factors must be managed effectively to ensure a sustainable renewable energy independent power producer procurement Programme (REIPPPP).

I have a consent form here for you to review and sign before we get started. (*I read out the sections of the consent form to the participant*).

Do you have any questions before we get started?

..... (Interview questions).....

Closing Remarks

Thank you very much for your time and valuable input to my research study. Is there anything else you would like to add or comment on?

Thank you so much for your time!

APPENDIX C: INTERVIEWS QUESTIONNAIRE

A VIABILITY STUDY OF INDEPENDENT POWER PRODUCERS IN THE NORTHERN CAPE ELECTRICITY SUPPLY MARKET: A CASE STUDY OF NORTHERN CAPE PROVINCE

Background: The Republic of South Africa has in the past tried to develop renewable energy through Renewable Energy Feed-In- Tariffs (REFIT). There was a high uncertainty of legality of feed –in-tariffs within South African procurement frame work and Eskom ability to manage the Programme of such magnitude was in question. Subsequently, the Department of Energy and National Treasury reconsidered the approach of renewable development in South African electricity market. In 2011 the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) was established to facilitate renewable energy development in South Africa. The Programme has managed to facilitate the development of #200 independent power producers in South Africa.

Aim of the Study: To *understand* the factors that affect renewable energy independent power producer procurement Programme (REIPPPP) since its inception to date with the intentions to develop a viable system model of how these factors must be managed effectively to ensure sustainable renewable energy independent power producer procurement Programme (REIPPPP).

Research Objectives:

1. Identify factors affecting the development of renewable energy
2. Perform a viable system diagnosis on REIPPPP Programme design and setting
3. Develop a viable system model that will ensure the sustainable independent power producers in South African Electricity Market.

Interviews Questions

SECTION A BIOGRAPHY

A-B1 What qualification do you possess?

A-B2 How many years of work experience do you have?

A-B3 How many years of work experience do you have in renewable energy environment or dealing with renewable energy projects?

A-B4 Are you originally from the Northern Cape Province? (Yes / No)

A-B5 What does your role entails in the development/ or management of independent power producers in the Northern Cape Province?

GENERAL

G-1 In your own understanding, please explain to me what are the key roles of the renewable energy independent power producer procurement programme (REIPPPP)?

SECTION B SYSTEM 1

B-S1A What factors influence the development of renewable energy infrastructure in the Northern Cape Province?

B-S1B In what ways will Eskom denationalization or privatization affect renewable energy independent power producer programme?

B-S1C How will the development of more non-renewable electricity plants in South Africa affect renewable energy independent power producer programme (REIPPPP)?

B-S1D Should Eskom development more renewable energy plants to meet electricity demand, how will this affect the renewable energy independent power producer procurement programme?

B-S1E What performance indicators are being used?

SECTION C SYSTEM 2

C-S2A In what ways does the renewable energy independent power producer procurement programme support the local Independent Power Producers?

C-S2B What are the supporting structures available for Independent Power Producers operating in the Northern Cape Province?

C-S2C What additional support do you think the Independent Power Producers require from REIPPPP programme to ensure profitability in the renewable energy industry in the Northern Cape?

SECTION D SYSTEM 3

D-S3A What are the critical qualifying criteria that REIPPPP programme uses during bidding rounds?

D-S3B How do REIPPPP programme manage these qualifying criteria?

D-S3C Who oversees the performance and management of Power Purchase Agreements?

D-S3D At what extent is REIPPPP programme synchronized with Eskom infrastructure upgrade and refurbishment plans?

SECTION E SYSTEM 4

E-S4A What is the level of local independent power producer participation on the renewable energy independent power producer procurement programme (REIPPPP)?

E-S4B What are the key attributes of REIPPPP programme that makes investors have confidence investing in South African renewable energy market?

E-S4C What are the risks associated with South Africa's renewable energy independent power procurement programme moving forward?

F-S5A Who design policy that govern REIPPPP programme in South Africa?

F-S5B What key elements do you think the renewable energy policy should include in support of independent power producers in South African electricity generation market?

F-S5C In what ways is the climate change policy supportive of the development of renewable energy in South Africa?

F-S5C In what ways is the climate change policy fail to adequately support the development of renewable energy?

Closing Remarks

Thank you very much for your time and valuable input to my research study. Is there anything else you would like to add or comment on?

Thank you so much for your time!

APPENDIX D: ONLINE SURVEY QUESTIONNAIRE

A VIABILITY STUDY OF INDEPENDENT POWER PRODUCERS IN THE NORTHERN CAPE ELECTRICITY SUPPLY MARKET: A CASE STUDY OF NORTHERN CAPE PROVINCE						
Background	The republic of South Africa has in the past try to develop renewable energy through renewable energy feed-in- tariffs (REFIT). There was a high uncertainty of legality of feed –in-tariffs within South African procurement frame work and Eskom ability to manage the program of such magnitude was in question. Subsequently, the Department of Energy and National Treasury reconsidered the approach of renewable development in South African electricity market. In 2011 the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) was establish to facilitate renewable energy development in South Africa. The program has managed to facilitate the development of #200 independent power producers in South Africa.					
Aim of the Study	To understand the factors that affect renewable energy independent power producer procurement program (REIPPPP) since its inception to date with the intentions to develop a viable system model of how these factors must be managed affectively to ensure a sustainable renewable energy independent power producer procurement program (REIPPPP).					
Research Objectives	The research primary objective is to understand factors that impact on the Renewable Energy IPP Procurement Programme (REIPPPP) (South African government Renewable Energy Programme). The secondary objectives of this research is to do an institutional setting diagnosis using Viable System Model with an intention to develop a Viable System Model of how the factors impacting on Renewable Energy IPP Procurement Programme could be managed effectively to ensure programme viability.					
Survey Questions						
Q1	I understand the information about this research project and I agree to participate in this survey					
	Yes		No			
Q2	2. Participant back ground information					
	2.1	What is your profession?				
		Engineer	Environmenta l specialist	Finance personne l	Project Manage r	other
	2.2	How many years of experience do you have in your field?				
		< 5 years	5 - 10 years	10 - 15 years	> 15 years	
2.3	How many years of experience do you have in working with renewable energy related projects?					
	< 5 years	5 - 10 years	10 - 15 years	> 15 years		

Q3	3.1 On the scale of 1 - 5, Please rank your understanding of the role of the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) in the development of renewable energy in South Africa.					
		1	2	3	4	5
	3.2 What have been strengths of the renewable energy independent power producer procurement program (REIPPPP)?					
	3.3 What have been weaknesses of the renewable energy independent power producer procurement program (REIPPPP)?					
	3.4 Which bidding round of REIPPPP program was more successful?					
		Round 1	Round 2	Round 3	Round 4	
	Please Explain your answer					
Q4	4.1 On the scale of 1 - 5, Please rank your understanding of the following					
		1- Have no idea	2	3	4	5 - Extremely Knowledgeable
	South Africa's Renewable Energy Policy					
	Environmental Policy					
	South Africa's Procurement Framework					
	4.2 Major factors contributing to the renewable energy development in South Africa					
		1 - Total Disagree	2	3	4	5 - Strongly Agree
	Economic					
	Climate Change concerns					
	Fossil Fuel depletion					
	Electricity Security					
	4.3 The renewable success in South Africa can be attributed to					
		1 - Total Disagree	2	3	4	5 - Strongly Agree
Political Support						

	REIPPPP Program setting/design					
	Economic Development Criteria					
	Demand for Renewable Energy					
	Clear Renewable Energy Policy					
	4.4 Factors that attract investors in South African renewable energy market					
		1 - Total Disagree	2	3	4	5 - Strongly Agree
	REIPPPP Program management					
	Potential projects profitability					
	Decline in renewable market in developed countries					
	Exploring new Renewable Energy market					
Q5	5.1 The success of the renewable energy development in the Northern Cape is highly dependent on Eskom infrastructure upgrade and refurbishment.					
		1 - Total Disagree	2	3	4	5 - Strongly Agree
	5.2 Eskom denationalization or privatization will negatively affect the renewable energy independent power procurement program.					
		1 - Total Disagree	2	3	4	5 - Strongly Agree

	5.3 Eskom development of more renewable energy plants to meet electricity demand will affect renewable energy independent power producer procurement program.	1 - Total Disagree	2	3	4	5 - Strongly Agree
Q6	6.1 What are the risks (Investment, technical or environmental etc.) associated with the development of renewable energy in South Africa? Please explain					
Q7	In what ways will Eskom denationalization or privatization affect renewable energy independent power producer program? Please explain					
Q8	In what ways will the development of another nuclear plant in South Africa affect renewable energy independent power producer procurement program (REIPPPP)? Please explain					
Q9	In what ways does the renewable energy independent power producer procurement program support the local Independent Power Producers? Please explain					
Q10	What are the risks associated with South Africa's renewable energy independent power procurement program moving forward? Please explain					

APPENDIX E: ETHICS APPLICATION FORM

EBE Faculty: Assessment of Ethics in Research Projects

Any person planning to undertake research in the Faculty of Engineering and the Built Environment at the University of Cape Town is required to complete this form before collecting or analysing data. When completed it should be submitted to the supervisor (where applicable) and from there to the Head of Department and then to the Faculty Office.

If you have answered YES to any of the above questions you will need to make an online submission to the EBE Ethics in Research Committee, via the following link: <https://universityofcapetown.submittable.com/submit/39349>. Please note that this form must still be filled out, signed and uploaded onto the online ethics application site.

Students must include a copy of the completed form with the dissertation/thesis when it is submitted for examination.

Name of Principal Researcher/Student: **Bongani Nyawo**

Department: **Mechanical Department**

If a Student: Degree: **Master of Philosophy (Engineering Management)** Supervisor:

If a Research Contract indicate source of funding/sponsorship:

Research Project Title: **A Viability Study of Independent Power Producers in the South African Electricity Supply Market: CASE STUDY IN NORTHERN CAPE PROVINCE**

Overview of ethics issues in your research project:

Question 1: Is there a possibility that your research could cause harm to a third party (i.e. a person not involved in your project)?	YES	<input checked="" type="radio"/> NO
Question 2: Is your research making use of human subjects as sources of data? If your answer is YES, please complete Addendum 2.	<input checked="" type="radio"/> YES	NO
Question 3: Does your research involve the participation of or provision of services to communities? If your answer is YES, please complete Addendum 3.	YES	<input checked="" type="radio"/> NO
Question 4: If your research is sponsored, is there any potential for conflicts of interest? If your answer is YES, please complete Addendum 4.	YES	<input checked="" type="radio"/> NO

If you have answered YES to any of the above questions, please append a copy of your research proposal, as well as any interview schedules or questionnaires (Addendum 1) and please complete make an online submission to the EBE Ethics in Research Committee, via the following link: <https://universityofcapetown.submittable.com/submit/39349>.

I hereby undertake to carry out my research in such a way that

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

Signed by:

	Full name and signature	Date
Principal Researcher/Student:	BONGANI NYAWO	27/07/2015

This application is approved by:

Supervisor (if applicable):		21/09/15
HOD (or delegated nominee): Final authority for all assessments with NO to all questions and for all undergraduate research.		
Chair : Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the above questions.		9 Mar 2017

This application was approved in 2015 but a signature was not obtained in 2015. Hence the signature in 2017

ADDENDUM 1:

Please append a copy of the research proposal here, as well as any interview schedules or questionnaires:

ADDENDUM 2: To be completed if you answered YES to Question 2:

It is assumed that you have read the UCT Code for Research involving Human Subjects (available at <http://web.uct.ac.za/depts/educate/download/uctcodeforresearchinvolvinghumansubjects.pdf>) in order to be able to answer the questions in this addendum.

2.1 Does the research discriminate against participation by individuals, or differentiate between participants, on the grounds of gender, race or ethnic group, age range, religion, income, handicap, illness or any similar classification?	YES	<input checked="" type="radio"/> NO
2.2 Does the research require the participation of socially or physically vulnerable people (children, aged, disabled, etc) or legally restricted groups?	YES	<input checked="" type="radio"/> NO
2.3 Will you not be able to secure the informed consent of all participants in the research? (In the case of children, will you not be able to obtain the consent of their guardians or parents?)	YES	<input checked="" type="radio"/> NO
2.4 Will any confidential data be collected or will identifiable records of individuals be kept?	<input checked="" type="radio"/> YES	NO
2.5 In reporting on this research is there any possibility that you will not be able to keep the identities of the individuals involved anonymous?	YES	<input checked="" type="radio"/> NO
2.6 Are there any foreseeable risks of physical, psychological or social harm to participants that might occur in the course of the research?	YES	<input checked="" type="radio"/> NO
2.7 Does the research include making payments or giving gifts to any participants?	YES	<input checked="" type="radio"/> NO

If you have answered YES to any of these questions, please describe how you plan to address these issues (append to form):

ADDENDUM 3: To be completed if you answered YES to Question 3:

3.1 Is the community expected to make decisions for, during or based on the research?	YES	NO
3.2 At the end of the research will any economic or social process be terminated or left unsupported, or equipment or facilities used in the research be recovered from the participants or community?	YES	NO
3.3 Will any service be provided at a level below the generally accepted standards?	YES	NO

If you have answered YES to any of these questions, please describe how you plan to address these issues (append to form)

ADDENDUM 4: To be completed if you answered YES to Question 4

4.1 Is there any existing or potential conflict of interest between a research sponsor, academic supervisor, other researchers or participants?	YES	NO
4.2 Will information that reveals the identity of participants be supplied to a research sponsor, other than with the permission of the individuals?	YES	NO
4.3 Does the proposed research potentially conflict with the research of any other individual or group within the University?	YES	NO

If you have answered YES to any of these questions, please describe how you plan to address these issues (append to form)

APPENDIX F: NORTHERN CAPE IPP PROJECTS

Technology	Capacity (MW)	Programme	Status
Solar Photovoltaic (PV)	82.5	REIPPPP Window 3	Construction
Solar Photovoltaic (PV)	40	REIPPPP Window 4	Approvals, planning and financing
Concentrated Solar Thermal (CSP)	50	REIPPPP Window 2	Fully operational
Onshore Wind	102	REIPPPP Window 4	Approvals, planning and financing
Solar Photovoltaic (PV)	50	REIPPPP Window 1	Fully operational
Solar Photovoltaic (PV)	75	REIPPPP Window 4	Approvals, planning and financing
Solar Photovoltaic (PV)	50	REIPPPP Window 1	Fully operational
Solar Photovoltaic (PV)	75	REIPPPP Window 4	Approvals, planning and financing
Solar Photovoltaic (PV)	75	REIPPPP Window 4	Approvals, planning and financing
Concentrated Solar Thermal (CSP)	100	Other	Awaiting construction (approved and financed)
Onshore Wind	136	REIPPPP Window 4	Approvals, planning and financing
Solar Photovoltaic (PV)	10	REIPPPP Window 1	Fully operational
Solar Photovoltaic (PV)	55	REIPPPP Window 4	Approvals, planning and financing
Solar Photovoltaic (PV)	19.9	REIPPPP Window 1	Fully operational
Concentrated Solar Thermal (CSP)	100	REIPPPP Window 3	Construction
Solar Photovoltaic (PV)	75	REIPPPP Window 2	Fully operational
Solar Photovoltaic (PV)	72.5	REIPPPP Window 1	Fully operational
Onshore Wind	137	REIPPPP Window 4	Approvals, planning and financing
Onshore Wind	140	REIPPPP Window 4	Approvals, planning and financing
Solar Photovoltaic (PV)	75	REIPPPP Window 1	Fully operational
Concentrated Solar Thermal (CSP)	100	REIPPPP Window 3	Awaiting construction (approved and financed)
Concentrated Solar Thermal (CSP)	100	REIPPPP Window 1	Fully operational
Concentrated Solar Thermal (CSP)	50	REIPPPP Window 1	Fully operational
Onshore Wind	138	REIPPPP Window 3	Construction
Solar Photovoltaic (PV)	75	REIPPPP Window 4	Approvals, planning and financing
Technology	Capacity (MW)	Programme	Status

Solar Photovoltaic (PV)	64	REIPPPP Window 1	Fully operational
Solar Photovoltaic (PV)	36.8	REIPPPP Window 2	Fully operational
Onshore Wind	138	REIPPPP Window 3	Construction
Onshore Wind	139	REIPPPP Window 3	Awaiting construction (approved and financed)
Onshore Wind	96	REIPPPP Window 3	Awaiting construction (approved and financed)
Solar Photovoltaic (PV)	75	REIPPPP Window 3	Construction
Solar Photovoltaic (PV)	9.7	REIPPPP Window 1	Fully operational
Solar Photovoltaic (PV)	19.9	REIPPPP Window 1	Fully operational
Solar Photovoltaic (PV)	75	REIPPPP Window 3	Construction
Small Hydro	10	REIPPPP Window 2	Fully operational
Onshore Wind	72.8	REIPPPP Window 1	Fully operational
Onshore Wind	79	REIPPPP Window 3	Construction
Concentrated Solar Thermal (CSP)	100	REIPPPP Window 3	Awaiting construction (approved and financed)
Solar Photovoltaic (PV)	75	REIPPPP Window 4	Approvals, planning and financing
Solar Photovoltaic (PV)	74	REIPPPP Window 2	Fully operational
Solar Photovoltaic (PV)	75	REIPPPP Window 1	Fully operational
Solar Photovoltaic (PV)	75	REIPPPP Window 1	Fully operational
Solar Photovoltaic (PV)	75	REIPPPP Window 4	Approvals, planning and financing
Onshore Wind	139	REIPPPP Window 4	Approvals, planning and financing
Solar Photovoltaic (PV)	8.9	REIPPPP Window 2	Fully operational
Concentrated Solar Thermal (CSP)	100	REIPPPP Window 3	Construction

APPENDIX G: CODED FACTORS FROM LITERATURE

C1-01	Programme Management
C00	Implementation power purchase
C01	administrative arrangements
C02	DoE Management team
C03	Experience Advisors
C04	Transparency
C05	Senior government officials
C06	Local authorities
C07	Other programmes
C08	Management control
C09	Trade unions
C10	Political support
C11	Independent System
C12	Independent market operator
C13	SME's Involvement

C1-04	Programme Funding
C00	Equity shareholders
C01	Corporate financing arrangement
C02	Long-term finance of projects
C03	Financial Resources
C04	Reliance of bidders registration fees
C05	Government budget
C06	Capital investment
C07	Sources of funding
C08	High transection costs
C09	Risk Insurance

C1-05	Competitive and Profitable Tariffs
C1-00	Competitive prices per megawatt
C1-01	Competitive Tendering
C1-02	Reasonable profit

C1-02	Programme Design
C00	Competitive tendering
C01	Economic development commitments
C02	Primarily rural communities beneficiaries
C03	Major contractual agreements
C04	Financial close
C05	Local content terms
C06	Ad-hoc Institutional setting
C07	Institutional capability
C08	Incentives for private sector
C09	Economic development requirements
C10	Formal Institution
C11	Bidding process structure
C12	Programme stakeholders
C13	Regulatory framework
C14	Licensing process
C15	Transparent procurement procedure
C16	Public-Private Partnership
C17	Bid requirements
C18	Qualification requirements
C19	Evaluation criteria
C20	Contract term
C21	Project structure
C22	Legal qualifications
C23	Environmental Approvals
C24	Development Risk
C25	Job creation
C26	Local ownership
C27	Enterprise development
C28	Socio-Economic development
C29	Community development
C30	Performance monitoring

C1-03	Electricity Market Structure
C00	Infrastructure investment
C01	International utilities
C02	Electricity tariffs
C03	Emerging market
C04	National power utility
C05	Single buyer model
C06	Reliance on coal
C07	Monopoly on power generation
C08	Economic
C09	Components manufacture
C10	Vertical integration supply chain
C11	Domestic industrialization
C12	Cost of electricity
C13	Eskom financial standing

C1-07	Policy Implementation
C00	Preferential procurement policy framework
C01	Preferential procurement policy exemption
C02	Procurement framework
C03	Effective policy
C04	Carbon emission
C05	Renewable energy policy
C06	Climate change

C1-08	Expertise and Skills
C1-00	Legal and technical experts
C1-01	Technical
C1-02	Local capacity building
C1-03	Professionals
C1-04	Transfer of skills
C1-05	Transfer of experience

C1-03	Bid Cost
C1-04	A reasonable level of profitability

C1-06	Technology Option
C1-00	Domestic project developers
C1-01	Electricity generation technologies
C1-02	The cap for individual technology
C1-03	Land ownership
C1-04	The diversity of energy sources
C1-05	Commercial consideration
C1-06	Research and Development

C31	Performance Measurement
C32	Reporting of economic development plans
C33	Community needs
C34	Direct financial benefits
C35	Dialogue with the private sector
C36	Negotiable PPA's and IA's

C1-10	International Investors Attraction
C1-00	Private investment
C1-01	International project developers
C1-02	International tender process
C1-03	International Credit Rating

C1-09	Renewable Energy Planning and Demand forecasting
C1-00	Capacity offered
C1-01	local renewable energy market
C1-02	Global renewable energy market
C1-03	Electricity planning
C1-04	Global over-capacity
C1-05	Competition
C1-06	The demand for Renewable Energy

APPENDIX H: VSD RENEWABLE ENERGY IPP PROCUREMENT PROGRAMME

Summary of Viable System Diagnosis (VSD) Renewable Energy IPP Procurement Programme			
1. Global renewable energy industry	2. Key Equipment Suppliers	3. Highly competitive environment	4. Financial resources commitments
5. Intense land acquisition process	6. Power selling price determination	7. Technology preference	8. Local communities project ownership
9. Intense procurement process	10. Single buyer of generated electricity	11. Government department overlapping roles	12. Intensive support requirement
13. Eskom conflicting roles and responsibility in the programme	14. Independent Power Producers payment method	15. lack of expertise support during OandM	16. Political instability in South Africa
17. Future energy planning	18. Programme fragmented structure	19. High number of supporting programmes	20. Performance target not the same for IPP's
21. IPP's compliance level with ED requirement	22. South African electricity market needs	23. Electrical power energy demand	24. Global Renewable Energy Market Demand
25. Localization of technology supply	26. Private investors attractions	27. Research and development availability	28. Skills availability in South Africa
29. Reduction of greenhouse gas emission	30. Responsibility of REIPPPP policy making	31. Public consultation	32. Private sector involvement

APPENDIX I: SUMMARY OF SURVEY FACTORS

Factor	Definition "Context"	Factor	Definition "Context"
Well defined and robust programme	The level of clearly defined current programme processes and management style.	Delays in commercial operations of approved IPPs	Deviation from original projects schedules due to management and resolution issues.
Competitive bidding rounds	High level of competition between the bidders in the capacity allocation.	Sharp falling of prices offered per kWh of energy	Decline of energy cost in kWh i.e. prices Eskom buys the energy from IPPs
Local content requirements	Sets of requirement that IPPs need to fulfil in South African renewable energy industry to ensure economic development	Decline in programme support	Slowly decreasing in Renewable Energy support from investors and local government as well as other stakeholders
Private Capital Investment	Investment that is required to implement the Renewable Energy Plants	Termination of power purchase agreements with IPPs	The discontinuation of service level agreement with Independent Power Producers
Programme contribution to job creation in SA	The role the programme plays in creating jobs mainly in South Africa, employing local people both skilled and unskilled.	Constrained Eskom Transmission and Distribution network	Inability of Eskom existing infrastructure to evacuate power generated by the IPP plants
Experienced expertise	People that have vast Renewable Energy experience and familiar with South African procurement frame work	Eskom denationalization	Privatizing Eskom Generation, Transmission and Distribution divisions.
Political Support	The support that the programme receive from South African government.	Development of renewable energy plants by Eskom	Eskom embarking on the development of their own Renewable Energy plants to meet electricity energy demands.
Lack of local IPP participation on the programme	The low level of local Independent Power Producer company in the Renewable Energy IPP procurement programme.	Single buyer of energy produced by IPPs	The current frame of power purchase arrangements that see Eskom the only buyer and reseller of energy produced by IPPs in South Africa.
High initial capital investment requirement	The high initial capital required by the developers to implement the renewable energy technologies.	Local and International economic dynamics	The economic situation in South Africa and the globe.
Lack of experienced people in renewable energy sector	Low numbers of people with significant renewable energy experience in South Africa.	Increase in electricity energy demand	The need for more electricity supply in South Africa.
Delays to projects benefits for local people	The time it takes to realise the said benefits to local communities and local businesses.	Increase in clean energy demand	The level of renewable energy requirements and necessity.
Lack of synergy between REIPPPP and Eskom infrastructure upgrade	The level of coordination between Renewable Energy IPP procurement programme schedule and Eskom infrastructure upgrade programmes	Climate change requirements	The renewable energy role in the climate change programmes.

Exploring of SA renewable energy market	The process of venturing into South African renewable energy market	Increase in security of supply requirements	The need to provide secure power supply to customers.
Renewable Energy Saturation in developed countries	The high level of renewable energy implementation in the developed countries.	IPP projects profitability in South Africa	The lucrativeness of Renewable Energy projects in South African renewable Energy market.

APPENDIX J: PARTICIPANTS' PERCEIVED FACTORS

Participants Perceived Factors		Participants - Interviewee												Frequency
No.	Factor	1	2	3	4	5	6	7	8	9	10	11	12	
1	Running out of Fossil fuel reserves	1	1			1			1			1	1	6
2	Competitive environment	1	1	1	1	1	1	1	1		1	1	1	11
3	Public benefits realization	1								1		1		3
4	Time of Renewable Energy plants availability	1	1	1		1	1	1		1	1	1	1	10
5	Job creation	1	1	1	1	1	1	1	1	1	1	1	1	12
6	Local support from REIPPPP	1	1	1					1			1	1	6
7	The lack of other department visibility in provincial level	1	1					1		1	1	1		6
8	Lack of coordination with other community development programmes	1	1	1		1		1	1				1	7
9	High level of international IPP involvement in REIPPPP programme	1	1	1	1	1	1	1	1	1	1	1	1	12
10	Declining cost of generated Electricity per kWh	1	1	1	1	1	1	1	1		1	1	1	11
11	High tariffs to Eskom	1	1	1			1	1				1		6
12	Limited qualified and Experienced People	1	1	1	1	1	1	1	1					8
13	Dependency on the International Skills Market	1	1					1			1	1	1	6
14	Lack of skills transfer programmes		1			1				1		1		4
15	Lack of basic services in the Communities	1	1						1				1	4
16	Technology Selection	1	1	1	1	1	1	1	1					8
17	Eskom grid or network capability to evacuate power generated by IPP's	1	1	1	1	1	1	1	1	1	1	1	1	12
18	Financial constraints to improve existing network infrastructure	1	1	1	1	1	1	1	1	1	1	1	1	12
19	Increase competition	1	1	1				1						4
20	Environmental impact strategies		1											1
21	Increasing IPP infrastructure development cost	1	1		1	1	1	1	1		1	1	1	10
22	IPP environmental contraventions	1	1						1			1		4
23	Lack of local IPP involvement	1	1	1		1				1	1		1	7
24	No support at provincial level for the IPPs	1	1	1				1		1			1	6
25	Feasibility of grid connection	1	1	1	1	1	1		1	1	1		1	10
26	DoE manages qualifying criteria	1		1										2
27	Eskom metering points vs. IPPs	1	1	1				1			1	1		6
28	Eskom was not ready for the IPP influx in SA Market as single buyer	1	1	1	1	1	1	1	1		1	1	1	11
29	Challenges in funding IPP projects from Eskom side	1	1	1						1	1	1	1	7
30	Programme attractiveness to the investors	1	1	1	1	1	1	1	1			1		9
31	DoE marketing strategy and stakeholders motivation	1	1							1		1		4
32	IPPs to consider dropping prices of energy per kWh	1	1	1				1		1	1	1	1	8
33	Eskom network flexibility to accommodate IPPs	1	1	1	1	1	1	1	1	1	1	1	1	12
34	The follow up on IPP business plan implementation	1	1	1				1				1		5

35	Involvement of local government	1	1				1				1	1		5
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Participants Perceived Factors		Participants - Interviewee												Frequency
No.	Factor	1	2	3	4	5	6	7	8	9	10	11	12	
36	Eskom IPPs projects funding model						1				1		1	3
37	IPPs payment arrangement			1			1			1		1	1	5
38	High Implementation rate of Renewable Energy Projects			1	1	1	1	1	1	1	1	1	1	10
39	Local communities active roles	1	1									1		3
40	Strategic IPP planning			1		1		1	1		1	1	1	7
41	Equipment supply demand	1	1	1	1	1	1	1		1			1	9
42	Local communities company participation		1		1	1	1			1		1	1	7