

Multi-Dimensional Barriers to the Development of Renewables Energy

Phiwa Makhoba

Student No: 11365219

**A research project submitted to the Gordon Institute of Business Science,
University of Pretoria, in partial fulfillment of the requirement for the degree of**

Master of Business Administration

07 November 2012



ABSTRACT

While some of the developed and emerging economies are registering phenomenal growth in their renewable energy industries, it would appear that there are still a number of factors that are limiting the renewable energy to its potential worldwide. This paper applies a theoretical framework using the systems thinking to examine three possible multi-dimensional factors that are barriers to be development of renewable energy in South Africa. The objective was to use a qualitative research to investigate further the barrier interconnection and multi-dimensional barriers limiting renewable energy development using the South Africa market for sampling and interviews.

The methodology employed involved a literature review. In addition, a questionnaire was designed and interviews were conducted to ascertain the prevalence of such barrier multi-dimensional and interconnection. The results obtained were analysed using qualitative method. These analyses revealed that the possible multi-dimensional barriers that were identified namely technology; pricing and costing; policy and regulations; and market performance are valid for South Africa. In addition, even though the results highlighted, as identified initially that technology have a significant impact as a linkage, the results suggest that the regulatory framework have a more significant linkage and effect on the relationship and interconnection.

Keywords: Renewable energy, multi-dimensional barriers, multi-dimensional barrier linkages, South Africa



Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other university. I further declare that I have obtained the necessary authorization and consent to carry out this research.

Phiwa Makhoba

Student Number: 11365219

Signed:

07 November 2012



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



DEDICATION

This research is dedicated to my late parents, my father Khombizwe and my mother Sizaphi. Who never went to school and didn't know what it is like being a student and yet they taught me the importance and value of education.



ACKNOWLEDGEMENTS

Many thanks go to the following people who enabled the creation of this research report and made the entire MBA journey an amazing journey.

I wish to express my gratitude to my supervisor, Mr. David Rabinowitz who was abundantly helpful and offered invaluable assistance, support and guidance, and his patience with me.

I wish to express my love and gratitude to the best wife in the world, ZamaNguni and children Sibusiso, Njabulo and Simphiwe who probably suffered more than me during this journey. I wish to thank you for your understanding and unconditional support throughout my MBA programme. Only you know what a rollercoaster ride it has been. You are the fuel that kept me going when I often thought of baling.

My gratitude also goes to Willem Theron, the SAE and Fuel Sourcing management and colleagues who have been very supporting and very understanding to me throughout my MBA programme.

Thank you to the friendly staff at of GIBS and Eskom library that was most helpful and understanding during the entire research.

Special thanks and credit goes to Nicolien Bredenkamp and Dr Michael Ndlovu for being my sound board, for guidance, advices and unconditional support throughout my MBA programme, I am grateful and humbled

Finally, I would like to thank the respondents that participated in this research, but remain anonymous. This research would not have been possible without you, thank you.



TABLE OF CONTENT

1	CHAPTER 1: INTRODUCTION TO THE RESEARCH PROBLEM.....	1
1.1	INTRODUCTION	1
1.2	BARRIERS TO RENEWABLE ENERGY DEVELOPMENT	1
1.3	IDENTIFICATION OF BARRIERS FOR THE STUDY	2
1.4	BROAD RENEWABLE ENERGY IMPLEMENTATION CHALLENGES	3
1.5	MULTI-DIMENSIONAL RENEWABLE ENERGY IMPLEMENTATION CHALLENGES	3
1.6	RESEARCH OBJECTIVE	4
1.6.1	<i>Cost and pricing</i>	5
1.6.2	<i>Legal and regulatory</i>	5
1.6.3	<i>Market performance</i>	6
1.7	SYSTEMS THEORY APPROACH.....	6
1.8	SCOPE OF THE RESEARCH	7
1.9	CONCLUSION.....	8
1.9.1	<i>Research layout</i>	8
2	CHAPTER 2: LITERATURE REVIEW.	10
2.1	INTRODUCTION	10
2.2	RENEWABLE ENERGY	10
2.2.1	<i>Global renewable energy</i>	10
2.2.2	<i>The importance of renewable energy</i>	12
2.3	CURRENT INVESTMENT TO RENEWABLE ENERGY.....	13
2.4	THE FUTURE OF RENEWABLE ENERGY.....	14
2.5	MULTI-DIMENSIONAL RENEWABLE ENERGY BARRIERS.....	16
2.5.1	<i>Technology</i>	17
2.5.2	<i>Costing and Pricing</i>	19
2.5.3	<i>Legal and Regulatory</i>	20
2.5.4	<i>Market Performance</i>	22
2.5.5	<i>Development of renewable energy in South Africa</i>	24
2.6	RESEARCH PROBLEM	25
2.7	CONCLUSION.....	26
3	CHAPTER THREE: RESEARCH QUESTIONS	27
3.1.	INTRODUCTION TO THE RESEARCH QUESTIONS	27



3.2.	MAIN QUESTION	27
3.3.	PRICING AND COSTING	27
3.4.	LEGAL AND REGULATORY	27
3.5.	MARKET PERFORMANCE	28
3.6.	TECHNOLOGY	28
3.7.	GENERAL	28
4	RESEARCH METHODOLOGY	29
4.1	INTRODUCTION	29
4.2	RESEARCH DESIGN AND PROCEDURES.....	29
4.3	QUALITATIVE RESEARCH METHODOLOGY	30
4.4	DATA COLLECTION	31
4.5	DATA ANALYSIS	32
4.6	DATA VALIDITY AND RELIABILITY	33
4.7	POPULATION	33
4.8	SAMPLING CRITERIA	34
4.9	SCOPE.....	35
4.10	UNIT OF ANALYSIS.....	35
4.11	RESEARCH LIMITATION	36
4.12	ETHICAL CONSIDERATIONS	37
4.13	CONCLUSION.....	37
5	CHAPTER 5: RESULTS	39
5.1	INTRODUCTION	39
5.2	OVERVIEW OF THE RESULTS	39
5.3	RESPONDENTS' BACKGROUND INFORMATION.....	40
5.4	PRICING AND COSTING	42
5.4.1	<i>Introduction of subsidies</i>	<i>42</i>
5.4.2	<i>Other incentives to renewable energy.....</i>	<i>44</i>
5.4.3	<i>Profitability and competitiveness of renewable energy.....</i>	<i>44</i>
5.4.4	<i>Current bidding prices</i>	<i>45</i>
5.4.5	<i>Current electricity tariff undermining renewable energy</i>	<i>45</i>
5.5	LEGAL AND REGULATORY	45
5.5.1	<i>Current regulations promoting renewable energy</i>	<i>46</i>



5.5.2 Effectiveness of the current regulations	47
5.5.3 Current process being cumbersome and time-consuming	47
5.6 MARKET PERFORMANCE	48
5.6.1 Political influence of investment into renewable energy	48
5.6.2 Lack of finance and risk profile understanding	49
5.6.3 Availability of funding for renewable energy	49
5.6.4 Role of donor funding	50
5.7 TECHNOLOGY	50
5.7.1 Renewable energy competing with conventional energy	51
5.7.2 Renewable energy replacing conventional energy	51
5.7.3 Importance of renewable energy in South Africa	53
5.8 GENERAL	53
5.8.1 South Africa's approach to renewable energy challenges	53
5.8.2 Economic differential between renewable energy and conventional energy	54
5.9 CONCLUSION	54
6 CHAPTER 6: DISCUSSION OF RESULTS	56
6.1 INTRODUCTION TO THE RESULTS DISCUSSION	56
6.2 PRICING AND COSTING	56
6.2.1 Introduction of subsidies	56
6.2.2 Other incentives to renewable	58
6.2.3 Profitability and competitiveness renewable energy investment	60
6.2.4 Current proposed bidding price	60
6.2.5 Current electricity tariff undermining renewable energy	61
6.3 LEGAL AND REGULATORY	62
6.3.1 Current regulations promoting renewable energy	63
6.3.2 Effectiveness of the current regulations	63
6.4 MARKET PERFORMANCE	64
6.4.1 Political influence of investment in renewable energy	64
6.4.2 The lack of finance and understating renewable energy risk profile	65
6.4.3 Availability of funding to renewable energy	67
6.4.4 Role of donor funding in the renewable energy development	67
6.5 TECHNOLOGY	68



6.5.1 Renewable energy technology competing with conventional energy	68
6.5.2 Renewable energy replacing conventional energy.....	70
6.5.3 Importance of renewable energy in South Africa.....	71
6.6 GENERAL.....	72
6.6.1 Renewable Energy development approach in RSA	72
6.6.2 Economic differentials between renewable energy and conventional energy	73
6.7 CONCLUSION ON THE RESULT ANALYSIS.....	73
7 CHAPTER 7: CONCLUSION	75
7.1 INTRODUCTION	75
7.2 THE RESEARCH OBJECTIVES	75
7.3 THE CENTRAL RESEARCH PROBLEM	75
7.3.1 Policies and Regulatory	76
7.3.2 Technology.....	77
7.3.3 Pricing and Costing.....	77
7.3.4 Market performance	78
7.4 RECOMMENDATIONS	78
7.5 RECOMMENDATIONS FOR FURTHER RESEARCH.....	79
7.6 CHAPTER CONCLUSION	79
REFERENCES.....	81
APPENDIX 1: QUESTIONNAIRE	88

LIST OF FIGURES AND TABLES

FIGURE 2.1: GLOBAL EMISSIONS PER REGION FROM FOSSIL FUEL USED.....	11
FIGURE 2.2: NEW INVESTMENTS IN CLEAN ENERGY	13
FIGURE 2.3: FORECASTED ELECTRICITY SUPPLY MIX BY 2050	14
FIGURE 2.4: FORECASTED ENERGY PRICES TO 2050.....	15
FIGURE 2.5: ELECTRICITY BY SOURCE IN SOUTH AFRICA	24
FIGURE 5.1: RESPONDENTS’ FORM OF RENEWABLE ENERGY INVOLVEMENT	40
FIGURE 6.1: INCENTIVES FOR GENERATING ELECTRICITY FROM RENEWABLE ENERGY	59
FIGURE 6.2: MOTIVE FOR INVESTMENT IN RENEWABLE ENERGY	65
FIGURE 6.3: RENEWABLE ENERGY GLOBAL FUNDING	66
FIGURE 6.4: RENEWABLE ENERGY LOAD FACTOR	70
TABLE 1: RESPONDENTS’ ROLE IN RENEWABLE ENERGY SECTOR	41
TABLE 2: RESPONDENTS’ LEVEL OF BELIEF IN RENEWABLE ENERGY REPLACING CONVENTIONAL ENERGY	42
TABLE 3: INTRODUCTION OF SUBSIDIES TO RENEWABLE ENERGY SECTOR.....	43
TABLE 4: REASONS PROVIDED AGAINST SUBSIDIES.....	43
TABLE 5: OTHER INCENTIVES TO PROMOTE RENEWABLE ENERGY.....	44
TABLE 6: PROFITABILITY AND COMPETITIVENESS OF THE FINANCIAL RETURN.....	44
TABLE 7: VIABILITY OF RENEWABLE ENERGY’S CURRENT PRICES.....	45
TABLE 8: CURRENT CONVENTIONAL ENERGY PRICES UNDERMINING RENEWABLE ENERGY	45
TABLE 9: CURRENT REGULATIONS PROMOTING RENEWABLE ENERGY DEVELOPMENT	46
TABLE 10: REASONS PROVIDED IN FAVOUR OF THE CURRENT REGULATIONS	46
TABLE 11: REASONS PROVIDED AGAINST THE CURRENT REGULATIONS.....	47
TABLE 12: EFFECTIVENESS OF THE CURRENT REGULATIONS	47
TABLE 13: CUMBERSOME AND TIME-CONSUMING APPROVALS.....	48
TABLE 14: POLITICAL INFLUENCE ON INVESTMENT DECISION.....	48
TABLE 15: REASONS PROVIDED FOR POLITICAL INFLUENCE	49
TABLE 16: RISK PROFILES FOR RENEWABLE ENERGY INVESTMENT	49
TABLE 17: AVAILABILITY OF FUNDING FOR RENEWABLE ENERGY	50
TABLE 18: ROLE OF DONOR FUNDING	50
TABLE 19: RENEWABLE ENERGY TECHNOLOGY COMPARED TO CONVENTIONAL ENERGY.....	51



TABLE 20: REASONS PROVIDED AGAINST RENEWABLE ENERGY COMPETING WITH CONVENTIONAL ENERGY.....	51
TABLE 21: RENEWABLE ENERGY REPLACING CONVENTIONAL ENERGY	52
TABLE 22: REASONS PROVIDED FOR RENEWABLE ENERGY NOT REPLACING CONVENTIONAL ENERGY .	52
TABLE 23: IMPORTANCE OF RENEWABLE ENERGY IN SOUTH AFRICA	53
TABLE 24: SOUTH AFRICAN APPROACH TO RENEWABLE ENERGY	54
TABLE 25: DEVELOPER’S MOTIVE FOR RENEWABLE ENERGY DEVELOPMENT.....	54



1 Chapter 1: Introduction to the Research Problem

1.1 Introduction

A key challenge facing economies across the globe is satisfying an increasing demand for electricity while controlling carbon dioxide emissions and other forms of pollution, as well as addressing additional concerns including energy security and economic development (Muller, 2010). This has necessitated energy industries worldwide to explore other means of producing electricity such as renewable energy, moving away or supplementing the conventional energy sources such as fossil fuel. These challenges, coupled with increasing oil prices and growing demand for energy on the global scale have shaped an environment in which renewable energy development is becoming more relevant (Lyon & Yin; 2010)

Renewable energy is generally assumed to be normatively beneficial and a solution to a number of problems such as social, environmental, and economic welfare. The overall favour that renewable energy seems to find combined with its relative scarcity suggests that there exists a need to empirically examine the obstacles to something that is almost universally seen as beneficial (Lyon & Yin, 2010).

Barry (2011) looking at Africa and South Africa, states that there is evidence of renewable energy implementations in Africa which points to a less than successful outcomes. She further states that currently the framework of factors which needs to be taken into account for the selection of renewable energy development in Africa does not exist.

1.2 Barriers to Renewable Energy Development

The world Energy Assessment found that, if applied in a modern way, renewable energy sources are “highly responsive to overall energy policy guidelines and environmental, social, and economic goals” (UNDP 2008, UNEP 2011, and Martinot 2011). Clay (2002) and later Martinot et al observed, however, that there are a variety of obstacles including costs, infrastructure, incentives and policies that can



act as barriers between developing countries and renewable energy (Masini & Menichetti, 2010; Martinot 2011).

As the energy industry attempt to increase their generation mix by developing 1renewable energy, they are facing various challenges. The need for enacting policies to support renewable energy development is often attributed to a variety of “barriers” or conditions that prevent investments from occurring (Nkomo, 2007). Often these barriers put renewable energy at an economic, regulatory, or institutional disadvantage relative to other forms of energy supply especially the fossil fuel source.

1.3 Identification of barriers for the study

Apart from the literature survey and study of the existing projects, interaction with various stakeholders will be important and critical in exploring and identifying the renewable energy development barriers in the South African context. Broadly, the barriers will be identified using the following approaches:

- *Literature review:* A literature review on global renewable energy development with associated barriers will be conducted;
- *Stakeholder’s interaction:* It is important that the stakeholders’ perspective is taken into consideration (Harrison & John, 2010). Stakeholders will include the renewable energy industry, owners of plant, consumers, relevant NGOs, experts, policy makers (government), and professional associations (financial and legal advisors). The interaction will be through structured interviews involving questionnaires. This approach will be very crucial to the identification of the barriers as the stakeholders’ perception on barriers may reveal the lacunae in existing policies and help in the identification of measures to overcome the barriers.

The objective will be to find out the relevance of a barrier (elements) for the development of renewable energy and identify measures that can be taken to overcome them. It may appear that once barriers have been identified, measures to



overcome them may follow from that, and hence stakeholders' involvement in identifying the measures may not be necessary (Harrison & John, 2010). Stakeholders need to be involved not only in identifying or confirming the barriers but also in identifying measures to overcome the barriers.

1.4 Broad renewable energy implementation challenges

Renewable energy projects are not always successful and for that both technical and non-technical factors are to be blame (Mabuza, Brent and Mapako, 2007). Lyon & Yin (2010) argues that the general lack of renewable energy development internationally is puzzling considering that renewable energy can be a solution to a number of problems such as providing social, environmental, and economic welfare (Lyon & Yin 2010). The whole world is grappling with challenges of reducing emissions of greenhouse gases associated with conventional energy sources, particularly developing countries such as South Africa, and other countries like Mozambique who has abundance of coal resources but have to consider and pursue other sources.

UNIDO highlights certain challenges which they call “non-technical challenges” such as lack of public awareness of reliability and cost of renewable energy; lack of government support with consequent non-supportive policies and regulations and a lack of ownership by the community (UNIDO, 2009). These challenges seem to be the international challenges, not any specific country.

1.5 Multi-dimensional renewable energy implementation challenges

Owen (2009) argues that there are three overlapping perspectives over and above technology that are obstacles for renewable energy development:

- Costing and pricing perspective;
- Policies and regulations perspective; and
- The market performance perspective.



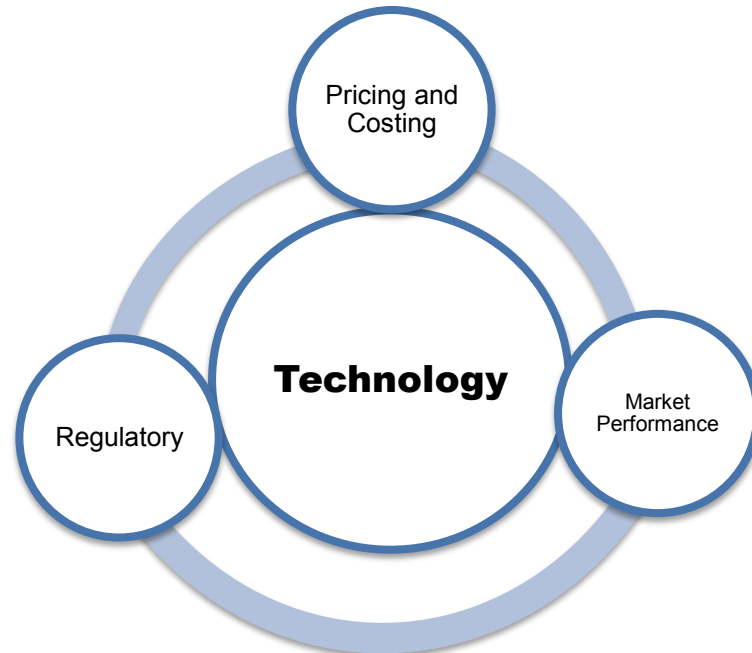
The problems that are harder to resolve than technology are the pricing, policies and capital availability problems (Eliot, 2011). Elliot then took this observation one step further and argued that, “The current financial, organizational, and institutional environment is not very well suited to renewable energy development acceptance: there is, arguably, something of a miss-match between the new technology and the existing support from government in the form of policies and pricing of the renewable (Eliot, 2011: 262). It is therefore not surprising that by default, the market performance becomes poor.

1.6 Research objective

It is important that the correct technology for a given situation is chosen to ensure cost effectiveness Barry (2011). Merven, Hughes & Davis (2011) also argues that the lack of financial support in renewable energy is due to a lack of well researched and prioritised technology which is what he considers the most important in renewable energy development.

Based on the above, it is clear that in the broader discussion of the renewable energy development a “wide range” of different barriers are still in play. While the analysis of these broad barriers renewable energy development is clearly still relevant, it is also clear that certain aspects of the broader dialogue are starting to focus more intently upon the linkages or the multi-dimensionalism of these levels.

The objective of the research is to further explore with an intention to understanding this barrier linkages and multi-dimensional barriers. Using the system thinking of understanding the interconnectedness of these main barriers, and also based Elliot’s argument that it seems as though even if the technology can be perfect, the policies and regulatory, market performance, pricing and industry context within which they operate can still provide challenges for the renewable energy development. The research will look at the three categories and their possible interconnection with technology as follows:



The three categories are as follows: (adapted from Beck and Martinot (2009))

1.6.1 Cost and pricing

Renewables have high initial capital costs but lower operating costs, making them more dependent on financing and the cost of capital (Banks & Schäffler, 2010). Other challenges include:

- difficulty to quantify future fuel-price risks for fossil fuels and incorporate monetary values for those risks into economic decision-making;
- transaction costs are often higher for small,
- decentralised renewable energy facilities than for large centralised facilities;
- real economic costs of environmental damages from fossil fuels (on human health, infrastructure, and ecosystems) are rarely priced into fuel costs.

1.6.2 Legal and regulatory

Independent power producers (IPPs) may be unable to sell into common power



grids in the absence of adequate legal frameworks. Transmission access and pricing rules may penalise smaller and/or intermittent renewable energy sources. Utilities may set burdensome interconnection requirements that are inappropriate or unnecessary for small power producers. Requirements for liability insurance may be excessive.

1.6.3 Market performance

Ovaska, 2008; Muller, 2010 and Mauro, 2010 all have stated that a number of challenges can prevent investment into the development of renewable energy, common factors mentioned among them are:

- consumers or investors may lack access to the credit required for capital intensive renewable energy investments;
- financiers, developers, and consumers may unfairly judge technology performance risks in their assessment; and
- market participants may lack sufficient technical, geographical, and/or commercial information to make otherwise sound economic decisions.

1.7 Systems theory approach

In an increasingly interconnected world, the overall lack of countries with significant renewable energy development indicates that there may be barriers that the developing countries share in common (Lyon & Yin, 2010). This research aims at exploring the possible relationship between technology, enabling policies and regulatory frameworks, market performance and renewable energy development.

It will apply a theoretical framework to explore and understand the above possible multi-dimensional factors that are barriers to the development of renewable energy in South Africa. The main objective was to explore and understand the possible barriers to renewable energy development, particularly in the developing countries paying attention to possible interconnection between the above barriers using systematic thinking approach. The objective is to explore the possible



interconnected variables that can explain renewable energy successes or failures.

The systems thinking theory is an old theory which was originally proposed by biologist Ludwig von Bertalanffy in nineteen forties. It has since been extended and popularised by scholars such as Lotfi Zadeh in the fifties and later by McNeill and Freiburger in the late nineties. Its aim is to analyse a complex system or issue, characterized by multiple, interrelated objectives, constraints and resources, and extending over various domains (Kefferputz, 2009; JANCZURA, 2010). The number of main barriers to renewable energy development is indeed characterised by such interconnections.

The relevance of the system thinking to this research further echoed from Cohn's argument that one common element of the systems thinking is that "knowing one part of a system enables the researcher to know something about another part and that the information content of a "piece of information" is proportional to the amount of information that can be inferred from the information" (Janczura, 2010). By examining and exploring these barriers systematically it is hoped a better understanding especially for the developing country such as South Africa will be achieved. A holist approach in exploring and examining the barriers as a complete functioning system will be conducted.

1.8 Scope of the Research

There is a wide range of studies dealing with barriers and challenges to renewable energy development in South Africa and in other countries worldwide. All these studies highlight the technology, stakeholders and stakeholder engagements as the major stumbling blocks in promoting renewable energy and renewable energy development.

This study considered technology as a barrier and explore the existing literature by examining other critical components, the main ones being pricing or costing, legal or regulatory and market performance and how the relationship or interconnection. The focus was primarily on renewable energy projects in South Africa.



The study was in the form of interviews which was conducted to evaluate whether these factors are currently valid for the South African renewable energy development market. The interviews investigated the possible aspects that may be unique to the South African context and could emerge as special factors which are also considerations for other emerging countries.

1.9 Conclusion

With the Green House Gas emission challenges and global security of supply challenges, global environmental challenges, renewable energy technologies provide a very attractive and sustainable solution. While renewable energy is becoming part of the solution, a number of challenges and obstacles have been faced and continue to be faced. These challenges can be addressed one by one or system approach can be established to explore and understand them with the aim of getting a solution. This research therefore aims at exploring and understanding the multi-dimensional barriers to the renewable energy using South Africa for sampling and conducting the research.

1.9.1 Research layout

This report will consists of the following chapters

- **Chapter 1 – Introduction:** This section of the report introduces the research topic and defines the main focus of the research. A short motivation is provided to explain what prompted this study, followed by the aim of the research.
- **Chapter 2 – Literature review:** This section of the report includes a comprehensive review of the literature that was considered during the investigation and appropriate theory base relating to the research problem defined in chapter one.
- **Chapter 3 – Research questions:** This chapter poses some relevant questions which will assist and guide the research as well as helping to define the research methodology to be applied.



- **Chapter 4 – Research Methodology:** This chapter is based on the inputs made to this research in chapters one to three. In this chapter, the way in which the actual research was done is explained in detail. The chapter begins with a short introduction followed by a description of the research design. This design describes and discusses the overall approach taken in answering the research questions stated in chapter three. This is followed by a methodology section in which the actual design process is explained as well as the research instrument used. The population and sample size are defined, as well as the data that were collected. The following section then defines how the data collected were analysed. As with any methodology some limitations were experienced and these are presented in this part of the report. Furthermore, some ethical considerations are listed and conclusion is given.
- **Chapter 5 – Results:** In this chapter the results of the surveys are presented based on the research questions posed and the interview responses.
- **Chapter 6 – Discussions of the results:** The results from the preceding section are discussed in relation to the material presented in chapters one to three.
- **Chapter 7 – Conclusion:** To conclude this research, chapter seven provides a review of the research and the main findings and indicates how these findings relate to academics and practitioners in the field. It also provides some recommendations for further research.



2 Chapter 2: Literature review.

2.1 Introduction

The literature review provides the theoretical background on barriers to the development of renewable energy. It starts by reviewing the literature on the status of the electricity sector in South Africa and the type of sources South Africa uses for its electricity sector. This is followed by a review of renewable energy development in South Africa together with the types of renewable energy, multi-dimensional renewable energy development barriers, and the types of technologies available. In conclusion, the research problem is stated

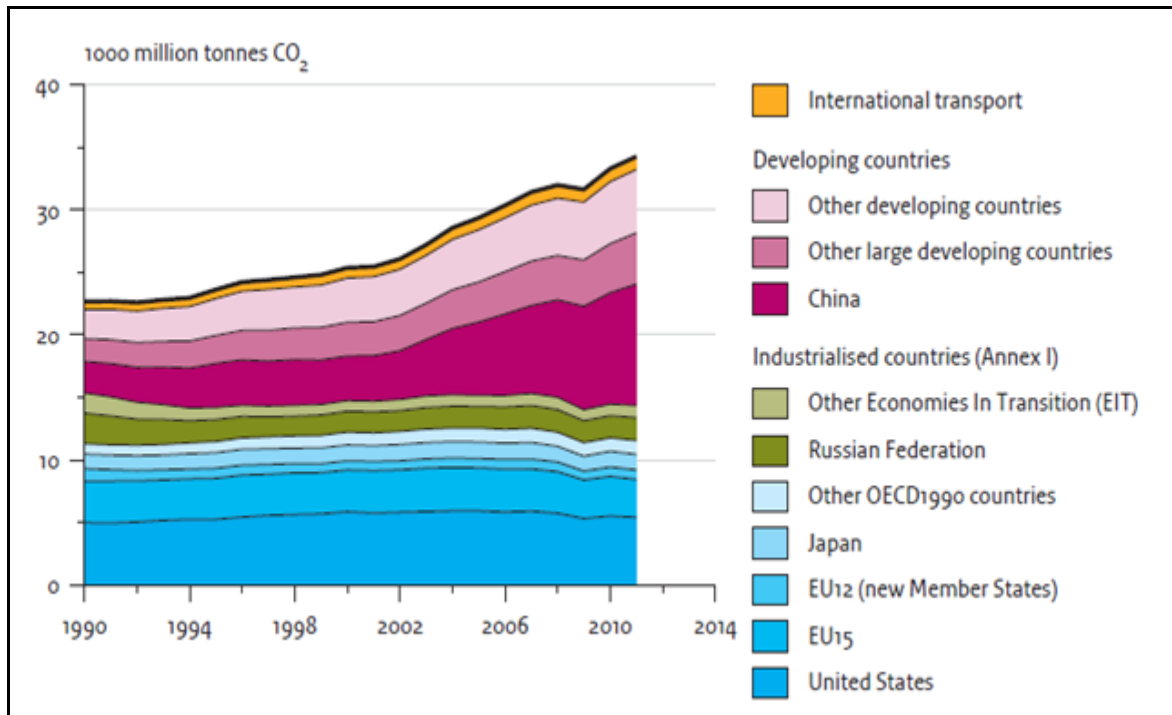
2.2 Renewable energy

2.2.1 Global renewable energy

In recent years, many countries around the world have started to direct their attention toward being environmentally clean and thinking consciously about sustainability. The world in recent years has started looking at renewable energy technologies as an alternative solution in the quest for an environmentally friendly and sustainable planet (Zach, 2009; UNEP, 2012). The chairperson of the World Council for Renewable Energy, Dr Scheer, argues that as long as members of parliament, journalists, scientists and the general public believe that renewable energy cannot replace conventional energy, fossil fuels will not be replaceable: “The reason renewable energy is not implemented as soon as possible is because most people believe it is impossible” (UNDP, 2008; Muller, 2010).

Renewable energy sources currently supply somewhere between 15% and 20% of total world energy demand (Painuly, 2010), the rest is supplied by conventional energy sources, mainly fossil fuel combustion. According to International Energy Agency (IEA) world energy outlook, approximately 90% of the world’s greenhouse gas (GHG) emissions are conventional (fossil fuel) from energy sources (Fossil fuel) (IEA, 2011).

Figure 2.1: Global emissions per region from fossil fuel used



Source: Painuly, 2010; IEA, 2011.

GHG emissions are mainly man-made challenges currently facing the world. The trend is still unfortunately increasing, as shown by Figure 2.1: Global emissions per region from fossil fuel used above. The increase is consistent with the increase in thermal power generation of 14.7% (mostly in coal-fired power stations) (Elliot, 2011), mainly due to global economic growth. At the moment, more than 20 new coal-fired plants are being planned or already in construction across the world with Germany and South Africa at the forefront.

This increase does not assist in curbing GHGs; however, there is slight increase in the renewable energy supply that is making a significant impact in curbing this man-made challenge. Total renewable energy sources have grown to supply 16.7% of global final energy consumption (UNEP, 2012). This growth though has come with some challenges, though, especially considering the potential of renewable energy and the impact it can make worldwide.



The importance of the newer renewable energy technologies is quickly gaining speed and momentum with new technologies (i.e. biomass, PV, solar thermal and wind) growing proportionally more rapidly than any other electricity supply technology (Kefferputz, 2009). South Africa alone is targeting 3800MW of renewable energy by 2014. With this growth, many countries, especially developing countries are facing a number of challenges in pursuit of their renewable energy development that have prevented them from meeting their global targets (Banks & Schäffler, 2010).

The use of renewable energy is seen as essential to ensure the security of the world's energy supply and to lessen the reliance of the world energy supply on fossil-fuels. When fossil fuels are not used, the generation of greenhouse gases can be lessened (IEA, 2011).

2.2.2 The importance of renewable energy

The fundamental reason for using renewable energy is that it is, precisely that, renewable (UNDP, 2008). Renewable energy generation offers the potential to actively deal with the threat of climate change challenges world-wide. Developing countries such as South Africa are among a small number of countries that emit disproportionately high levels of greenhouse gases, mainly due to relatively high energy intensity per unit of GDP and a continued reliance on a heavily polluting “minerals-energy” complex (Bushnell, 2010).

Many countries possess some of the most promising available renewable energy resources in world (Banks & Schäffler, 2010; Merven, Hughes & Davis, 2011). Many studies have endorsed solar and wind renewable technologies in particular as scalable resources with strong output capacity over relatively small areas (Muller, 2010). Solar is the resource with the largest theoretical potential, with wind and wave providing other viable alternatives.

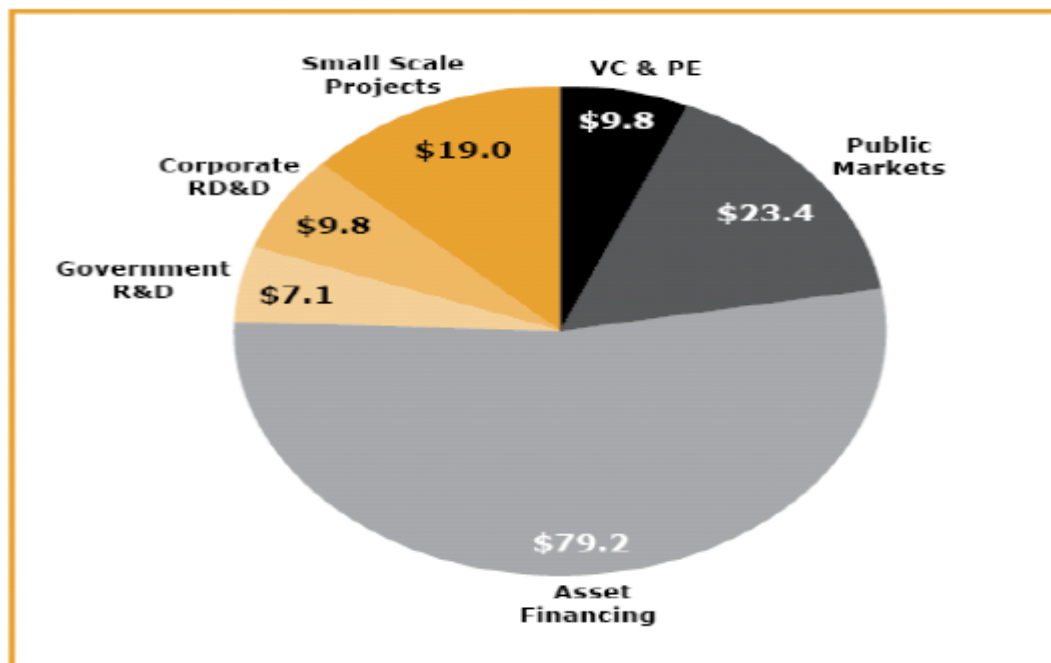
More recently, the Energy Research Center at the University of Cape Town found

that wind energy has a massive theoretical supply potential that can make a significant impact in pursuit of renewable energy development and the global production of energy from cleaner technologies (IEA, 2011). In addition, emerging technologies like commercial wave farms still face some technical and economic barriers, but could become viable over the next twenty years (UNEP, 2012).

2.3 Current investment to renewable energy

Investment in renewable energy, excluding large hydro, is on an upward trend (IEA, 2011). Figure 2.2: New Investments in clean energy below shows global investment in clean energy technology by type of finance. Notwithstanding this new investment, the International Energy Agency has estimated that \$16 trillion needs to be invested in energy per sector by 2030 (IEA, 2011), to meet the projected growth in demand for new electricity and fuel sources worldwide (Masini & Menichetti, 2010)

Figure 2.2: New Investments in clean energy



Source: (IEA, 2011)

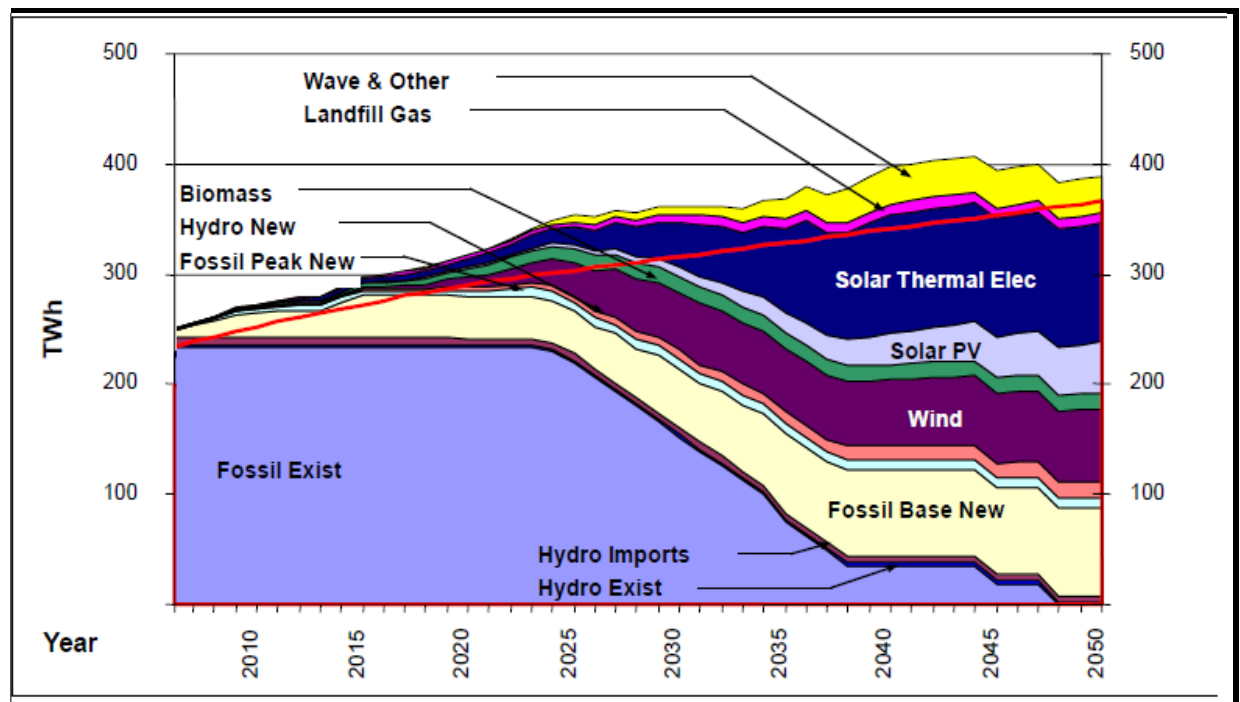
Investment in renewable technology or lack thereof, remains reliant on the fact that renewable energy still competes with conventional energy technologies such as

fossil fuel (Houser, 2010). South Africa is building two fossil-fuel power stations. Masini & Menichetti also argues that one of the main factors an investor considers for their investment decision is comparison with other technologies; however, the focus on cleaner technologies and criticism investors receive for investing in fossil technologies is fast gaining momentum (Masini & Menichetti, 2010). It is therefore not surprising to see an increased focus and appetite for renewable energy investment.

2.4 The future of renewable energy

Effective large-scale renewable energy projects will take time to develop and, even at a 20 percent annual growth rate, it will take several years before they can start to add energy capacity to the grid on the scale required (Zach, 2008). [Figure 2.3: Forecasted electricity supply mix by 2050 by Banks & Schäffler (2010) which shows a 20% growth in the renewable energy while there is a decrease in the use of fossil fuel. The biggest contributor of the 20% is wind and solar.

Figure 2.3: Forecasted electricity supply mix by 2050

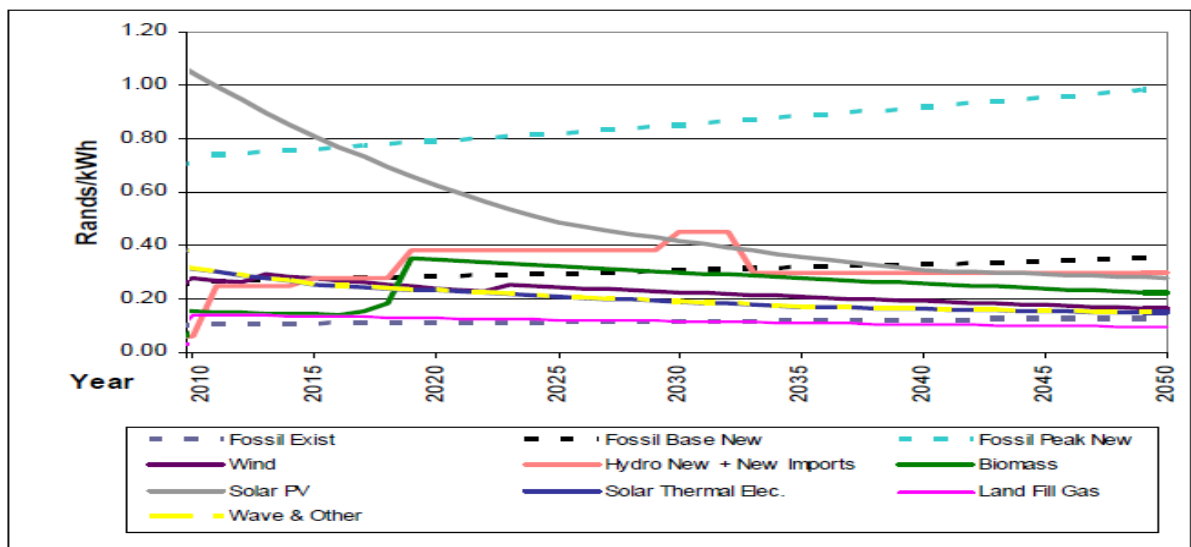


Source: Banks & Schäffler, 2010)

Lower cost options, such as biomass, landfill gas, and selected wind sites, are initially more attractive than solar and large-scale wind. However, these low-cost options have a limited resource base and it becomes important to balance development effort - harvesting the lowest-cost resources but, at the same time, developing the necessary technical capacity to harness larger-scale solar and possible wave technologies (Nadal, Nilsson, Nyber & Janczura, 2010).

Wind, solar, biomass, ocean, and hydro resources could all make substantial contributions to the energy mix in the near term. It is quite possible to imagine renewable energy contributing more than 50% to the electricity mix by 2050 in developing countries such as South Africa as shown in Figure 2.3: Forecasted electricity supply mix by 2050 above.

Figure 2.4: Forecasted energy prices to 2050



Source: Banks & Schäffler, 2010)

Although speculative, Figure 2.4: Forecasted energy prices to 2050 above shows that renewable energy options are likely to be the most cost-effective options for energy supply in South Africa in the future as the fossil-fuel prices are increasing while renewable energy prices continue with a steady decrease. Conventional fossil fuel pricing is particularly difficult to predict (e.g. oil price in 2010/11), but if



prices continue rising as they are currently, it will not be long before solar thermal technologies in particular present a large-scale, economically viable power supply option.

2.5 Multi-dimensional renewable energy barriers

The challenges and barriers to renewable energy are mainly technological, but many other interconnected relationships exist to technology and financial or market performance, regulation, and pricing of renewable energy (Geller, 2011). Elliot also finds that in order to examine renewable energy development challenges worldwide, a supply side that he calls “technology pushes” can be used. For example, he argues that the type of technology plays a critical role an investor to make a decision to invest in renewable energy technology (Elliot, 2011). This interconnection has also been evident in markets such as South Africa where, during the bidding process for window one and window two of the renewable energy, the Department of Energy stipulates the number of megawatts from each technology (Wind, hydro, solar etc.) per bidding process.

Taking this possible interconnection argument further, Lyon & Yin stated that in order to fully examine the possible relationships among the barriers to renewable energy, a “kitchen sink approach” can be used where all the main barriers such as technology, regulations, pricing and investment are thrown together into one discussion instead of exploring them in isolation (Lyon & Yin 2010). Painuly also found that the barriers to renewable energy technology development penetration include “cost-effectiveness, institutional or regulatory, market performance such as lack of investment and inconsistent pricing structures” (Painuly, 2010). The above literature suggests that technology underpins all the main barriers and challenges to renewable energy development and that these barriers cannot be explored in isolation.

Norbert and Painuly argue that the potential for renewable energy can be referred to as technological potential and techno-economic potential (Painuly, 2011). They



explain that technological potential refers to the case (level of usage) when it is assumed that a technically feasible technology is universally used and constraints such as cost, reliability, and other such attributes that may hinder its application, do not exist. The techno-economic potential, meanwhile, refers to the case when it is assumed that a technically feasible and economically viable technology is universally used in a competitive market and constraints such as consumer preferences, costing and pricing, institutional barriers, financial barriers etc. to its usage do not exist.

This theory of interconnection of technology and other main barriers to renewable energy such as pricing and economically viable technology is also found in Bogach and Piscatello who, building from Norbert and Painuly, stated that the current level of renewable energy technological potential refers to the highest order of theoretical possible usage of technology followed by techno-economic potential and market performance in that order (Lyon & Yin, 2010). The bond between technology, costing and pricing, the extent of market performance, and the level of investment is indeed strong.

2.5.1 Technology

Despite technological development and economic viability for several applications, renewable energy development has tapped only a small fraction of its potential due to the existence of several types of barriers to its penetration (Painuly, 2011). These barriers vary across countries and technologies.

The nature and maturity level of renewable energy technology in comparison to conventional energy technologies will always have a direct influence on the size and type of investment decision it attracts (Fakir & Nicol, 2011). Jacobsson (2009) further argues that a mature and established technology such as solar photovoltaic (PV) can possibly attract more funding compared to other types of renewable energy technology. This is good news as it has created a track record for PV as a sustainable technology that thereby reduces the risk for investors. Hamilton



believes that “technology risk is directly connected to the lack of track record for new renewable energy technologies” (Owen, 2009)

There are uncertainties in some technologies that may not be suitable because they produce an unreliable power supply (Eskom, 2011). Much renewable energy technology is unproven and relatively new. It might therefore not be able to survive competitively with more established conventional energy technology (Owen, 2009).

The nature of the electricity tariff also undermines renewable energy efforts (DoE, 2011). Mauro (2010) argue that innovation can reduce renewable energy production cost to a comparable level with conventional energy options. This is also confirmed by Martinot (2011) who also argues that technological innovation can increase the competitiveness of renewable energy technology thereby bringing down renewable energy prices.

Generation of energy from renewable resources is economically unattractive due to the high cost of energy generation and availability of cheaper alternatives energy (Adelegan & Radzewicz-Bak, 2009). The relatively high costs of energy generation from renewable resources compared to conventional energy, both in terms of investment costs and final energy costs, further restrain efforts to promote the utilization of renewable energy.

2.5.1.1 Solar water heaters for hot water supply

The global use of solar water heaters (SWH) is driven largely by the socio-economic need for job creation, environmental concerns, energy security, national economy and peak demand reduction. Preliminary estimates for global thermal heating suggest additions of 18-19 gigawatts (Chiu, 2009).

2.5.1.1 Concentrating Solar Power

The international deployment of concentrating solar power (CSP) generation technology has been minimal. However, about 100MW of new capacity has been



completed recently and favourable policy regimes in Spain and the USA have led to an explosion of new orders with around 10 000MW of new capacity under planning (Roy, Disenyana & Kiratu, 2010). If this project can materialise, CSP will play a key role in the renewable energy space in the near future. The IEA's Energy Technology Perspective identifies solar thermal technology as a very promising option for those parts of the world with extremely good solar resources (IEA, 2011).

2.5.1.2 Photovoltaic

Internationally the photovoltaic (PV) energy industry grew by 11GW in total in 2010 with Germany remaining the global leader with 5.3GW of installed capacity (Roy, Disenyana & Kiratu, 2010). Banks and Schäffler (2010) predict that up to 20% of electricity supply in 2050 could come from solar PVs.

2.5.1.3 Wind

Wind power is one of the most mature new renewable energy technologies. It is currently in use worldwide, and is still growing rapidly, especially in developing countries such as China and India (Roy, Disenyana & Kiratu, 2010). According to Houser, (2010), one-third of the world's electricity can be supplied by wind.

2.5.2 Costing and Pricing

(Adelegan & Radzewicz-Bak, 2009) and Beck & Martinot (2011) argue that renewable energy "costs more" than the conventional energy sources, resulting in cost-driven decisions, policies and regulations that are preventing renewable energy development. Renewables can be an important part of the solution, but recently many renewable technologies have become significantly more expensive than fossil fuels (Adelenga and Radzewicz-Bak, 2009). It also does not help that there are countries that are still building massive fossil fuel power stations, such as South Africa. This can be seen to result directly in the prevention of aggressive renewable energy development.



Most renewable energy systems differ from conventional energy in terms of their cost structure. While energy systems based on fossil fuel generally have moderate or low up-front capital costs, but high operating costs due to their fuel consumption, renewables generally have zero or very minimal fuel costs (sunlight, wind, geothermal heat etc.), but require a fairly high initial investment (Adelenga and Radzewicz-Bak, 2009). As a result, they require a relatively high tariff to recover the related investment.

The issue of subsidies for renewable energy in comparison to fossil fuel is also important. A number of policies have been instituted in an attempt to compensate for cost-related barriers by providing additional subsidies for renewable energy in the form of tax credits or incentives, by establishing special pricing and power purchasing rules, and by lowering transaction costs (Beck & Martinot, 2011). These subsidies are not sustainable, however, and they do not make renewable energy competitive especially in the long run.

Despite many calls for reducing subsidies for fossil fuels and nuclear power, in practice this proves politically difficult (Beck & Martinot, 2011). The focus should not be to increase subsidies for renewable energy instead; a better approach would be to reduce subsidies for conventional energy sources with an intention of eliminating them completely. This will ensure that renewable energy becomes sustainable in the absence of subsidies. Many countries such as Spain and South Africa have abandoned the REFIT tariff model, arguing that it is not promoting the right behaviour. Now IPPs are bidding a “competitive price” which comes at a high premium, making the utilities and other energy off-takers price takers of the bidding price from the winning tenders. This is proving to be another form of subsidizing renewable energy because most utilities operate in a regulated market.

2.5.3 Legal and Regulatory

While governments are increasingly hesitant to intervene and are allowing the markets to achieve competitive success on their own, there are other barriers



creating dissonance in this process (Muller, 2010). The relationship between renewable energy markets and government intervention is increasingly becoming of particular interest. One barrier to greater renewable energy penetration is the lack of enabling policy and regulatory frameworks, which usually favour traditional forms of energy sources (Roy, et al, 2010). In this way, and while attempting to operate in a context designed for substantially different forms of energy, renewable energies are being left to fight for themselves.

There is a large body of work advocating specific sorts of policies and regulatory frameworks for renewable energy development (Roy, Disenyana & Kiratu, 2010). The International Energy Agency projects that, without new policy initiatives, fossil fuels will account for more than 90% of total primary energy demand by 2020 (IEA, 2011). Intervention by states in creating an enabling environment for renewable energy development is becoming a must, not a nice-to-do, for policy makers around the world.

The low degree of state intervention into energy markets through enabling policies and regulatory frameworks could be a common barrier at the international level (Merven, Hughes & Davis, 2011). It appears that the most successful states are those that have intervened on the part of renewable energy markets and the sooner the states that are still lagging behind catch up with the rest the better.

There are far too many agencies involved in approvals in the renewable energy development, including the DoE, National Energy Regulators and other related departments such as the Department of Water Affairs and Forestry (DWAF), provincial government and local authorities (Harrison & John, 2010). Time taken to process approvals for licenses, Environmental Impact Analysis (EIAs) or negotiation of Power Purchase Agreements with the off-taker some is very cumbersome and too overly long. Project developers and owners experience difficulties identifying the right public sector finance partner while finding that the CDM process is also expensive and long.



There is a clear need for refocusing the energy fuel mix in the country's energy equation by giving importance to fast-tracking renewable energy development through making the approval process less cumbersome. Lack of functioning institutional networks for renewable energy could be overcome by encouraging joint effort between government agencies and private institutions, in order to explore the technical and commercial viability of energy generation from renewable resources and enhance capacity building of key players such as government decision-makers (Fakir and Nicol, 2008).

2.5.4 Market Performance

Lack of adequate financial resources has been a chronic problem for the development of renewable energy (Adelegan & Radzewicz-Bak, 2009). The financing of the initial phase of development of new renewable energy technology is important in accelerating market linkages such as costing and market performance related to the funding of the selected technology. A large financing gap also exist because the focus of much of the current spending is on maintenance and operation of the existing conventional energy sources, with little remaining to fund long-term renewable energy investments in order to address the power supply gap (Geller, 2011).

Martinot et al. make a note that, changing investment patterns make it more important to think about markets for renewable energy, rather than simply about the technologies themselves and their economic characteristics (Martinot et al, 2011). Therefore financial institutions, and not the donor agencies, need to focus and provide sustainable financing for renewable energy market.

The dependency of renewable energy on donor funding makes the projects unsustainable, especially when the donor funding runs dry. Most donor driven programmes which have not had other forms of financing have failed once the donor agencies have left. This calls for pragmatic measures towards sustainable financing schemes (Knittel, 2006).



Renewable energy development projects are unique in the sense that they tend to have a high initial development cost with relatively lower operational costs. Renewable energy development projects are capital intensive and highly dependent on the condition of capital cost financing. At the same time, they need to compete with energy programmes that may be obtaining some degree of subsidy through direct government intervention on the tariff (Eskom, 2011). It is therefore important to actively involve and engage financial institutions in programmes for renewable energy development in South Africa so that they will come to understand the key issues at stake and to avoid any surprises.

Many of these projects and technologies, however, are new in developing countries, and therefore present a risk for investors. Lack of experience in renewable energy, unfamiliarity in understanding and managing technology risks and missing sector know-how deflates willingness to invest in renewable energy (Beal, Goyen & Phillips, 2005).

Presently, many green energy projects are implemented with the assistance of grants. This is because new technologies bear a certain amount of uncertainty that create a barrier for their development (UNIDO, 2009). This uncertainty results in high financing costs for research, development and deployment. This in turn artificially raises the price of clean energy options, delaying their full integration into the energy marketplace.

The initial cost for efficient equipment is substantially higher than the standard alternative, and the payback period or economic return may be unacceptable (Lyon & Yin, 2010). Renewable or green energy projects generally face difficulty in getting financing and bank loan approval due to the high risk involved and also the lack of technical knowledge on the part of the financiers (Merven, Hughes & Davis, 2011).

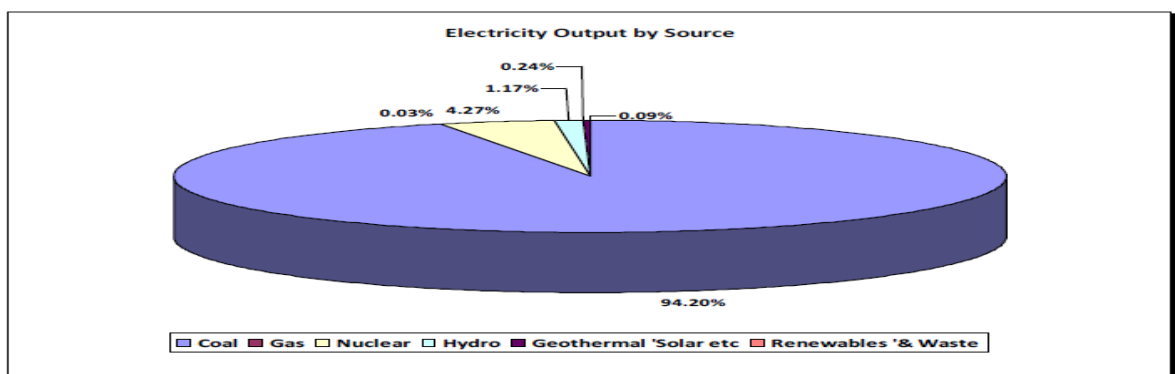
(Fakir & Nicol, 2011) made some other observations about barriers to renewable energy development such as:

- Energy sector competition and bias resulting from the low cost of energy from conventional sources such as fossil fuel which uses cheap low quality coal.
- The renewable energy financial markets are nascent and private investors have been risk-averse in this regard.
- For smaller IPPs trying to make a breakthrough in the renewable energy market, the biggest hurdle is finding the initial pre-feasibility and feasibility finance.
- Most RE projects fail because developers do not budget adequately and do not realistically determine the return on investment for an initiative, and in so doing do not take profit margins and cash flow scenarios into account for the duration of the project.

2.5.5 Development of renewable energy in South Africa

South Africa is well endowed, with abundant renewable energy resources that can be converted to productive energy uses. At present, however, the application of renewable energy technologies is very slow in South Africa (Rudd, 2011). DoE has very ambitious targets stipulated on paper such as IRP targeting 3800MW by 2014, but they still remain targets, with windows one and two being delayed for financial close and window 3 tenders having been postponed to a future date to be announced.

Figure 2.5: Electricity by source in South Africa



Source: DoE (2010)



Diversification of energy generation contributes to energy security provided that efficient, affordable and cost effective technologies are selected (UNIDO, 2010). Renewable energies are those obtained from a natural, recurring and continuous outflow of energy in the existing environment (Barry, 2011).

2.6 Research problem

A closer look at some of the financial incentives for renewables reveals that, for a variety of reasons, they sometimes even worked against the development of renewable technologies. While working out cost-benefit analysis and calculating the internal rate of return for any power project, hidden or indirect subsidies on pricing on resources and infrastructure were never taken into account in the case of conventional sources of energy. On the other hand, economic analyses of renewable energy projects rarely supported their economic justification.

There is also a need for the creation of a level playing field which will enable renewables to compete with conventional sources of energy. Renewable energy development involves a number of institutions that depends upon the structure and ability of these institutions to successfully implement renewable energy programmes. Institutional issues in renewable energy systems seem to have assumed a special significance in light of recent economic reforms.

This follows Elliot's observation and argument that, "The current financial, organizational, and institutional environment is not very well suited to renewable energy development acceptance: there is, arguably, something of a miss-match between the new technology and the existing support from government in the form of policies and pricing of the renewable (Elliot, 2011: 262). It is therefore not surprising that by default, market performance is poor. The objective of the research is therefore to further this understanding of barrier linkages and multi-dimensions in the South African market.



2.7 Conclusion

There is a considerable amount of literature on the various barriers to renewable energy development. The literature has shown that the previous studies have mostly focused on unpacking barriers for renewable energy in a broader sense, dealing with social, political and economic challenges for each type of renewable energy sources individually (Ovaska, 2008). Some scholars such as Geller, Elliot, Painuly, Norbert and Hamilton to name just a few, have started to suggest that there might be an interconnection between these barriers, especially the main ones such as technology, pricing and investment in renewable energy.

This research aims at exploring and understanding this interconnection. The objective of this research is to investigate further the barrier interconnection and multi-dimensional barriers limiting renewable energy development using the South Africa market for sampling and interviews. The next section will describe in full the methodology of the research, how the data will be gathered, and how the gathered data will be analysed.



3 CHAPTER THREE: Research Questions

3.1. Introduction to the Research Questions

Based on the literature review on the work that has been done in the field barriers to renewable energy, it is evident that there is space for more work that still needs to be done. This is especially true considering that this research will mainly focus on the South African renewable development market. The objective of this research is to explore factors that prohibit the speedy development of renewable energy in South Africa.

3.2. Main Question

- 3.2.1. Why is South Africa failing to expand electricity generation from renewable sources? What are the barriers to such expansion?
- 3.2.2. What have been the experiences in the area of renewable energy projects in South Africa? What barriers and drivers have been encountered, and how can these experiences be of use in South Africa?

3.3. Pricing and costing

- 3.3.1. Are factors ranging from the capital-intensity of renewable energy technologies, to the provision of subsidies to fossil fuels that make renewable energy generation in the short-term, more costly or more difficult to implement than conventional fossil fuel-based technologies, particularly for large-scale generation?
- 3.3.2. Is the financial return from the renewable energy investment profitable and competitive with other technologies?

3.4. Legal and Regulatory

- 3.4.1. Is the current regulatory environment an enabling level playing field for the renewable energy development?
- 3.4.2. Is the current process effective in promoting renewable energy development?



3.5. Market Performance

- 3.5.1. Are macroeconomic risks hindering the development of renewable energy and can they be mitigated to the tolerable level?
- 3.5.2. Is there sufficient access to credit to purchase or develop renewable energy?

3.6. Technology

- 3.6.1. Is there enough experience in the renewable energy technology application in South Africa?
- 3.6.2. Does the country have the sufficient renewable energy capacity that can be exploited by proven technologies?

3.7. General

- 3.7.1. How do renewable energy stakeholders perceive developments for renewable energy projects within the next two to five years?



4 Research Methodology

4.1 Introduction

This chapter aims to outline the proposed research philosophy, the methodology employed and its appropriateness of the research, the design process and possible limitations of the research. The development of the interview guide and the influence of the guide on the data will be discussed.

The chapter provides a justification for the design choice for the research and instrument, the sampling methodology, the application of the interview, the application of the interview guide, and the system that is used during the data collection is examined in depth to allow the reader the opportunity to understand the rationale behind this approach. Lastly, the method of analysis is discussed, allowing the reader to follow all steps of analysis.

4.2 Research Design and Procedures

The research was in the form of an investigative approach. A series of semi-structured interviews as the primary research approach were conducted with individuals who held senior positions at major South African business and non-government organizations. Semi-structured interviews addressing open ended questions encouraged in-depth discussion from which additional issues and perspectives on the topic evolved (Polit & Hungler, 1998). The interviewees selected represents crucial producers of the renewable energy, financial and legal advisors and other crucial roles in energy discourse, and are differentially imbued with organizational, development and social capacity to engage in decision-making in the energy sector.

The interviews were sorted into the respective discipline groups e.g. economic, costing and pricing, market performance and technology. All interviews were audio recorded with the permission of the interviewee and varied in length from 45 minutes to 60 minutes and presented the respondents with sufficient opportunity to provide detailed answers to the research questions. The interviews were informal



and open-ended, and carried out in a conversational style. In total 13 interviews were conducted, with seven individuals from the business sector, and six from the government sector. The government sector was made up of one from the regulator (NERSA), two from DoE and three from the utility, Eskom.

Beatty and Willis (2007) define cognitive interviewing as “the administration of draft survey questions while collecting additional verbal information about the survey responses which is used to evaluate the quality of the response or to help determine whether the question is generating the information that its author intends”. Using this definition, the time constraints of the research and the limited sample availability, an adapted cognitive interview technique was chosen, in the sense that the structured questionnaire was answered by the respondent during face to face interview. The researcher conducted the interviews in person, with only one interview done telephonically due to the unavailability of the respondent.

4.3 Qualitative research methodology

Phelps and Horman (2010) recognise the importance of qualitative research methods in understanding complex construction-related phenomena, of which renewable energy development can be an example. This research will use the qualitative research method of interviews to answer the research aim: Multi-dimensional factors prohibiting the speedy development of the renewable energy.

Miles & Huberman (1994) also comment on the usefulness of qualitative data by stating that, “Qualitative data, with their emphasis on people’s lived experience, are fundamentally well suited for locating the meanings people place on the events, processes, and structures of their lives, their ‘perceptions, assumptions, prejudgements, presuppositions’ and for connecting these meanings to social world around them” (p.10). This is relevant for the study of exploring the multi-dimensional renewable energy barriers.

Qualitative data in the form of personal interviews is grounded in the experiences of people, they tend to yield deeper information and allow the researcher a level of



flexibility to explore the research topic with more freedom than is allowed by quantitative studies. Personal interviews are direct communication with the respondent in which the interviewer asks face-to-face questions which offer the respondent the opportunity to delve deeper should the answer not be clear (Zikmund, 2003).

This method was deemed appropriate in this research because in testing the dimensions of effective dialogue with respondents, some answers required elaboration to obtain more details or the researcher wanted to test the respondents' views on certain dialogue dimensions. Marshall and Rossman (2003) argue that the use of in-depth interviews as a method of gathering data is appropriate when the purpose of the study "is to cover and describe the participant's perspectives on the events" (p.120). This was in line with the objective of this research. An interview approach is deemed particularly appropriate because:

- The research aim requires an understanding of current practices and experiences within the renewable development projects; therefore it is very 'contextual';
- Interviewing permits an in-depth exploration of the knowledge and experience held by individuals on a particular research topic (Charmaz, 2006); and
- Because the research method concerns contemporary, real-life projects, it will help to fill the gap in the academic literature on the current practice of renewable energy development.

4.4 Data collection

A questionnaire for semi-structured interviews was chosen as a data collection instrument. A questionnaire was printed as a self-report form designed to elicit information that could be obtained through the responses of the subjects during the interviews. The researcher introduced the questions (Appendix 2) to the participant being interviewed. This was done by way of an open-ended question giving the



respondents enough flexibility to answer the question the way they chose. The researcher, where necessary, would then pose questions to the respondents as a follow up for more explanation or to test the respondent's dimensions that had been sourced from the literature review. This was also done to elicit views and responses that may have been omitted or not considered.

The interview questionnaire was designed and broken down into different sections namely: economic, costing and pricing, market performance and technology as multi-dimensional barriers to the renewable energy development. The introduction and general sections were also included in order to gather data about the respondent and to reveal other challenges related to the above factors that might not be covered in the specified questions based on their respective experience and knowledge.

During the interview the researcher made written notes of what was said by the respondents. These were later used for analysis. In addition, the interviews were electronically recorded using the voice recorder function on the interviewer's Blackberry 9900 Smartphone. All the respondents were provided with a brief background of the interview only and no questions were forwarded to the respondents prior to the interview.

A well-established survey method was used (Zikmund, 2003) by targeting respondents who have experienced in the field of renewable energy development, who have worked or have been involved in the renewable energy development environment directly or indirectly. e.g. project developers, financial advisors and other role players in the renewable energy development such as business sector (financial and legal advisory), Eskom Holdings, DoE, IDC and NERSA were targeted for the interviews.

4.5 Data analysis

The data obtained from the interviews was analysed using a frequency analysis method. The Microsoft Excel software package was used to conduct the frequency



and content analysis.

The open-ended questions were analysed through quantitative frequency and content analysis by the researcher to quantify emerging characteristics and contents. Content analysis is the process of analysing verbal or written communications in a systematic way to measure variables quantitatively (Polit and Hungler 1995). It is a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding (Stemler, 2001).

Key and substantive points from each question were identified and selected by the researcher. The researcher then formulated a frequency table based on the necessary categories identified.

4.6 Data Validity and Reliability

Polit and Hungler (1995) refer to reliability as the degree of consistency with which an instrument measures the attribute it is designed to measure. Reliability requires repeatability of results, that a researcher working at different points in time and under different circumstances on the same set of data should achieve the same result (Krippendoff, 1980). Zikmund (2003) defines validity as the “ability of a scale of measuring instrument to measure what it is intended to measure” (p.302).

The researcher used multiple sources of information to validate inferences and to bring credibility to the data. Data reliability was ensured by minimising sources of measurement data like data collector bias. Data collector bias was minimised by the researcher being the only one to conduct the interviews and standardising conditions such as exhibiting similar personal attributes to all respondents.

4.7 Population

According to Burns and Groove (1993), a population is defined as all elements (individuals, objects and events) that meet the sample criteria for inclusion in a



study. Zikmund (2003) defines the population as “a complete group of entities sharing some common set of characteristics” (p.369). The study population consists of renewable projects in the Republic of South Africa, including all the individuals that are directly and indirectly involved in renewable energy development in South Africa.

The relevant target population consisted of all the individuals who have a direct or indirect interest in renewable energy development in South Africa, these included Eskom, Department of Energy (DoE), National Energy Regulator of South Africa (NERSA), Independent Power Producers (IPPs), Financiers and Financial Advisory’s (e.g. Banks and accounting firms). Due to the large number and spread, from buyers to sellers and developers, determining the size of this population was not possible.

4.8 Sampling criteria

The primary method of sampling was a non-probability convenience sample in the form of a qualitative method. Respondents that were selected in the sample were selected to meet the specific criteria based on the researcher’s judgment. The sample for the in-depth interviews was selected from within the renewable energy target population group.

Mouton (1996) defines a sample as elements selected with the intention of finding out something about the total population from which they are taken. A convenient sample consists of subjects included in the study because they happen to be in the right place at the right time (Polit & Hungler 1995). The sample included financiers and financial advisors, project developers directly or indirectly involved in the renewable energy projects. They were interviewed in order to ensure a proper relevance representation of the general population. The selection was based on convenience sampling based on the availability of the respondents. The selected respondents were interviewed using a structured interview approach, and they were sorted into the respective discipline groups. To be included in the sample they had



to:

- have developed or to currently involved directly or indirectly in renewable energy development;
- be mentally sound in order to consent to participation; and
- be willing to participate.

The participants were also asked to suggest other possible participants to interview leading to snowball sampling which increased the sample size (Zikmund, 2003). The researcher further relied on personal contacts and networks to identify potential candidates.

4.9 Scope

There have been several reviews of potential technological, economic, social, or public barriers and possible solutions to renewable energy development. Although important, there is also a need for multi-dimensional analyses of these barriers and identification of the most significant underlying multi-dimensional barriers if viable solutions are to be developed.

This paper applies a theoretical framework to examine three possible multi-dimensional factors that are barriers to be development of renewable energy in South Africa. The multi-dimensional barriers are costing and pricing, legal and regulatory and market performance.

4.10 Unit of analysis

Zhang and Wildermuth (2006) describe the unit of analysis as the use of themes as coding units appropriate when one is “primarily looking for the expression of an idea” (p. 3). The unit of analysis in this research was the theme expressed as a word or parts of the sentence by the respondents from the interviews. The researcher was looking at words in a sentence or parts of a sentence that could indicate the themes in the dialogue to the interviewer.



4.11 Research limitation

The following are limitations of the research:

- This research was based on certain factors of the multi-dimensional barriers to renewable energy development in South Africa; this does not exclude other factors as possible barriers;
- This research was only applicable to South Africa due to the fact that the researcher's focus was renewable energy development in South Africa;
- The researcher used a non-probability convenience sample, as a result, only those whom the researcher was able to gain access to for interviews, whereas it could be possible that more valuable information and input could be gained from other experts not interviewed; and
- The research was a qualitative research, meaning the researcher does not reach a definitive conclusion and the results and findings cannot be extrapolated to other countries or industries (Zikmund, 2003).

Suitability of the questionnaire to the respondents: Care was taken to design a suitable questionnaire for each category but it was not unreasonable for certain respondents to deem other questions irrelevant, other factors that inhibited the research, such as non-response bias caused by respondents choosing not to respond to some questions due to personal and or sensitivity reasons. Then there was a response bias where the response could have been influenced by the respondent's perception of what they could have thought the researcher wanted to hear.

It is also possible that there was extremity bias in terms of which respondents exaggerated certain issues by responding on the extreme end of the scale with the objective of highlighting certain issues. In addition, there may have been interviewer bias where the interviewer might have led respondents to make responses which they would not normally have given or influence the response obtained.



4.12 Ethical considerations

To render the research ethical, the rights to self-determination, confidentiality and informed consent were strictly observed. Respondents were promised confidentiality, meaning that the information they provided would not be publicly reported in a way which identified them (Polit and Hungler 1995). In this research, confidentiality will be maintained by keeping the collected data confidential and not revealing the respondent's identity when reporting or publishing the study (Burns and Grove 1993).

Written permission to conduct the research study was obtained from the Gordon Institute of Business Science Ethical Clearance Committee at the University of Pretoria. Burns and Grove (1993) define informed consent as the prospective respondent's agreement to participate voluntarily in a study, which is reached after assimilation of essential information about the study. A respondent's consent is obtained before the interview was conducted. All the participants were informed of their right to voluntary consent or to decline to participate, and more importantly, to withdraw participation at any time without penalty.

Respondents were informed about the purpose of the study, the procedures that the researcher was going to use to collect and analyse the data, and assured that there will be no potential risks or costs involved. The ethical principle of self-determination was also to be maintained. Respondents were treated as autonomous agents by informing them about the research and allowing them to voluntarily choose to participate or not.

4.13 Conclusion

This chapter discusses the methodology and methods that the researcher used during the qualitative inquiry. The purpose of this chapter was to guide the reader to understand the rationale of the research methodology in order to increase appreciation for the discussions that follow in the next chapters.



The research methodology chosen in this research is an exploratory experience survey-based research making use of interviews. The objective is to explore with the intention of understating the multi-dimensional barriers to renewable energy development in South Africa. A special focus is on the systematic approach to explore the interconnectedness of the barriers to renewable energy as one of the most promising mechanisms to scale up renewable energy development (Phelps and Horman, 2010). As such, valuable data will result from this methodology which will provide the basis for the insights required to answer the questions defined in Chapter 3. The data gathered will be presented in the following chapter and detailed analysis will be contained in chapter six.



5 Chapter 5: Results

5.1 Introduction

This chapter summarises the results and information gathered during the semi-structured interviews with the stakeholders in renewable energy development such as developers, financial and legal advisors, policy makers, and buyers. A key objective was to gain a better understanding of the renewable energy development multi-dimensional barriers in South Africa. The information and the questions asked from respondents were focused so as to elicit information that would answer the research questions highlighted in Chapter three.

The research methodology selected and applied for this research was an experience survey making use of interviews conducted in person by the researcher (Zikmund, 2003). Interviews were conducted using semi-structured interview questionnaires. In order to allow the respondents the opportunity to answer in whatever way they saw fit, questions were posed to respondents in an open manner.

The researcher further probed the respondents to test whether the dimensions of dialogue identified in the literature review process were present in the renewable energy dialogue. With the permission of the respondents, interviews were electronically recorded and later transcribed. The data from both sources were then analysed, using qualitative content analysis. These results were aggregated, and the results are discussed in this chapter. The structure follows the broad headings used in Chapter three.

5.2 Overview of the results

Out of the target of 15, 13 interviews were successful making resulting in 87% success rate. To preserve their anonymity, the respondents' names have been omitted and they have been classified as respondents. Initially, 15 respondents were chosen using the judgemental sampling technique including those



recommended by the initial respondents using the snowballing sampling technique; however, three respondents' interviews did not take place due to various reasons.

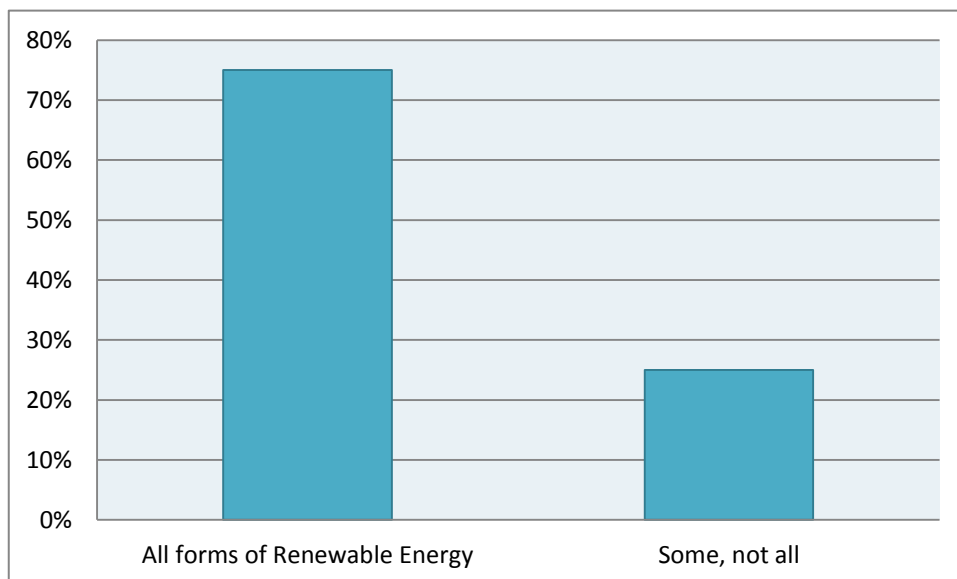
5.3 Respondents' background information

Identification and background information the interviewees

This part of the research was designed in order to understand whether the respondents' respective experience and role in the industry had any influence on renewable energy development in South Africa. This section details the results obtained from the respondents during the interviews and consists of information pertaining to each respondent's experience and role in the industry.

Figure 5.1: Respondents' form of renewable energy involvement shows the make-up of the respondents' respective involvement in the different forms of renewable energy development. 75% of the respondents are dealing with renewable energy as the portfolio, meaning they are dealing with all forms of the renewable. Of the 25% not involved with renewable energy development as a portfolio, 100% of them are in the electricity sector.

Figure 5.1: Respondents' form of renewable energy involvement





Another aspect of the question was to investigate the type of industry and the role that the respondent played in renewable energy development. The results are shown in Table 1: Respondents' role in renewable energy sector below. It shows the roles the respondents play in the sector, the type of the industry and which forms of renewable energy they are dealing with.

Table 1: Respondents' role in renewable energy sector

Participants	Industry	Role in renewable energy development	Form of renewable energy
1	Electricity	Project development	CSP
2	Electricity	Developer	Small hydro (<10MW)
3	Advisory service	Advisory	All
4	Energy sector	Policy development	All
5	Energy sector	Developer	All
6	Energy sector	Project sponsor and setting up policies	All
7	Banking	Financial advisory and funding the renewable energy projects	All
8	Electricity	Project development, execution and operation	All
9	Energy sector	Advisory	All
10	Energy sector	Regulator	All
11	Banking	Funding	All
12	Energy sector	Developer	Solar
13	Banking	Funding and Advisory	All

In order to ascertain the respondent's level of interest and belief in and commitment into renewable energy development in comparison to conventional energy sources, the respondents were asked whether they thought renewable energy would eventually replace conventional energy sources in South Africa in the long run, and if so by when. The results are illustrated in Table 2: Respondents' level of belief in renewable energy replacing conventional energy below.



Table 2: Respondents' level of belief in renewable energy replacing conventional energy

Answer	Frequency	Percentage
Yes	2	15%
No	11	85%

The 85% who did not agree that renewable energy would replace the conventional energy sources cited different reasons but the common theme among all of them was that the nature of the South African economy needed a huge base load to support it which renewable energy can't provide. There was almost consensus that renewable energy could not replace conventional energy in South Africa; it could only complement it. The low capacity factor from renewable energy was also a common factor among the respondents who responded to the question with a "No".

5.4 Pricing and costing

This part of the research aimed at establishing whether the factors ranging from the capital intensity of renewable energy technologies, to the provision of subsidies, to fossil fuels made renewable energy generation in the short term, more costly or more difficult to implement than conventional fossil-fuel-based technologies, particularly for large-scale generation.

It also aimed at ascertaining whether the financial return from the renewable energy investment with the current selling or bidding price made it profitable and competitive and was not undermined by the current conventional energy prices.

5.4.1 Introduction of subsidies

Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

The majority of the respondents believed that there was no need to introduce subsidies to the current renewable energy development structure, as indicated in



Table 3: Introduction of subsidies to renewable energy sector below. Almost all of them believed that subsidies were not sustainable. Four main comments made when discussing this question were:

- subsidies can only work to a point;
- the projects must prove their independent sustainability on their own as a full business model; and
- they will create unnecessary burden to tax payers.

Table 3: Introduction of subsidies to renewable energy sector

Answer	Frequency	Percentage
Yes	4	31%
No	9	69%

A number of reasons were provided by the respondents as to why they did not believe there was a need for the subsidies for renewable energy in South Africa. Table 4: Reasons provided against subsidies below illustrates the reasons cited most by the respondents in response to the above question and the frequency of the reasons cited.

Table 4: Reasons provided against subsidies

Reasons provided against subsidies	Frequency
Need to promote free market principles	12
Renewable energy projects must be sustainable on their own	10
Subsidies will make renewable energy projects unsustainable in the long run	7
Current bidding prices are already at a premium	2
Unnecessary burden on tax payers	1



5.4.2 Other incentives to renewable energy

What do you think could be other incentives to make renewable energy less costly and more sustainable?

Over and above subsidising the renewable energy development, respondents were asked whether they thought there could be other incentives that could be introduced in South Africa to promote and make renewable energy development more sustainable and profitable. Table 5: Other incentives to promote renewable energy below, shows that the majority of the respondents did not believe that; over and above what had been done, there was a need for other incentives for renewable energy development.

Table 5: Other incentives to promote renewable energy

Answer	Frequency	Percentage
Other incentives needed	5	38%
Do not need other incentives	8	62%

5.4.3 Profitability and competitiveness of renewable energy

Is the financial return from the renewable energy investment profitable and competitive with other technologies?

As shown in Table 6: Profitability and competitiveness of the financial return below, all the respondents who were asked this question believed that the financial return from the renewable energy investment was profitable and competitive.

Table 6: Profitability and competitiveness of the financial return

Answer	Frequency	Percentage
Yes	13	100%
No	0	0.0%



5.4.4 Current bidding prices

Do the current bidding prices for renewable energy make it a viable sustainable solution for the current energy challenges?

Table 7: Viability of renewable energy’s current prices below illustrates that all the respondents who were asked this question believed that the current bidding prices for renewable energy was sustainable.

Table 7: Viability of renewable energy’s current prices

Answer	Frequency	Percentage
Yes	13	100%
No	0	0.0%

5.4.5 Current electricity tariff undermining renewable energy

Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?

Most of the respondents, as indicated in Table 8: Current conventional energy prices undermining renewable energy below did not agree that the current nature of the electricity tariff undermined renewable energy efforts in South Africa.

Table 8: Current conventional energy prices undermining renewable energy

Answer	Frequency	Percentage
Yes	4	21%
No	9	69%

5.5 *Legal and regulatory*

This part of the research aimed at investigating the relationship between the renewable energy market and government intervention, how effective the intervention was and whether it was favourable in promoting the renewable energy development renewable energy development.



5.5.1 Current regulations promoting renewable energy

Do you think the current incentives and regulations are favourable for promoting renewable energy development?

Table 9: Current regulations promoting renewable energy development below illustrates that there was an almost equal split of the respondents interviewed on whether they thought current incentives and regulations were favourable for promoting renewable energy development with 54% not agreeing that the current incentives and regulations were favourable for promoting renewable energy.

Table 9: Current regulations promoting renewable energy development

Answer	Frequency	Percentage
Yes	6	46%
No	7	54%

Table 10: Reasons provided in favour of the current regulations below illustrates the answers to this question and the frequency with which the respondents believed the regulations were favourable for promoting renewable energy development.

Table 10: Reasons provided in favour of the current regulations

Reasons provided	Frequency
It is an evolving process	6
It is a good work in progress	5
Very good policy direction	5
It is clear but can still be improved	3
High participation from IPPs	2
Establishment of ISMO	1
Policy makers are positively involved	1
Designed for the conventional technologies for example self-dispatch mechanism	1



Table 11: Reasons provided against the current regulations below illustrates the answer to this question and the frequency with which the respondents believed the regulations were not favourable for promoting renewable energy development.

Table 11: Reasons provided against the current regulations

Reasons provided	Frequency
Designed to suit the monopoly system	4
Favours those that are at advanced stage; if starting from the beginning, one cannot meet all the requirements	2
Process is too elaborative	2
DoE is overdoing it	1
Politically the environment is not too friendly	1
People are taking short cuts	1
Many IPPs wanting waivers and exemptions	1
Timelines are ridiculous	1

5.5.2 Effectiveness of the current regulations

Based on your experience, would you describe the current regulations as effective?

Table 12: Effectiveness of the current regulations below shows that most of the respondents believed that the current regulations were effective.

Table 12: Effectiveness of the current regulations

Answer	Frequency	Percentage
Yes	8	62%
No	5	38%

5.5.3 Current process being cumbersome and time-consuming

Is the process of approvals in South Africa’s renewable energy development cumbersome and time-consuming?



Table 13: Cumbersome and time-consuming approvals below shows that 54% of the respondents believed that the current process of approvals in South Africa’s renewable energy development was cumbersome and time consuming, and 46% find the process not cumbersome or time-consuming.

Table 13: Cumbersome and time-consuming approvals

Answer	Frequency	Percentage
Yes	7	54%
No	6	46%

5.6 Market performance

This section aimed at researching the macroeconomic risks such as political influence that were hindering or influencing renewable energy development and whether they could be mitigated to a tolerable level, and whether there was sufficient access to credit to purchase or develop renewable energy.

5.6.1 Political influence of investment into renewable energy

Are the investment decisions in the renewable energy market in South Africa driven by political influence?

Table 14: Political influence on investment decision below shows that 54% of the respondents believed that the investment decisions in the renewable energy market in South Africa were influenced by political influence.

Table 14: Political influence on investment decision

Answer	Frequency	Percentage
Yes	7	54%
No	6	46%

Table 15: Reasons provided for political influence below illustrates the answer to this question and the frequency with which responses were cited by the respondents across the interviews.



Table 15: Reasons provided for political influence

Reasons provided for political influence	Frequency
Too many ministers involved driving different agendas	5
Push for localisation and job creation is political	5
Renewable energy tariffs are too high/affordability	3
Too many unexplained delays	2
Need to honour global commitments such as in Kyoto Protocol	2
Driven by IRP2010, which is a DoE plan	1
There are strong green lobbyists pushing for renewable energy development	1
The current energy industry structure is politically driven	1

5.6.2 Lack of finance and risk profile understanding

Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understand the key issues at stake as well as the risk profiles for renewable energy?

Table 16: Risk profiles for renewable energy investment below illustrates that almost all the respondents did not believe that the lack of finance in programmes for renewable energy development in South Africa was due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for renewable energy.

Table 16: Risk profiles for renewable energy investment

Answer	Frequency	Percentage
Yes	1	08%
No	12	92%

5.6.3 Availability of funding for renewable energy

Do you think there is sufficient availability of funding to develop renewable energy in South Africa?



Majority of the respondents, as illustrated in Table 17: Availability of funding for renewable energy below, were of the opinion that there was sufficient availability of local funding to develop renewable energy in South Africa.

Table 17: Availability of funding for renewable energy

Answer	Frequency	Percentage
Yes	8	62%
No	5	38%

5.6.4 Role of donor funding

In your experience, what do you think is the role of donor funding in renewable energy development?

Table 18: Role of donor funding below illustrates the answers to this question and the frequency with which they were cited by the respondents across the interviews.

Table 18: Role of donor funding

Role	Number
Other	12
Promoting	13
Supplementing	4
To drive the price down	0

5.7 Technology

South Africa continues to invest in and build conventional energy sources such as fossil fuel for example Medupi and Kusile. This part of the research aimed at researching whether that did not result in renewable energy development and investment in it directly competing with conventional energy technologies such as fossil fuel.

Directly linked to that was the question whether South Africa had sufficient renewable energy capacity that could be exploited by proven technologies.



5.7.1 Renewable energy competing with conventional energy

Do you think the investment or lack of it in renewable technology is due to it competing with conventional energy technologies such as fossil fuel?

Most of the respondents who were asked this question believed that renewable technology could not compete with conventional energy technologies. Table 19: Renewable energy technology compared to conventional energy below shows that 85% of the respondents did not believe that there was or should there be a competition between renewable energy and conventional energy sources

Table 19: Renewable energy technology compared to conventional energy

Answer	Frequency	Percentage
Yes	2	15%
No	11	85%

Table 20: Reasons provided below illustrates the answers to this question and the frequency with which they were cited by the respondents across the interviews.

Table 20: Reasons provided against renewable energy competing with conventional energy

Reasons provided	Frequency
Complementing, not competing	11
Renewable energy is too expensive	8
Investors understand the risk involved	5
First of the kind "risk" to investors	1

5.7.2 Renewable energy replacing conventional energy

Do you think renewable energy will eventually replace conventional energy sources in South Africa in the long run and by when?

This question intended to investigate whether the respondents thought that the drive for renewable energy would replace conventional energy sources with Renewable energy and whether that could be possible in South Africa. Table 21: Renewable energy replacing conventional energy below shows that the majority of the respondents did not believe that renewable energy development would ever replace conventional energy.

Table 21: Renewable energy replacing conventional energy

Renewable energy replacing conventional energy sources in the near future		
Answer	Frequency	Percentage
Yes	2	15%
No	11	85%

Table 22: Reasons provided for renewable energy not replacing conventional energy below illustrates the answers to this question and the frequency with which they were cited by the respondents across the interviews.

Table 22: Reasons provided for renewable energy not replacing conventional energy

Reasons provided	Frequency
It can only complement, not replace conventional Energy sources	10
Renewable energy cannot provide a base-load or peaking plant	8
Renewable energy is unpredictable; therefore one cannot plan around it.	8
Renewable energy sources are intermittent (not available 24 hours)	7
South Africa does not have enough primary energy capacity for renewable energy for example , not enough water or wind	5
Renewable energy technology not fully developed	3
Can only provide a healthy mix of energy sources	2
Renewable energy creates grid instability	2
South African economic structure cannot be sustained by renewable energy. It is a very energy-intensive sector	1
Can only happen in the very distant future	1
Cost of storage for renewable energy is very high	1



5.7.3 Importance of renewable energy in South Africa

Do you think renewable energy can be an important part of the energy solution in South Africa?

As Table 23: Importance of renewable energy in South Africa below illustrates, all respondents who were asked this question agreed that renewable energy could and had to be an important part of the energy solution in South Africa.

Table 23: Importance of renewable energy in South Africa

Answer	Frequency	Percentage
Yes	13	100%
No	0	0%

5.8 General

Renewable energy development involves a lot of stakeholders. This section aimed to explore the approach to renewable energy development, whether it was an interconnected approach in nature or it was a fragmented approach, with each stakeholder only focusing only on its area of interest.

The section also explores what exactly the drive behind renewable energy development is; looking economically at what differentiates renewable energy projects from conventional energy projects.

5.8.1 South Africa's approach to renewable energy challenges

Do you think the renewable energy development approach in South Africa should be a multi-disciplinary approach, identifying the inter-connected nature of renewable energy development (technology, funding, policy and regulatory, and pricing and costing) and the need for inter-connected and inter-disciplinary solutions?



Table 24: South African approach to renewable energy below shows that there was almost agreement from all the respondents that there was a need for a multi-dimensional approach to renewable energy development.

Table 24: South African approach to renewable energy

Answer	Frequency	Percentage
Yes	12	92%
No	1	8%

5.8.2 Economic differential between renewable energy and conventional energy

What, in your opinion, do you think differentiates economically between renewable energy projects and conventional energy projects?

Table 25: Developer’s motive for renewable energy development below illustrates the answers to this question and the frequency with which they were cited by the respondents across the interviews.

Table 25: Developer’s motive for renewable energy development

Differential	Frequency
Profit margins	13
Moral ground (Belief in green economy)	0
Associated financial risks	1
Project life cycle	0
Other	0

5.9 Conclusion

This chapter has presented the results of the interviews for each question that was asked. Based on the results obtained, it can be confirmed that the research design, experience survey and methodology, that is, the personal interviews applied were appropriate.



The sample chosen, and the amount and type of data gathered yielded meaningful and insightful data which could be analysed in order to make academically sound and meaningful conclusions. The following chapter will analyse these results, demonstrate their meaning in the context of the theory presented in chapter two and show their relevance to the renewable energy development in South Africa.



6 CHAPTER 6: DISCUSSION OF RESULTS

6.1 Introduction to the results discussion

This chapter discusses the results of the study within the context of the research questions defined in Chapter three. The following sections each discuss a single research question by examining the results as documented in Chapter five and reflecting on the literature review that is presented in Chapter two.

The preceding chapter presented the outcome of the results from the qualitative, face-to-face, in-depth interviews. This chapter will analyse and interpret these results based on two inputs: the results produced in Chapter five and the literature review conducted in Chapter two. This chapter will provide more insights into the research problem with the evidence that the research problem has been answered.

The content analysis using secondary data as well as the in-depth interviews with the respondents provided an extensive set of data from which the researcher was able to compare the themes that emerged and assess the effectiveness of the dialogue around renewable energy.

Most of the arguments presented in this chapter draw from facts presented in Chapter 5; it is, therefore, logical for the structure of this chapter to follow in the same manner. Therefore, this chapter will start with a short discussion of the sample used, including some observations. Following on from this, the observations, insights, and inferences pertaining to the dataset will be discussed, and analysis will be done.

6.2 Pricing and costing

6.2.1 Introduction of subsidies

The evidence from the interviews, as indicated by Table 5.2 in the preceding chapter, points to the need for keeping the renewable energy market independent of subsidies. One of the main points emerging from the interviews regarding the subsidies is that the energy sector must maintain free market principles and that the



current bidding prices are already at a premium. The evidence suggests that the stakeholders of renewable energy would like to see the renewable energy sector as an independent sustainable business model not based on subsidies.

Volpi argues that the fact that more traditional forms of energy are currently still benefiting from a massive number of subsidies, including, but not limited to, direct forms such tax reductions, obligations to purchase a certain form of energy, reduced electricity rates for large (usually industrial) users, infrastructural support, exemptions from risks or liabilities, and research and development funds is no doubt acting as a barrier to renewable energy development (Volpi, 2009).

Subsidies can be a sensitive and critical issue in renewable energy, as Martinot et al show in a telling summary, “Lessons suggested by experience are that:

- subsidies are unlikely to lead to sustainable markets unless they explicitly create conditions where they are no longer needed (that is, smart subsidies);
- subsidies can undermine private investments and business in new markets and should be applied with attention to private-sector conditions in a particular market;
- subsidies can be used effectively to build up initial market volume, local expertise, user awareness, appropriate technology adaptation, quality standards, and entrepreneurial activities;
- subsidies are more effective when tied to operating performance rather than investment; and
- continuing subsidies may always be needed for poorer segments of the population (Martinot et al, (2011).

This points to the evidence based on the responses and reasons given for not supporting subsidies, as indicated by Table 5.3 in Chapter five. The overall evidence is that the renewable energy sector should be sustainable; if subsidies are introduced, there must be a clear timeline and objectives such as to get the project



off the ground or to support a certain part of the community that cannot afford the tariffs, and at a certain point they must come to an end.

6.2.2 Other incentives to renewable

The success of renewable energy in the global electricity sector, as per Figure 6.1: Incentives for generating electricity from renewable energy below can vary greatly by country, depending on what instruments there are, what the most efficient and effective support is, and what those incentives could mean for investors (Owen, 2009; Banks & Schäffler, 2010; IEA, 2011). If there are no or minimum instruments put in place and the support is not efficient or effective, the growth in the renewable energy sector will also be very minimal.

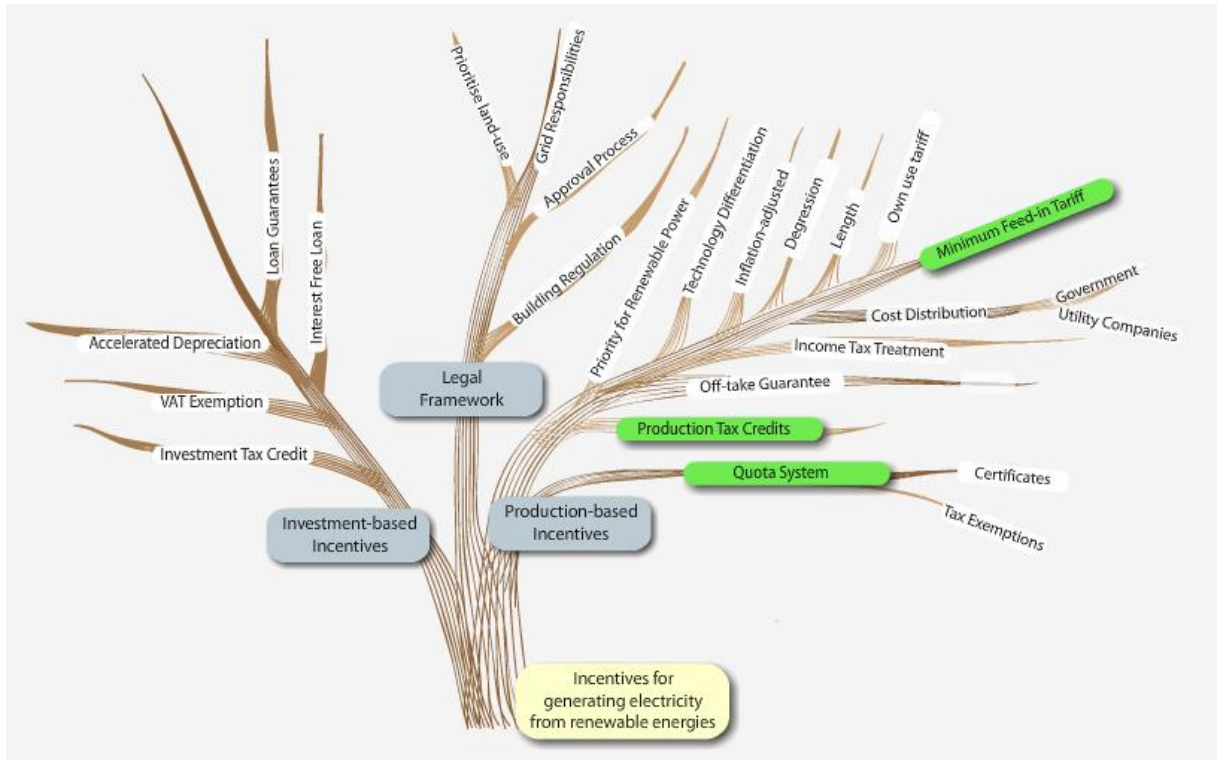
Muller, 2010 and Houser, 2010, using the Rhino model shown figure 6.1 states that at the minimum, there must be incentives for investment, for generating renewable energy and the legal framework must also align. The model, as depicted by Figure 6.1: Incentives for generating electricity from renewable energy below is based on three main incentive categories. The roll-out of renewable energy programmes in South Africa, to a certain extent, follows this model:

- Investment-based incentives: providing interest-free loans, exchange rate guarantees, etc.;
- Production-based incentives: developers receiving tax credits, guaranteeing minimum tariff or price guarantees; and
- A robust legal framework: providing a one-stop shop agency approach and effective and efficient approval processes.

One of the factors raised as an incentive to make renewable energy less costly and more sustainable in South Africa was that the Independent Development Corporation (IDC) and Development Bank of South Africa (DBSA) could provide favourable rates and favourable contracting terms to renewable energy developers compared to what the banks were offering, and that Eskom or government had to strengthen the transmission infrastructure, provide Carbon taxes, strengthen and

emphasise on quota systems, and offer green credits/certificates for renewable energy development.

Figure 6.1: Incentives for generating electricity from renewable energy



Source: Rhino Energy, 2012

This follows the evidence from the interviews as demonstrated by Table 3: Introduction of subsidies to renewable energy sector in chapter five. The market is divided, with the majority of the respondents not in favour of the incentives; however, on further probing, it became clear that those who were in disagreement actually supported the incentives, but they believed that South Africa had done a reasonable and sufficient amount to incentives the development of renewable energy. Therefore, the evidence points to the fact that renewable energy development does need incentives, but to a certain point.



6.2.3 Profitability and competitiveness renewable energy investment

The overwhelming majority of the interview respondents, as shown by Table 6: Profitability and competitiveness of the financial return in the preceding chapter, believe that the financial return from renewable energy investment, as it is currently proposed from Window one and two is profitable and very competitive. What was interesting is the observation that the financial returns from Window one are much higher than Window two, and Window three is expected to be even lower than Window two.

This could be as a result of many factors such as the maturity of the process and a full understanding of the technology from the power producer's perspective. The DoE may have accepted or been willing to pay a higher premium in Window one to ensure higher participation, and it may also have used some learning from Window one in Window two, and the investors' expectations and how they priced the risk may have decreased and is expected to decrease even further as the process matures and becomes more effective and more stable.

By and large, investors prefer renewable energy technologies that are financially viable; the financial viability of their investment is very important (Bushnell, 2010). No investor will invest in any type of technology that is not competitive and profitable, and that is not financially viable. The overwhelming response from, and participation by, investors in the renewable energy Tender one and two are indications that they deem them financially viable.

6.2.4 Current proposed bidding price

This question was answered based on the current bidding process under way for renewable energy by the Department of Energy (DoE). All the respondents in the bidding process bid a price for their product, among other things. As a result, all the interview respondents believe that the price that the prospective independent power producer were bidding is a sustainable price that has been modelled to ensure a fair and equitable return to both investors and IPPs. Almost all the respondents argue



that had the bidding price not be sustainable, none of the IPPs would have got funding for their projects.

The South African bidding process is very similar to the UK's "renewables obligation" process, which includes the following key elements (Lyon & Yin, 2010):

- The government issues an order for a fixed amount of electricity required from renewable sources (xMWh);
- It invites tenders, which have to meet the required specifications;
- Developers submit bids for proposed projects within each of the technology categories such as biomass, wind, etc., and the projects with the lowest per-kWh price are awarded power purchase contracts;
- Specific technologies are excluded from the obligations as they approach competitiveness in the open market;
- Once a tender has been successful, a purchase of power is secured;
- Technologies can be excluded when they become cost-competitive; and
- The regional utilities are obliged to purchase power from awarded generators at a premium price. The difference between the premium price and the average monthly power pool purchasing price is subsidised through the fossil levy as administered by the Non-fossil Purchasing Agency.

The DoE has adopted a similar approach, with Eskom as the utility that will be the off-taker of the energy from the contracts that would have been negotiated and concluded by the DoE. The premium that Eskom is paying, will be ring-fenced and clawed back from the price determination by NERSA (it is hoped). However, the delay in finalising this process for the first two bids due to this premium is becoming a sticking issue between Eskom, NERSA, and the DoE, among other challenges.

6.2.5 Current electricity tariff undermining renewable energy

Most predictions suggest that technological innovation will eventually make renewable energy comparable to conventional energy prices; however, currently, conventional energy prices are still far cheaper than renewable energy due to many



reasons including the maturity of the conventional energy sector and cheap sources such as coal (Banks & Schäffler, 2010).

Respondents had mixed responses to this question as indicated by Table 8: Current conventional energy prices undermining renewable energy with 69% not agreeing that, with the recent increases in electricity tariffs, there was a clear indication that some of the low-cost renewable energy sources (i.e. wind) will soon compete with conventional sources. One respondent stated:

“It’s not a question of price but the market; electricity is a regulated market with prices determined by NERSA, it’s the market with a prohibition of the willing seller willing buyer approach. There must be a market reform with the Independent System and Market Operator (ISMO) with a standardized approach across the industry.”

Other factors highlighted was that the new builds (Medupi and Kusile) were definitely comparable to, or slightly higher than, some of the renewable energy prices, and there was an abundance of coal and water, which would cause conventional energy to continue to undermine renewable energy prices.

Others highlighted the favourable treatment given to conventional energy, for example conventional energy being subsidised, consumers paying below marginal cost, averaging pricing being done, and low taxes compared to renewable energy as one of the main reasons for conventional energy undermining renewable energy. One respondent believed that conventional energy prices “are creating a barrier to entry” for renewable energy. All were in agreement that the current nature of electricity prices undermined renewable energy development.

6.3 Legal and regulatory

If renewables are expected to achieve competitive success through more market-led developments, then the regulatory framework and enabling policies that favour conventional energy should be removed (Lyon & Yin, 2011). With great technology,



a robust legal framework has to be in place to attract investors, with more investors resulting in healthy competition, which will drive down prices.

6.3.1 Current regulations promoting renewable energy

A slightly higher number of respondents - 54%, as shown in Table 9: Current regulations promoting renewable energy development thinks that current incentives and regulations are favourable for promoting renewable energy development. The main reasons cited for believing the process is favourable include the fact that it is a new process; therefore, it is evolving. Most respondents agree that there is a very good and clear policy direction. The high number of IPP participants is also an indication that the process is effective. Policy makers are positively involved. Reasons cited for believing that the process is not effective include that the process is designed for a monopoly system, the timelines favour those that are at an advanced stage, and the process is too elaborate

6.3.2 Effectiveness of the current regulations

“it’s a new process to everyone involved, its new to the policy makers (DoE), it’s new to the IPPs, it’s new to the utility, Eskom who will be an off-taker, but the encouraging part is that all the stakeholders are getting into grips with it, some try to take short cuts, some argue that they can’t meet certain requirements therefore ask for certain waivers or exemption. Interestingly some are deep in the process but still don’t fully comprehend the impact to them especially financial impact e.g. Eskom still don’t know how these prices will be ring-fenced, NERSA is currently in no position to provide a clear answer The good news is that everyone agrees that it has to be done and everyone has a role to play”.

The above was one of the comprehensive responses obtained in this question from one respondent, summarising the process. The process is streamlined and approval process as a law governing the role and responsibilities of developers around grid connection and operation is also clear. There were, however other strong and negative opinions such as:



“It’s a crazy process, the process of putting up a 1000MW or a 10MW plant is exactly the same... it is only favourable to those with deep pockets... the timelines are ridiculous e.g. to get the EIA takes about 18 months, by the time you get the EIA the process would have been long closed”.

There is no country that would like to have a framework that is too lax as it may attract a gold rush that is unsustainable and unmanageable; however, if the process is too bureaucratic, on the other hand, it will most certainly stifle any investment. It is a learning process that is developing but it is somewhat effective and clear.

6.4 Market performance

6.4.1 Political influence of investment in renewable energy

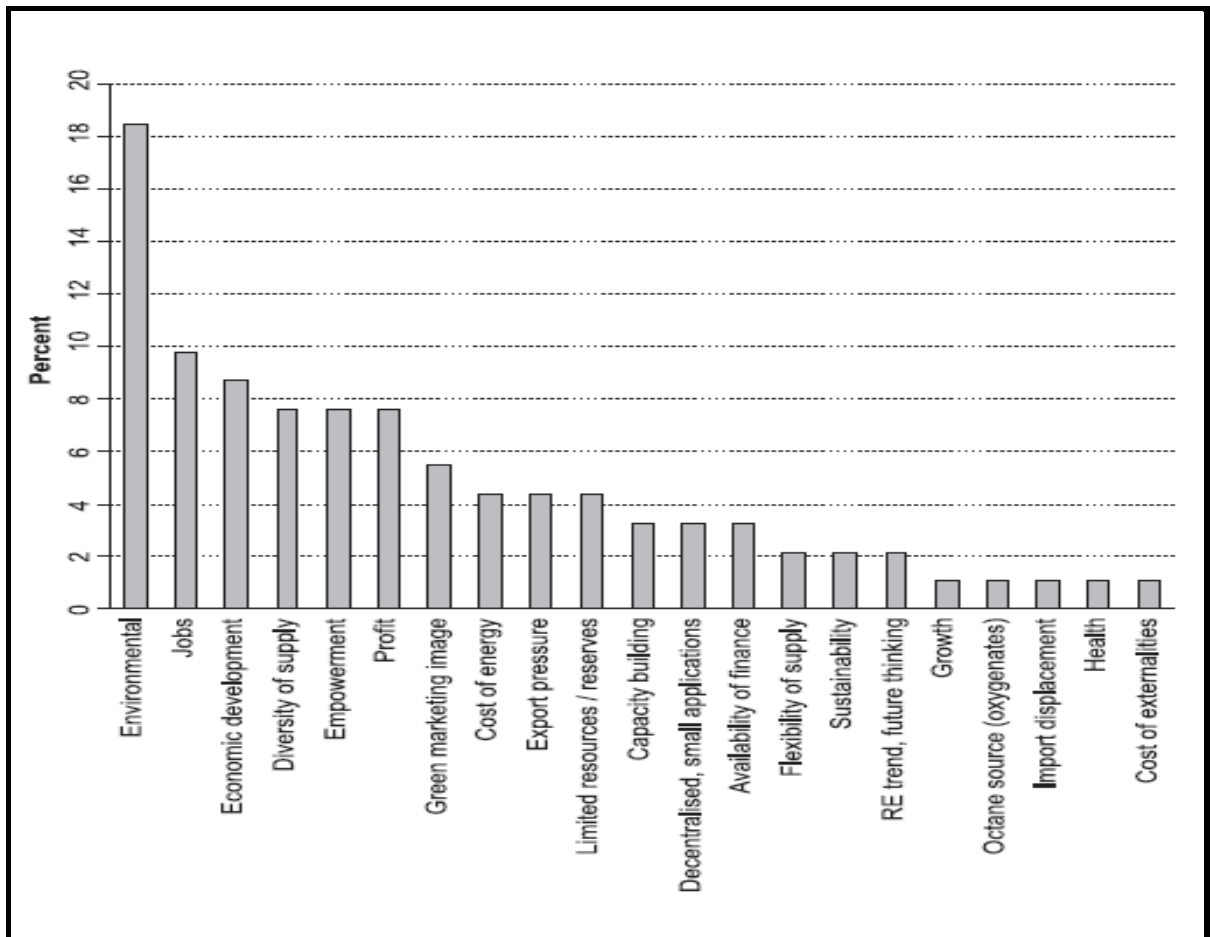
The results obtained are almost evenly split in responding to this question. A total of 54% of the respondents believe that the investment decisions in the renewable energy market in South Africa are influenced by political influence, as illustrated by Table 15: Reasons provided for political influence. The major factors cited include the fact that there are too many ministers who are involved in the approval process and that they all have different agendas in the process and that, there are a very strong push and unrealistic requirements for localisation and job creation from renewable energy development.

A clash of interests among the key stakeholders of the renewable energy process may lead to powerful lobbies against renewable energy development (Beal, Goyen & Phillips, 2005). One respondent was not particularly satisfied with the fact that there were too many ministers involved in the approval process, the current delay in finalising the Window one and two bidding process, and the infinite delay in opening the Window three bidding being attributed to this.

Some respondents highlighted the unstable macro-economic environment in South Africa as one of the indirect political influences. The unstable macro-environment does increase the risk and uncertainty for new investment in any country. As a result, this may indeed have an influence on the decision for any investor to invest

or not invest in renewable energy development in South Africa. In a study conducted by Painuly, the macro-environment was the number-one factor when an investor considered whether to investing in a country, as show in figure 6.1 below.

Figure 6.2: Motive for investment in renewable energy



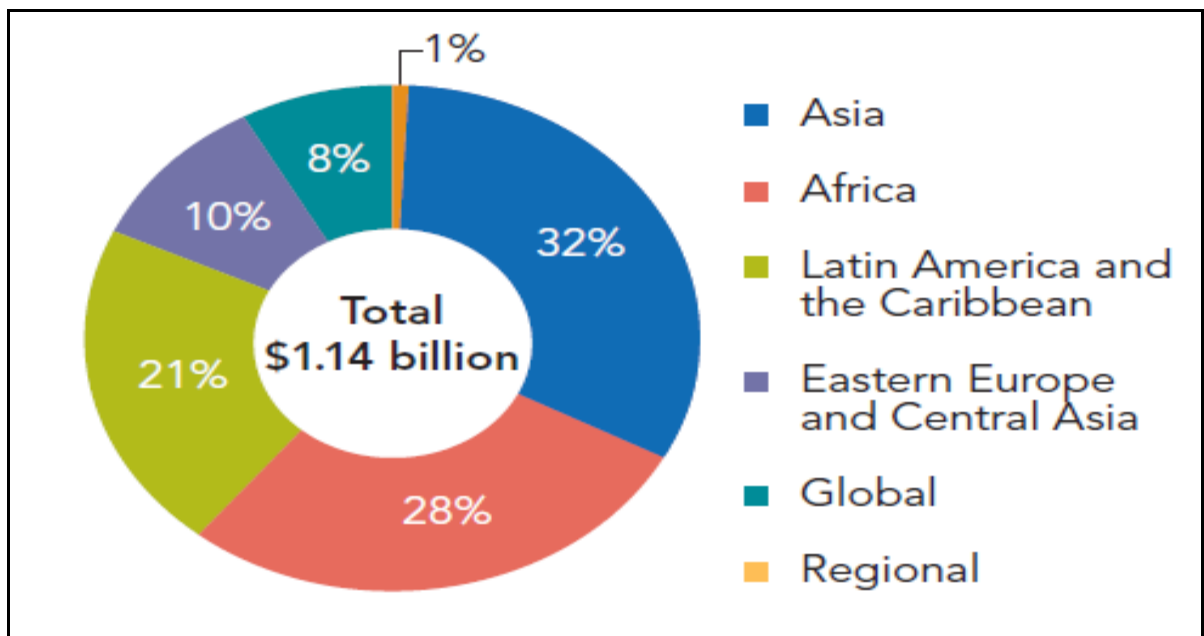
Source: Painuly, 2010

6.4.2 The lack of finance and understating renewable energy risk profile

All the respondents but one as shown by Table 16: Risk profiles for renewable energy investment do not believe that the lack of finance in programmes for renewable energy development in South Africa is due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy. Most respondents believe that investors know what they are getting themselves into, and that they have done similar deals in other countries

and have a very good advisory team during a very thorough due diligence. Figure 6.3: Renewable energy global funding below shows renewable energy funding levels across the world, illustrating that there is world experience to be tapped into to understand the risks associated with funding in renewable energy. Africa being second highest also may also suggest that Africa is not being viewed as risky by investors in renewable energy.

Figure 6.3: Renewable energy global funding



Source: Rhino Energy, 2012

A high payback period makes renewable energy projects unviable: benefits of renewable energy generation tend to materialise in the medium to long term; however, the private sector is driven by immediate financial returns (UNEP, 2011).

The evidence suggests that there is no lack of finance for renewable energy and Africa is actually the second largest investors' "safe heaven" in which to invest for renewable energy; therefore, investors seem to understand the risk. One strong opinion from the respondents was as follows:



“Investors perform a thorough due diligence, have a strong advisory including subject matter experts and have the world’s experience behind them”.

6.4.3 Availability of funding to renewable energy

If there is no access to funding, or a lack of access, it can effectively reduce the number of producers in the market; as a result competition and efficiency may suffer, eventually leading to higher prices. Availability of funding has a direct influence on the level of competition and prices.

There was consensus among all the respondents as shown by Table 17: Availability of funding for renewable energy that there was sufficient availability of funding to develop renewable energy in South Africa. As demonstrated by Figure 6.3: Renewable energy global funding above, South Africa is the second highest in attracting funding for renewable energy. This can only mean that renewable energy prices will eventually become competitive with conventional energy technologies as the number of producers of renewable energy increases.

6.4.4 Role of donor funding in the renewable energy development

Renewable energy development projects follow the same project life cycle as any other projects. The start is the concept phase or investment climate, followed by energy master plan, prefeasibility, feasibility and then investment in the project. At an early stage, there is a lot of risk as the project is still merely research. Investors do not generally become involved while funding is still very much needed; if the developers do not have a strong balance, donor funding plays a significant role.

The role of donor funding is to promote renewable energy, especially during the research or concept phase. Its aim is to supplement funding from the developers before the investors can come in during the feasibility stage, where they deem the risk manageable and that the project will probably be a success (Ovaska, 2008; Mauro,2010;).



One of the rare, but interesting roles of the donor funding mentioned by one of the respondents is that donors, especially foreign donors, tend to promote suppliers from their country of origin. They do this by promoting and funding projects such as renewable energy but one of the stringent conditions of their funding is that the receiver of the fund must use suppliers from the donor's country of origin. This is in the face of what South Africa is trying to achieve through renewable energy development which include "localisation"; the idea is that developers must use local suppliers during the development and operation of the project

6.5 Technology

6.5.1 Renewable energy technology competing with conventional energy

According to The Global Competitiveness Report 2010-2011 released by the World Economic Forum, South Africa ranked 76th for technological readiness out of 139 countries in 2010 (Bushnell, 2010). For any investor to invest in renewable energy, a technological factor will be a big influence. From the interviews, 85% of the respondents as illustrated by Table 20: Reasons provided against renewable energy competing with conventional energy stated that renewable energy technology could not compete with conventional energy technologies and that it should not; it should play a complementary role to conventional energy technologies.

The major factors highlighted by respondents are that renewable energy by and large cannot provide base-load, it is too expensive, and renewable energy technology, by its nature is not reliable (for example, it can only produce when the wind is blowing or when the sun is shining). South Africa's industrial sector accounts for approximately 30% of the energy demand and, therefore, needs a more stable source of energy supply.

While some believe that these technologies are unreliable and unsustainable for the type of industry sector we have in South Africa, it would be very difficult to overlook these technologies as they can provide South Africa with a very healthy mix of



generation. It also came out clearly that investors fully understood the risk involved; therefore, rather than the technology adapting to the South African market which might be very difficult to do, it would perhaps be easier for South Africa to adapt to suit the technology through local technological innovation.

Since renewable energy is still a new field for most countries, including South Africa, the risk of technological reliability is still very high. Given their novel track record, renewable energy projects are exposed to a higher degree of technological risk (relating to the likelihood of the technology used underperforming or not performing at all) than conventional, well-proven technologies in the area of fossil fuel generation (UNEP, 2012). However there are some technologies like wind and photovoltaic that are fast gaining experience and South African can make use of these while on the learning curve on the less tried and tested technologies.

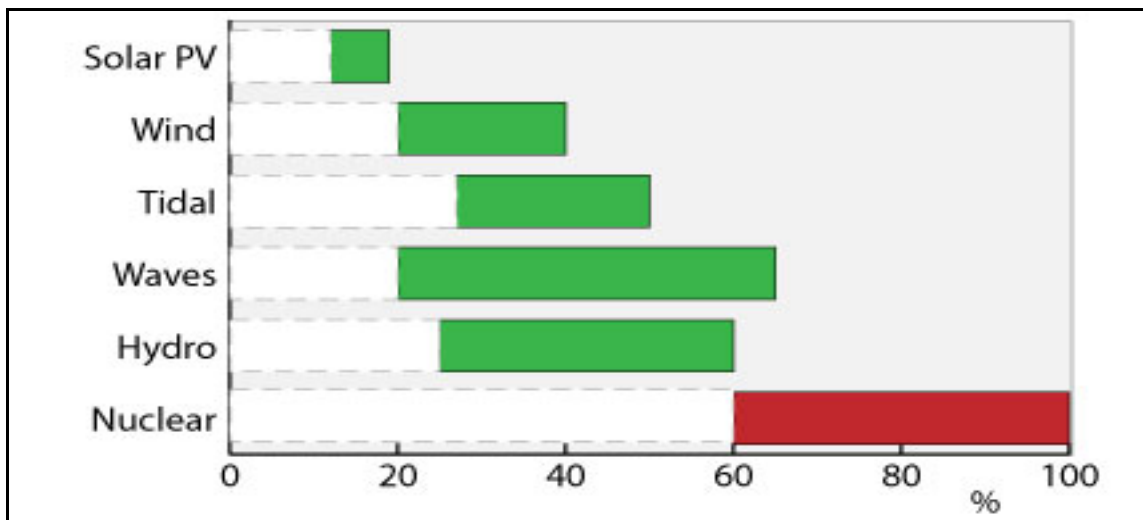
Another factor that came out from the respondents was the capital intensity of renewable energy technologies compared to conventional technologies. The capital intensity, which tends to be higher for renewable energy than for fossil fuel-based generation projects, means that the encountered investment risk landscape in developing countries will tend to have a particularly detrimental effect on project cost structure, especially on the cost of capital, in the case of renewable energy projects (UNEP, 2012).

Access to the grid for renewable energy technologies was also highlighted as one of the possible hindrance. The grid in South Africa does not cover the entire country, and what is more challenging is the fact that transmission and distribution infrastructure is currently owned by Eskom, which is also the producer of electricity and, therefore, could potentially sabotage the IPPs in terms of availability of the transmission and distribution network. The DoE is planning to counter this by establishing the ISMO (Independent System and Market Operator) which will schedule and dispatch the available and contracted plants; if this becomes successful it will eliminate or reduce the grid access challenge faced by renewable energy.

6.5.2 Renewable energy replacing conventional energy

The majority of the respondents, as illustrated by Table 21: Renewable energy replacing conventional energy does not believe that renewable energy development would ever replace conventional energy. There were a number of reasons that were mentioned by respondents why they did not believe that conventional energy sources would be replaced by renewable energy. The factor most mentioned was that renewable energy could only complement conventional energy sources due to the fact that renewable energy is unpredictable and could not provide the base load profile due to its unpredictability.

Figure 6.4: Renewable energy load factor



Source: Phelps & Horman, 2010; Rhino Energy, 2012

There are number of reasons why the energy plant's capacity factor will never operate at 100%; some of the reasons include fluctuations in the availability of the primary energy source and outages due to maintenance; however, the target is that it should be as close to 100% as possible. Figure 6.4: Renewable energy load factor above indicates that for renewable energy sources, it is mostly below 50% this is mainly due to availability of the primary energy source, for example, solar plants that can only generate when there is sun.



6.5.3 Importance of renewable energy in South Africa

The factors and reasons from the interviews ranged from it possibly being good for job creation, reducing our carbon emissions, bringing foreign development investments (FDIs), and possibly being used as an opportunity for localisation and job creation to it providing a big opportunity to drive things such localisation and employment creation. There is no doubt that most of the respondents agree that renewable energy can be an important part of the energy solution. The one respondent who did not agree had this to say:

“the debate on whether renewable can be an important part of the energy solution in South Africa is a philosophical debate, South Africa has enough cheap coal, it is a known fact that renewable energy is expensive and unreliable . . . nuclear is also another logical approach way before one start considering renewable energy, taking its safety into consideration”

The country requires energy in order to meet the electricity demand, which, in turn, drives the economy (Mauro, 2010). Renewable energy will be cheaper in the near future and this will have a positive impact on the environment and complement the environmental unfriendly conventional sources. Renewable energy can also provide system stability in the sense that it can help create maintenance or outage space, and can supplement the peaking profile (Phelps Horman, 2010).

According to Agama Energy (2008), if all renewable energy projects are successful a total of 36400 direct jobs alone can be created in the South African economy, with additional spin-off employment potential. A key finding from the Agama Energy Study which was later supported by Lyn & Yin (2010) is that the development of large-scale renewable energy projects will sustain and substantially boost the numbers of jobs in the energy sector.

The success of renewable energy projects means success of renewable energy technology, which can be attributed to an enabling framework that allows and attracts investment and is based on viable pricing (Merven, Hughes & Davis, 2011).



It is, therefore, no surprising that all the respondents agree that renewable energy can and must be an important part of the energy solution in South Africa.

6.6 General

6.6.1 Renewable Energy development approach in RSA

A fragmented approach to renewable energy development is more likely to create more problems than to yield good results (Friedman & Sarge, 2008). There is agreement among the respondents that there is a need for a multi-dimensional approach to RED. In their responses, all the respondents suggest that there is a strong interconnection of the barriers, but unless there is a good policy framework that supports renewable energy development, technology will always be lagging behind which will result in a lack of investment and renewable energy prices remaining too high.

This supports the proposition put forward by Owen, 2009; Masini & Menichetti, 2010; Merven, Hughes & Davis, 2011; GEF, 2012) on the definition of the barrier-removal strategy, “that it should focus on the following fields”:

- **Policy frameworks:** governments must play an essential role in setting policies favourable to the adoption of environmentally sound technologies (ESTs);
- **Technology:** the range of available technologies should be robust and operational - more mature technologies are easier to transfer;
- **Awareness and information:** national stakeholders, especially market participants, must be aware of the technology and have information on its costs, uses, and markets;
- **Business and delivery models:** market based approaches are preferred; businesses and institutions must be in place to deliver to and service those markets; and



- **Availability of financing:** financing must be available for technology dissemination, though it is insufficient in itself to ensure the market penetration of ESTs.

6.6.2 Economic differentials between renewable energy and conventional energy

There is a notion of morality when it comes to the green economy and reducing greenhouse gas emissions – hence, the possibility that the development of renewable energy is, to some extent, taking the moral ground. The respondents believe that none of the developments of renewable energy are based on moral ground; they are all based on the profit margin or profitability of each project.

With the involvement of institutional funding, the financial backing and the motive of investment to every project is based on the financial strength of each project (Ovaska, 2008). The renewable energy is attracting a lot of funding; this is evidence that they are profitable.

6.7 Conclusion on the result analysis

This chapter has analysed the results of the interviews that were conducted. The objective of the chapter was to answer the questions looking at the current state of renewable energy in South Africa and the challenges being faced in the renewable energy development and the possible relationship and interconnection between the main barriers such as technology, pricing and costing, legal and regulatory factors, and market performance.

The interviews covered a wide range of possible challenges, ranging from pricing, to policy, technology, investment and other related factors relevant in testing the possible relationship and interconnection between all or some of these barriers. The majority of the participants share the view that, in South Africa, the government has done some good work in encouraging renewable energy technology, but a lot of work still needs to be done to create an enabling environment for renewable energy



technology. In terms of market performance, it is very encouraging that the market approach for promoting renewable energy has been adopted, and as a result funding is available. There are still a number of concerns including the robustness and operational know-how of the technology and the maturity of the technology.



7 Chapter 7: Conclusion

7.1 Introduction

This chapter addresses the main multi-dimensional barriers to renewable energy as outlined in Chapter one as well as how the research objectives have been met through conducting this research. As far as could possibly be ascertained, this is the only South African study dealing with multi-dimensional barriers to renewable energy. As such, it will provide a basis for further research into similar fields.

7.2 The Research Objectives

The objective of the research was to explore these barrier linkages and multi-dimensional barriers, with an intention to understand them. A further objective was to use systems thinking to understand the interconnection of the main barriers. The research aim was to look at the technology and its possible linkages with pricing and costing, policy and regulatory, and market performance.

This was done by looking at the available literature and conducting semi-structured interviews with South African renewable energy stakeholders. Chapters five and six set out the results of these interviews and described the stakeholders' views, their perceptions, and their experience regarding the outlined barriers to renewable energy in South Africa. To this end, recommendations for further research are made.

7.3 The Central Research Problem

There have been various studies focusing on particular technological, social, political, or economic barriers and solutions to renewable energy programmes (Mandle, 2008; Houser, 2010; Verbruggen, Fishedick, Moomaw, Weir, Nadala, Nilsson, Nyboer & Janczura, 2010). Although such studies are important, there is also a need for a multi-dimensional understanding of the underlying barriers to renewable energy in order to determine the most effective possible and sustainable solutions. In order to advance renewable energy investment, and to better



understand the barriers and potential solutions to its further development, a more balanced examination is required that focuses on the various underlying dimensions of the problem and the complexity of the interactions between those dimensions (Bushnell, 2011; Beck & Martinot, 2011).

7.3.1 Policies and Regulatory

Many countries are putting good policies in place, as a result, there is emerging experience with renewable energy policies around the world; however, the impact of various policies and regulations still needs to be perfectly understood (Kefferputz, 2009). South Africa is no different; its policies are new, are yet to be fully tested and are still considered “experimental” in nature; as a result they are still evolving.

Over and above putting good policies in place, the government has to define what the vision for renewable energy development is and what role renewable energy technologies are expected to play. It is clear that financiers and developers play a significant role in renewable energy development; however, governments play a critical role in reducing drivers of the political and regulatory risk landscape.

The results of the research lead to the conclusion that the factor with the most influence in the development of renewable energy is an enabling policies and regulatory frameworks. The results indicate that the relationships between enabling policies and regulatory frameworks and renewable energy development are strong.

Given appropriate enabling government regulatory frameworks, there is no reason why the world cannot achieve the required and necessary targets in renewable energy technologies. Large renewable energy programmes worldwide have not merely emerged from enabling conditions; they have had to take on powerful and influential incumbents, and have faced deliberate, strategy-driven, dedicated regulatory frameworks (Beck & Martinot, 2011).



7.3.2 Technology

There is potential for renewable energy to play a significant role in meeting growing global energy demands. The challenge, however, is that even if additional resources such as technology development are directed towards renewable energy programmes, the penetration of renewable energy will still be limited by the presence of some of the underlying barriers, especially if technology or any other barrier is addressed in isolation (Hodgson, 2009).

Understanding the barriers to renewable energy is not a one-dimensional problem that can be explained by any one technological or economic barrier (Houser, 2010). Respondents in the research highlighted technology and policy barriers as the most significant barriers, with regulatory framework considered the significant of the two. They all admit, however, that both have significant impact on the market performance with the amount of investment it can attract for renewable energy which eventually impacts on the price as well. Intervention with a combination of technical assistance for policy and regulatory support, building the technical and institutional capacity, and establishing financing mechanisms for investment in the deployment and diffusion of renewable energy technologies is therefore critical in creating conducive environment for renewable energy development (IEA, 2011).

7.3.3 Pricing and Costing

An enabling framework, with good renewable energy policies and a regulatory framework can ensure that the correct incentive mechanisms channel financial resources into renewable energy deployment, also by improving return expectations by ensuring the profitability of renewable energy projects (Bushnell, 2011). The results indicate that there is a still significant flow of public subsidies to fossil fuels. These flows need to be switched from fossil fuels to renewable energies. Governments need to improve the risk-return profile of renewable energy relative to conventional, particularly fossil-fuel-based, technologies and projects within their jurisdictions (UNEP, 2011).



7.3.4 Market performance

Investment in renewable energy and efficiency is important to reduce the negative economic, social, and environmental impacts of energy production and consumption (Merven, Hughes & Davis, 2011). South Africa has some experience with renewable energy, though largely limited to traditional biomass and off-grid applications. Renewables make a negligible contribution to bulk electricity supply. International climate finance must be used efficiently and effectively by unlocking and leveraging much greater volumes of private capital to improve renewable energy contribution. Fossil fuel subsidies to fund the required incentive mechanisms for renewable energy must be phased out (Barry, 2011). As has been demonstrated from literature, result of the research has confirmed that renewable energy development has been attractive for new investments, however, challenges such as regulatory framework, availability and maturity of technology, and profitability of the sector are the significant factors that determines the amount of investment.

7.4 Recommendations

A level playing field for renewable energy technologies will not help unless renewable energy proponents, developers and financiers have access to national electricity markets and grids with reasonable ease (IEA, 2011). As Komar notes, “A growing number of countries are using a very simple approach to get to new renewable capacity built: They are setting a mandatory goal (renewable obligation and quota) for renewable content and letting the market find the least expensive way to get there,” (Komar, 2004,156). South Africa has developed a similar approach; however, the process has suddenly been stuck, or moving slowly; it is no doubt a learning process, but that has to bring megawatts on the grid.

The current electricity situation mandates that the perceived and real constraints or barriers to the rapid and orderly introduction of renewable energy should be addressed as a matter of national urgency. These constraints are not unique to any



particular country; they have been encountered and been overcome successfully elsewhere in the world

A system-based approach that integrates technology and investment in renewable energy development with specific mechanisms to identify and address underlying barriers such as policy and regulatory aspects, will result in greater penetration of renewable energy in a more cost-effective way (Beaty & Willis, 2007). The most important constraint is not money, men, machines, materials or management, but the motivation, the inspired political will, as stated in the quote from Banks and Schäffler (2010):

“The most important constraint is not money, men, machines, materials or management, but the motivation, the inspired political will.”

7.5 Recommendations for further research

When talking about the international barriers to renewable energy development, the variables that are important to a particular country depend on its level of development. This research looked at a possible systems approach in order to explore and understand the barriers to renewable energy. This can be taken forward, using the systems approach to explore the barriers with the intention of identifying the most significant underlying barrier and its impact on renewable energy development.

When exploring technology as a barrier to renewable energy, grid connection was mentioned. Research needs to be done on access to the grid as a possible barrier to renewable energy, and the impact of grid versus off-grid renewable technology.

7.6 Chapter Conclusion

This final chapter of the research has addressed the main research problem of the using system’s approach to exploring and understanding the multi-dimensional barriers and their possible relationship and interconnection and reviewed the



research objectives and demonstrated how these objectives have been met. The researcher has also made some recommendation to industry stakeholders and those outside the industry who interested in this subject for further research. This chapter serves as a formal conclusion to the research project presented.

REFERENCES

- Adelegan. O.J., & Radzewicz-Bak, B.E. (2009). What determines energy market development in sub-Saharan Africa? IMF Working Paper, 09/213, (Washington: International Monetary Fund, USA), pp. 1-32.
- AfDB, (2010). "Clean energy investment framework for Africa", Operations Policies and Compliance Department.
- Agama Energy. (2003). Employment Potential of Renewable Energy in South Africa
- Barry, D. (2011) Contribution to the Theory and Practice of Technology Selection: The case of Projects to ensure a sustainable energy base for Africa. PhD of Project Management. University of Pretoria, Johannesburg.
- Barry, J. (2009). Proposal to promote solar energy systems in Mali, Enhanced Energy foundation, Pasadena, CA 91107, USA.
- Banks, D., & Schäffler, J. (2006). The potential contribution of renewable energy in South Africa. Johannesburg: Sustainable Energy & Climate Change Project, Earth life Africa.
- Beal, D.J., Goyen, M., & Phillips, P. (2005). Why do we invest ethically: Journal of Investing. Vol 14, No 3, 66-78
- Beatty, P.C., & Willis, G.B. (2007). The research synthesis: The practice of cognitive interviewing. Public Opinion Quarterly, Vol 71 No 2, 287-311.
- Beck, F. & E. Martinot, (2004). "Renewable Energy Policies and Barriers." Encyclopaedia of Energy.
- Burns, N, & Grove, S. (1993). The practice of Research. 2nd ed. Philadelphia: W.B. Saunders Company.



- Bushnell, D. (2010). Conquering climate change. *Futurist*, Vol 44 No3, 25-27
- Charmaz, K. (2006). The “core category” of grounded theory: Making constant comparisons, Vol. 1, No. 3.
- Chiu, A. (2009). Solar Thermal Heating Up Sharply. WorldWatch institute.
- Clay, R. (2002). Renewable Energy: Empowering the Developing World. *Environmental Health Perspectives* , 30-33.
- Dalgaard, C.J., Hanson, H., and Tarp,F. (2004). Aid effective Disputed. *Journal of International development*. Vol 12, 375-398.
- DME. (2009). *Implementation progress for the first five years of the Renewable Energy White Paper*. Pretoria, South Africa: Government Printers.
- DoE. (2011). *The Renewable Energy Market Transformation Project*. Paper presented at the WWF Conference on Renewable Energy.
- Eberhard, A. (2008). From state to market and back again: South Africa's power sector reforms. *Economic and Political Weekly*.
- Elliot, D. (2011). Renewable energy and sustainable futures. *Futures* 32: 261-274.
- Eskom (2011). *Annual report*. Retrieved July 2012 from: <http://www.eskom.co.za/annreport11/>.
- Evans, A., Strezov, V. & Evans, T. (2009, June). Assessment of sustainability indicators for renewable energy technologies. *Renewable and Sustainable Energy Reviews*, 13(5), pp. 1082–1088,
- Fakir, S., & Nicol,D. (2008). Obstacles and Barriers to Renewable Energy in South Africa. Pretoria: Department of Environmental Affairs and Tourism.
- Fakir, S. & Nicol, D. (2011) *Investigation by the National Environmental Advisory*



Forum on "Obstacles and Barriers to Renewable Energy in South Africa. South Africa: Department of Energy.

Friedman, M. (1995). Getting back to real renewable energy growth. *Electricity journal*. Vol 5 No 4.

Friedman, J.M., Sarge, L.S., (2008). The utility analysis of choices involving risk. *Journal of Political economy*. Vol 16 No 7.

Geller, H. (2003). *Energy Revolution: Policies for a Sustainable Future*. London: Island Press.

Harrison, J.S., & St John, C.H. (2010). Managing and partnering with external stakeholders. *Academy of Management Executive* , 16 (5), 46-60.

Houser, T. (2010) Copenhagen, the Accord, and the way forward. *Peterson Institute of International Economics*, 10(5), 1-17

International Energy Agency (IEA), (2012). Key world statistics 2012. Retrieved from www.iea.org

International Energy Agency (IEA), (2011). Clean Energy Progress Report, Paris, OECD/IEA.

Jacobsson, S., & Lauber, V. (2006). The politics and policy of energy system transformation: Explaining the German diffusion of renewable energy technology. *Energy Policy*, 34, 256-276. doi: 10.1016/j.enpol.200.08.029.

Janczura, K. (2010). Price volatility and the efficient energy portfolio for the united States. *Atlantic Economic Journal*, Vol 38 No 2, 169-178.

Kefferputz, R. (2009). Europe's gas crisis. Heinrich Boll Foundation. Retrieved from <http://www.boell.eu/web129-481.html>

KfW, 2005, Financing Renewable Energy: Instruments, Strategies, Practices



Approach. Frankfurt, KfW.38

Knittel, C.R., (2006). "The adoption of state electricity regulation. The role of interest groups." *Journal of industrial Economics* 54(2): 201-222.

Krippendoff, K. (1980). *Content analysis: An Introduction to its methodology*. Newbury Park: Sage.

Lyon, T.P. and H.Yin, (2010). "Why do states adopt renewable portfolio standards? An empirical investigation." *The energy journal* 31(3): 113-157. Vol 31 no 3-7.

Mabuza, L.O.K., Brent, A.C & Mapako, M., (2007). The transfer of energy technologies in a developing country context – Towards improved practice from past successes and failures. *Proceedings of the World Academy of science, Engineering and Technology*. Vol 22 No 1, 237-241.

Mandle, J. (2008). Reconciling development, global climate change, and politics. *Challenge*, Vol 51 No 6, 60-79.

Masini, A., & Menichetti, E. (2010). The impact of behavioural factors in the renewable energy investment decision making process: Conceptual framework and empirical findings. *Energy Policy*. Doi:10.1016/j.enpol.2012.06.062

Martinot, et al., (2011). "Renewable energy markets in developing countries," *Annual Review of Energy and the Environment* 27: p. 309-348.

Marshall, C., & Rossman, G. D. (2006). *Designing effective research* (4th ed.). London: Sage Publication Ltd.

Mauro, P. (2010). Corruption and growth: *The quarterly journal of economics*. Vol 110 No 3 681-712

Merven, B., Hughes, A., & Davis, S. (2011). Analysis of energy consumption for selection of countries in the Southern Africa development community: *Journal of*



Energy in Southern Africa. Vol 21 no 1.

Merven, B., Hughes, A., & Davis, S. (2011). Johannesburg shows green credentials. African business review. [Online], Accessed: 06 July 2012. http://www.africanbusinessreview.co.za/money_matters/johannesburg-shows-green-credentials.

Miles, M.B., & Huberman, A.M. (1994) Qualitative data analysis: An expanded sourcebook (2nd ed). London: Sage

Mouton, J. (1996). Understanding social research. Pretoria: Van Schaik.

Muller, B. (2010). Copenhagen 2009: Failure or final wake-up call for our leaders? Oxford, UK: Oxford Institute for Energy Studies.

Nkomo, J.C. (2007). Energy and Economic Development: Challenges for South Africa. Journal of Energy Southern Africa. Vol 16 No 3.

Ovaska, T. (2008) The failure of Renewable energy development. Cato Journal. Vol 23 No 2: 175-188

Owen, A.D. (2006a). Evaluating the costs and benefits of renewable energy. The Australian Economic Review, Vol 39 No 2, 207-215.

Owen, A.D. (2006b). Renewable Energy: Externality costs as market barriers. Energy Policy, Vol 34 No 1, 632-642.

Painuly, J.P. (2010). Barriers to renewable energy penetration: A framework for analysis. Energy Policy. Vol 39 No 6, 73-89

Phelps, A.F., and Horman, M.J. (2010) "Ethnographic Theory Building Research in Construction" Journal of Construction Engineering and Management, Vol 136 No 1

Polit, D.F, and Hungler, B.P. (1993). Research. Principles and Methods. fourth ed. Philadelphia, New York, Hagestown: J.B. Lippincott Company.



Polit, D.F, and Hungler, B.P. (1995). *Research. Principles and Methods*. fourth ed. Philadelphia, New York, Hagestown: J.B. Lippincott Company.

Roy, S. Disenyana, T. and Kiratu, S. (2010). *Clean Energy Investment in Developing Countries: Domestic barriers and opportunity in South Africa*.

Sebitosi, A.B., Pillay, P., (2005). *Energy service in sub-sahara Africa: how conducive is the environment?* *Energy Policy*. Vol 33 No 16, 20442051

Sebitosi, A.B., Pillay, P., (2007). *Modelling a sustainability yardstick in modern energisation of rural sub-Saharan Africa*. *Energy policy*. Vol35 No 1, 548-552.

Stemler, S. (2001). *An overview of content analysis*. Retrieved October 3, 2012, from Practical Assessment, Research & Evaluation: <http://pareonline.net/getvn.asp?v=8&n=02>

UNEP, (2012). *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication – A Synthesis for Policy Makers*.

UNEP F1 and Partners. 2011, *Investment-grade climate change policy: Financing the transition to the low carbon economy*.

United Nations Industrial Development Organization (UNIDO), (2010). *Module 12: Overview of renewable energy and energy efficiency: Training package on sustainable energy regulation and policy making for Africa*, UNIDO.

Volpi, G. (2005). *Renewable Energy for Developing Countries: Challenges and Opportunities*. In V. Lauber ed., *Switching to Renewable Power: A Framework for the 21st Century* (pp. 1-268). London: Earth scan.

Wacziarg, R. (2010). *The diffusion of renewable energy development*. *Journal of economic literature*. Vol 11 No 1: 907-918.

Winkler, H., Mavhunga, J., (2002). *Potential impacts of electricity industry*



restructuring on renewable energy and energy efficiency. *Journal of energy in Southern Africa* Vol 13 No 2, 43-49, H. (2008). Tax credits underscore need for renewable energy subsidies. *Idaho Business Review*.

Zhang, Y., & Wildermuth, B. M. (2006). *Content analysis*.

Zikmund, W.G. (2003). *Business Research Methods*, 7th edition. South Western Publishing, Ohio.



APPENDIX 1: QUESTIONNAIRE

INTERVIEW ONE SCHEDULE

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) Background Information - Interviewee

- a) Name of the Company: **Withheld**
- b) Industry: **Electricity**
- c) Role in Industry: **Project development.**

2) Identification

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)
 - i) **Development**
- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?
 - i) **CSP**
 - ii) Please explain
- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?
 - i) **Yes**
(1) Its new technology that is developing fast
 - ii) No
 - iii) Please explain

3) Pricing and Costing

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?
 - i) **Yes**



(1) But government have other important challenges so it can't be sustainable

- ii) No
- iii) Please explain
- b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?
 - i) **Strengthening the Tx infrastructure**
 - ii) **Global commitment**
- c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
 - i) **Yes**
 - ii) No
 - iii) Please explain
- d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges? There is no fixed price, it's a competitive bidding process
 - i) **Yes**
 - ii) No
 - iii) Please explain
- e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
 - i) Yes
 - ii) **No**
 - iii) Please explain.
- f) When do you believe the above will be at a level that supports RE?
 - i)

4) Legal and regulatory

- a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
 - i) Yes
 - ii) **No**



- iii) Please explain
- b) Based on your experience, would you describe the current regulations as effective?
 - i) **Yes**
 - ii) No
 - iii) Please explain
- c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?
 - i) Yes
 - ii) **No**
 - (1) It's a huge process but working well**
 - iii) Please explain

5) Market Performance

- a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?
 - i) Yes
 - ii) **No**
 - iii) Please explain
- b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?
 - i) Yes
 - ii) **No**
 - iii) Please explain
- c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?
 - i) **Yes**
 - ii) No
 - iii) Please explain



d) In your experience, what do you think is the role of donor funding in the renewable energy development?

- i) **Promoting**
- ii) **Supplementing**
- iii) To drive the price down
- iv) Other
- v) Please explain

6) Technology

a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?

- i) Yes
- ii) **No**

(1) Investors do understand the risk involved

- iii) Please explain

7) General

a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?

- i) **Yes**
- ii) No
- iii) Please explain

b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?

- i) **Profit Margins**
- ii) Project Life cycle
- iii) Associated financial risks
- iv) Other
- v) Please explain

c) Do you think renewable energy can be an important part of the energy solution in South Africa?



- i) **Yes**
- ii) No
- iii) Please explain



INTERVIEW TWO

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) **Background Information - Interviewee**

- a) Name of the Company: **Withheld**
- b) Industry: **Energy and Electricity**
- c) Role in Industry: **Project Development**

2) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)

- i) **Developing and advisory**

- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?

- i) **Small Hydros – less than 10MW**

- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?

- i) **Yes**

- ii) **No**

- (1) **RSA doesn't have enough primary energy for RE**

- (a) **Wind is erratic**

- (b) **Not enough sun**

3) **Pricing and Costing**

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

- i) **Yes**

- (1) **Must subsidise capex not opex**

- ii) **No**

- b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?



- i) **Nothing – It must be a viable business**
 - c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
 - i) **Yes**
 - (1) It's a good viable business**
 - ii) No
 - d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges?
 - i) **Yes**
 - (1) There is no fixed price, it's a competitive bidding process**
 - ii) No
 - e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
 - i) Yes
 - ii) **No**
 - f) When do you believe the above will be at a level that supports RE?
- 4) Legal and regulatory**
- a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
 - i) Yes
 - ii) **No**
 - (1) People are taking short cuts**
 - (2) Many people are wanting waivers**
 - b) Based on your experience, would you describe the current regulations as effective?
 - i) **Yes**
 - ii) No
 - c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?
 - i) **Yes**



- ii) No

5) Market Performance

- a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?

- i) **Yes**

(1) The push for localisation, job creation and BEE requirement

- ii) No

- b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?

- i) Yes

- ii) **No**

(1) There is appetite

- c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?

- i) **Yes**

- ii) No

- d) In your experience, what do you think is the role of donor funding in the renewable energy development?

- i) **Promoting**

- ii) **Supplementing**

- iii) To drive the price down

- iv) Other

- e) What is the risk appetite of the financial institution in funding RE

- i) **Question not asked**

6) Technology

- a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?

- i) Yes



ii) **No**

7) General

a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?

i) **Yes**

ii) No

b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?

i) **Profit Margins**

ii) Project Life cycle

iii) Associated financial risks

iv) Other

c) Do you think renewable energy can be an important part of the energy solution in South Africa?

i) **Yes**

ii) No



APPENDIX 1: INTERVIEW THREE

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) **Background Information - Interviewee**

- a) Name of the Company: **Withheld**
- b) Industry: **Financial advisory**
- c) Role in Industry: **Power utility global infrastructure**

2) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)
 - i) **Advisory**
- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?
 - i) **Advising across the sector but wind is the most attractive and most competitive**
- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?
 - i) **Yes: But as a global perspective not RSA, it's a more mainstream discussion. There is a need for a step change; it's not going to be a radical shift maybe in the next two to three decades. There will be a lot of funding needed**
 - ii) No
 - iii) By when
 - iv) And why that period

3) **Pricing and Costing**

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?
 - i) Yes



- ii) **No: But a market price shift is needed, other things like limiting or completely stopping the development of the conventional technologies can help. Subsidies can only be removed when the conventional prices are comparable to RE**
 - b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?
 - i) **None – RE should be adopted at a commercial level**
 - c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
 - i) **Yes: The bidding process is correct**
 - ii) No
 - d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges? There is no fixed price, it's a competitive bidding process
 - i) **Yes:**
 - ii) No
 - e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
 - i) Yes
 - ii) **No: It's not a question of price but the market; it's a regulated price with a prohibition of the willing seller willing buyer approach. There must be a market reform with the ISMO with a standardized approached across the industry**
 - f) When do you believe the above will be at a level that supports RE
 - i) **It is currently, but it's a process. RSA has cheap coal but the coal prices are increasing steeply so they are not sustainable**
- 4) **Legal and regulatory**
- a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
 - i) **Yes – It is clear but can always be improved**
 - ii) No



- b) Based on your experience, would you describe the current regulations as effective?
- i) **Yes: it's a new process but all the parties involved are getting into grips with it,**
- ii) No
- c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?
- i) Yes
- ii) **No investors would like to see an easier one**
- 5) Market Performance**
- a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?
- i) Yes
- ii) **No: Its an open tender process which is open, free and fare**
- b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?
- i) Yes
- ii) **No: Its steep learning process for everyone involved, but financiers are correctly advised, and they have a lot of adjustment to do in this new world of risks, but they know how to price in the risks for the correct reward**
- c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?
- i) **Yes – however RE is presenting liquidity and compliance challenges, it's a free market so its about who gets there first with relatively less risk**
- ii) No



d) In your experience, what do you think is the role of donor funding in the renewable energy development?

- i) **Promoting: Need the stimulus for everyone else to follow**
- ii) Supplementing
- iii) To drive the price down
- iv) Other
- e) What is the risk appetite of the financial institution in funding RE

6) Technology

- a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?
 - i) **Yes: Banks are generally worry of the “first of a kind risk”**
 - ii) No

7) General

- a) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?
 - i) **Profit Margins: It’s a business decision, there are those that claim moral ground but at the end of the day, it has to be profitable**
 - ii) Project Life cycle
 - iii) Associated financial risks
 - iv) Other
- b) Do you think renewable energy can be an important part of the energy solution in South Africa?
 - i) **Yes: Can also use it as an opportunity for localisation and job creation**
 - ii) No



APPENDIX 1: INTERVIEW FOUR SCHEDULE

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) **Background Information - Interviewee**

- a) Name of the Company: **Withheld**
- b) Industry: Energy
- c) Role in Industry: Policy, facilitating entry into the sector

2) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)

i) **Policy development**

- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?

- i) **Currently, we are driving the IRP 2012 therefore we are looking at the entire portfolio but believe that later will be bias towards certain type of the renewable energy based on costs, resource availability etc**

- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?

- i) Yes

- ii) **No: RE is not well developed to that level, even if it can happen, it will be in a very distant future**

- iii) By when

- iv) And why that period

3) **Pricing and Costing**

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

- i) Yes

- ii) **No**



- b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?
- i) **None**
- c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
- i) **Yes**
- ii) No
- d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges? There is no fixed price, it's a competitive bidding process
- i) **Yes**
- ii) No
- e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
- i) Yes
- ii) **No**
- f) When do you believe the above will be at a level that supports RE
- 4) Legal and regulatory**
- a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
- i) Yes
- ii) **No: There are small glitches, but are as a result that it is the new process to all the parties involved, things like having a challenge with RE in terms of self-dispatch, while that is easy for the conventional technologies, its not easy with RE technologies**
- b) Based on your experience, would you describe the current regulations as effective?
- i) **Yes, it is achieving exactly what it is meant to achieve**
- ii) No



c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?

i) Yes

ii) **No: By its nature of the process, its long and involving a lot of parties and processes but it is a well understood and effective process**

5) Market Performance

a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?

i) Yes

ii) **No: This is based on the IRP2010 which was a well consulted process**

b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?

i) Yes

ii) **No: They understand the risk and they have priced it into their models, but one need to understand that it's a new technology therefore the risk and unknowns will always be there for all the parties involved**

c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?

i) **Yes: But relative, it is depending on the role out. If the RE requirements were at one short, than there will be challenges with finance, but the phasing approach is making it easier for funding**

ii) No

d) In your experience, what do you think is the role of donor funding in the renewable energy development?

i) Promoting

ii) Supplementing



- iii) To drive the price down
 - iv) **Other: For the piloting of the projects and promoting the RE development, they are playing a critical role, Investors don't want to come in at a concept stage**
 - e) What is the risk appetite of the financial institution in funding RE: **There is a lot of appetite and funding is there**
- 6) Technology**
- a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?
 - i) Yes
 - ii) **No: These technologies don't have to compete, as they complement each other e.g. RE can't provide a base load, and its unreliable**
- 7) General**
- a) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?
 - i) **Profit Margins: It's a business decision**
 - ii) Project Life cycle
 - iii) Associated financial risks
 - iv) Other
 - b) Do you think renewable energy can be an important part of the energy solution in South Africa?
 - i) **Yes: It is providing a big opportunity to drive things like localisation and employment creation**
 - ii) No



APPENDIX 1: INTERVIEW FIVE SCHEDULE

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) **Background Information - Interviewee**

- a) Name of the Company: **Withheld**
- b) Industry: **Development**
- c) Role in Industry: **Project Development.**

2) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)

i) **Project Development**

- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?

i) **All of the technology**

- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?

i) **Yes**

ii) **No:**

(1) **There is still a lot of ignorance about the RE**

(2) **RE creates a Grid instability**

(a) **But can be used maybe for Peaking profile**

(3) **RSA has insufficient RE capacity (no water, insufficient wind etc)**

3) **Pricing and Costing**

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

i) **Yes**

ii) **No**

(1) **The current structure makes RE inherently have subsidies**

(a) **Eskom is a price taker, which is ring-fenced by NERSA**



- b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?
 - i) **There are no incentives needed, RSA must focus on new technology development which will eventually drive price down**
 - ii) **If RSA can introduce things like carbon tax and carbon credit, that will stimulate RE development**
- c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
 - i) **Yes**
 - (1) **It is for both the equity investors and the banks, relative to the risk taken**
 - ii) No
- d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges?
 - i) **Yes**
 - (1) **RSA is a very attractive RE market currently**
 - ii) No
- e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
 - i) Yes
 - ii) **No:**
 - (1) **But it has a potential if it stays the same**
 - (2) **The new build (Medupi and Kusile) are very competitive to RE, and with the new technology development and maturity to RE, RE prices are coming down, as evident from window 1 to window prices**
- f) When do you believe the above will be at a level that supports RE?
 - i) **Question not asked**
- 4) **Legal and regulatory**
 - a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
 - i) **Yes**



(1) Policy makers have tried very hard

(2) It has teething problems but it is running relatively well

ii) No

b) Based on your experience, would you describe the current regulations as effective?

i) **Yes**

ii) No

c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?

i) **Yes**

(1) The current structure is based on the 100% project finance, therefore by its nature it's a long process but everyone understand it and happy with it

ii) No

5) Market Performance

a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?

i) **Yes**

(1) There is a strong green lobbyist therefore RE development can't be ignored

(2) RSA has made global commitments such as in Kyoto protocol that need to be honoured

(3) But it remain free and fair

ii) No

b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?

i) Yes

ii) **No**



(1) There is no lack of finance, banks are having a huge appetite into this

c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?

i) **Yes**

(1) There is interest

(2) What is lacking is resources such as human capital e.g. deal makers of such projects

ii) No

d) In your experience, what do you think is the role of donor funding in the renewable energy development?

i) **Promoting**

ii) Supplementing

iii) To drive the price down

iv) Other

6) Technology

a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?

i) Yes

ii) **No**

(1) There is just generally lack of electricity in RSA (peak demand)

(2) RE development is currently playing the complementary role to the fossil fuel technology

7) General

a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?

i) **Yes**



(1) By the nature of its structure, it forces them to work together, the risk allocation is crucial

ii) No

b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?

i) **Profit Margins**

(1) RSA is currently a hotspot, RE is a very attractive programme

(2) There is generally lack of development in the world and RSA is currently very aggressive with its development

ii) Project Life cycle

iii) Associated financial risks

iv) Other

c) Do you think renewable energy can be an important part of the energy solution in South Africa?

i) **Yes**

(1) This is a philosophical debate

(a) RSA has enough cheap coal

(b) Nuclear is also another logical approach, taking its safety into consideration

(2) RE will play a significant role in the RSA energy mix

ii) No

APPENDIX 1: INTERVIEW SIX

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) **Background Information - Interviewee**

a) Name of the Company: **Withheld**

b) Industry: Energy sector

c) Role in Industry: Policy maker

2) **Identification**



- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)
 - i) **Project sponsor and setting up policies**
- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?
 - i) **All RE**
- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?
 - i) Yes
 - ii) **No**
- (1) What is possible is the healthy mix**
- (2) Want to introduce other sources of energy other than the conventional energy sources**
- (3) RSA wants to be the leader in the continent on RE development**
- (4) We are stimulating the industry**
- 3) Pricing and Costing**
 - a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?
 - i) Yes
 - ii) **No**
 - (1) RSA is not looking at subsidizing RE, we are currently paying a premium so as to get the development going**
 - (2) The premium is also to entice the technology providers**
 - b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?
 - i) **No – There is no need for the additional incentives other than the premium that is being paid currently**
 - c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
 - i) **Yes**



- (1) Otherwise they wouldn't be getting so much funding from the banks**
- (2) There was obviously a first mover advantage in the sense that the IPP on the first window period had higher returns**
- (3) The returns from window one to two have dropped for about 30% to 40%**
 - ii) No
 - d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges? There is no fixed price, it's a competitive bidding process
 - i) **Yes**
- (1) It is a very good investment for the investor however it is not sustainable for the consumer as the price is relatively high**
 - ii) No
 - e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
 - i) Yes
 - ii) **No**
- (1) The prices are comparable, in fact the new build (Medupi and Kusile) is more expensive than RE**
- 4) Legal and regulatory**
 - a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
 - i) Yes
 - ii) **No**
- (1) Its work in progress**
- (2) The current regulations were designed for a monopoly sector**
- (3) Currently there is an overhaul of the legislations**
 - (a) Introduction of ISMO**
 - (b) Introduction of competition (IPP)**
 - (c) Amending the legislations e.g. Energy regulation act, NERSA Act**



b) Based on your experience, would you describe the current regulations as effective?

i) Yes

ii) **No**

(1) It is not effective, as stated above

c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?

i) **Yes**

(1) There are too many ministers and governance involved e.g. DoE, DPE, Treasury (Finance)

ii) No

5) Market Performance

a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?

i) Yes

ii) **No**

b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?

i) Yes

ii) **No**

(1) The risk has been factored in and priced accordingly

c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?

i) Yes

ii) **No**

(1) Not in RSA, there is a need for the international funding as well, and the interest is there



- d) In your experience, what do you think is the role of donor funding in the renewable energy development?
- i) **Promoting**
- (1) They are playing a developmental role**
- (2) Funding the concept or prefeasibility studies**
- (3) Alleviating the upfront risks**
- (a) Banks only comes in when there is relative certainty that the project is viable**
- ii) Supplementing
- iii) To drive the price down
- iv) Other
- 6) Technology**
- a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?
- i) Yes
- ii) **No**
- (1) RE is too expensive, therefore plays a complementary role to conventional energy sources**
- (2) RE can't provide a base load**
- 7) General**
- a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?
- i) **Yes**
- (1) The introduction of the IRP2010 and the new gen policy has ensured that the extent of the challenge is fully understood by all the parties involved and the need to work together in finding a solution**
- ii) No



- b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?
- i) **Profit Margins**
 - ii) Project Life cycle
 - iii) Associated financial risks
 - iv) Other
- c) Do you think renewable energy can be an important part of the energy solution in South Africa?
- i) **Yes**
 - ii) No
 - iii) Please explain

APPENDIX 1: INTERVIEW SEVEN

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) **Background Information - Interviewee**

- a) Name of the Company: **Withheld**
- b) Industry: **Energy.**
- c) Role in Industry: **Project Development.**

2) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)
 - i) **Full value chain**
 - ii) **Project development and execution, operation**
- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?
 - i) **All the RE options**
- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?
 - i) Yes



ii) **No**

(1) It can only complement

3) Pricing and Costing

a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

i) Yes

ii) **No**

(1) We need to promote the free market principles

(2) We need to make sure its sustainable

b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?

i) **At an initial stage**

ii) **IDC providing favourable rates and favourable contracting terms**

c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?

i) **Yes**

(1) That's why there are lot of foreign investors

ii) No

d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges? There is no fixed price, it's a competitive bidding process

i) **Yes**

(1) There is a good path for RE e.g. 20yrs

ii) No

e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?

i) Yes

ii) **No**

4) Legal and regulatory



- a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
- i) **Yes**
- (1) There is a very good policy direction**
- ii) No
- b) Based on your experience, would you describe the current regulations as effective?
- i) **Yes**
- ii) No
- c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?
- i) Yes
- ii) **No**
- (1) The process is very clear if you know what you are doing**
- (2) It is a well consulted process**
- 5) Market Performance**
- a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?
- i) **Yes**
- (1) RSA have economics needs but are hugely driven by political agenda**
- ii) No
- b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?
- i) Yes
- ii) **No**
- (1) Most of the investors fully understand the risks**
- c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?



i) **Yes**

(1) There is sufficient global funding

(2) There has been a lot of JV

ii) No

d) In your experience, what do you think is the role of donor funding in the renewable energy development?

i) **Promoting**

ii) **Supplementing**

iii) To drive the price down

iv) Other

6) Technology

a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?

i) Yes

ii) **No**

7) General

a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?

i) **Yes**

(1) DoE is coordinating but there is sufficient cooperation

ii) No

b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?

i) **Profit Margins**

ii) Project Life cycle

iii) Associated financial risks

iv) Other



- c) Do you think renewable energy can be an important part of the energy solution in South Africa?
- i) **Yes**
 - (1) Job creation**
 - (2) Carbon emissions**
 - (3) FDI's**
 - ii) No



INTERVIEW EIGHT

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) **Background Information - Interviewee**

- a) Name of the Company: **Withheld**
- b) Industry: **Energy**
- c) Role in Industry: **Advisory**

2) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)

i) **Facilitating informed decision making on the energy**

(1) **Promoting the correct information**

- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?

i) **All**

- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?

i) **Yes**

ii) **No**

- (1) **The problem is the nature of the Renewable Energy technologies, it can't provide base load electricity**

- (2) **RSA is a very energy intensive sector, RE can't sustain the industry. E.g. can't dedicate a RE plant to supporting a mine**

3) **Pricing and Costing**

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

i) **Yes**

ii) **No**

- (1) **Subsidies can only work to a point, they are not sustainable**



- b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?
- i) **By focusing in rural areas with a small scale approach**
- c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
- i) **Yes**
- (1) But only time will tell if it will be sustainable**
- ii) No
- d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges?
- i) **Yes**
- (1)**
- ii) No
- e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
- i) Yes
- ii) **No**
- 4) Legal and regulatory**
- a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
- i) **Yes**
- ii) No
- b) Based on your experience, would you describe the current regulations as effective?
- i) **Yes**
- ii) No
- c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?
- i) Yes
- ii) **No**



- (1) There is too much paper work involved**
- (2) The process of putting up a 1000MW or a 50MW plant is exactly the same**
- 5) Market Performance**
 - a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?
 - i) **Yes**
 - (1) Heavily**
 - (2) The economics of RE development don't make sense therefore something else must drive RE**
 - ii) No
 - b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?
 - i) Yes
 - ii) **No**
 - (1) They have priced in the risks**
 - (2) In fact I think they have overpriced it**
 - c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?
 - i) **Yes**
 - (1) Provided the process is clear and efficient external funding will always be there**
 - (2) The problem in South Africa for RE development is not going to be funding, the problem will be on the logistics e.g. we might not have enough cranes to lift these heavy machines, transporting it might be a challenge**
 - ii) No
 - d) In your experience, what do you think is the role of donor funding in the renewable energy development?



- i) **Promoting**
- ii) **Supplementing**
- iii) To drive the price down
- iv) Other
- 6) Technology**
- a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?
 - i) Yes
 - ii) **No**
- (1) Not competing but complementing**
- (2) RSA need a healthy mix e.g. 15% RE**
- 7) General**
- a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?
 - i) **Yes**
 - ii) No
- b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?
 - i) **Profit Margins**
 - ii) Project Life cycle
 - iii) Associated financial risks
 - iv) Other
- c) Do you think renewable energy can be an important part of the energy solution in South Africa?
 - i) **Yes**
- (1) To provide system stability**
- ii) No



INTERVIEW NINE

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) **Background Information - Interviewee**

- a) Name of the Company: **Withheld**
- b) Industry: **Energy**
- c) Role in Industry: **Advisory**

2) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)

i) **Facilitating informed decision making on the energy**

(1) **Promoting the correct information**

- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?

i) **All**

- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?

i) **Yes**

ii) **No**

- (1) **The problem is the nature of the Renewable Energy technologies, it can't provide base load electricity**

- (2) **RSA is a very energy intensive sector, RE can't sustain the industry. E.g. can't dedicate a RE plant to supporting a mine**

3) **Pricing and Costing**

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

i) **Yes**

ii) **No**

- (1) **Subsidies can only work to a point, they are not sustainable**



- b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?
- i) **By focusing in rural areas with a small scale approach**
- c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
- i) **Yes**
- (1) But only time will tell if it will be sustainable**
- ii) No
- d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges?
- i) **Yes**
- (1)**
- ii) No
- e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
- i) Yes
- ii) **No**
- 4) Legal and regulatory**
- a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
- i) **Yes**
- ii) No
- b) Based on your experience, would you describe the current regulations as effective?
- i) **Yes**
- ii) No
- c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?
- i) Yes
- ii) **No**



- (1) There is too much paper work involved**
- (2) The process of putting up a 1000MW or a 50MW plant is exactly the same**
- 5) Market Performance**
 - a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?
 - i) **Yes**
 - (1) Heavily**
 - (2) The economics of RE development don't make sense therefore something else must drive RE**
 - ii) No
 - b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?
 - i) Yes
 - ii) **No**
 - (1) They have priced in the risks**
 - (2) In fact I think they have overpriced it**
 - c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?
 - i) **Yes**
 - (1) Provided the process is clear and efficient external funding will always be there**
 - (2) The problem in South Africa for RE development is not going to be funding, the problem will be on the logistics e.g. we might not have enough cranes to lift these heavy machines, transporting it might be a challenge**
 - ii) No
 - d) In your experience, what do you think is the role of donor funding in the renewable energy development?



- i) **Promoting**
 - ii) **Supplementing**
 - iii) To drive the price down
 - iv) Other
- 6) Technology**
- a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?
 - i) Yes
 - ii) **No**
- (1) Not competing but complementing**
- (2) RSA need a healthy mix e.g. 15% RE**
- 7) General**
- a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?
 - i) **Yes**
 - ii) No
 - b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?
 - i) **Profit Margins**
 - ii) Project Life cycle
 - iii) Associated financial risks
 - iv) Other
 - c) Do you think renewable energy can be an important part of the energy solution in South Africa?
 - i) **Yes**
- (1) To provide system stability**
- ii) No



INTERVIEW TEN

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) **Background Information - Interviewee**

- a) Name of the Company: **Withheld.**
- b) Industry: **Banking.**
- c) Role in Industry: **Funding.**

2) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)

i) **Funding**

- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?

i) **All**

- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?

i) **Yes**

ii) **No**

(1) **Will augment not replace**

(2) **Technology not fully developed**

(3) **Can't provide the base load or peaking portfolio**

3) **Pricing and Costing**

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

i) **Yes**

ii) **No**

(1) **It will create an unnecessary burden on tax payers**

(2) **The model must work on its on**

(3) **The subsidy model hasn't work in other countries such as Spain**



- b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?
- i) **No, none is needed**
- c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
- i) **Yes**
- (1) At high tariff**
- (2)**
- ii) No
- d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges?
- i) **Yes**
- (1) By the nature of the bidding process**
- ii) No
- e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
- i) **Yes**
- (1) There is still abundance of coal**
- (2) There is still a huge gap between RE and the conventional energy**
- ii) No
- 4) Legal and regulatory**
- a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
- i) Yes
- ii) **No**
- (1) They are too elaborate**
- (2) The DoE is overdoing it**
- (3) Politically, the environment is not too friendly**
- (a) E.g. Window one and two closing has been postponed**
- b) Based on your experience, would you describe the current regulations as effective?



- i) Yes
- ii) **No**
- c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?

i) Yes

ii) **No**

(1) It's a smooth process which is well consulted

5) Market Performance

- a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?

i) Yes

ii) **No**

(1) Parties are multi national

- b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?

i) Yes

ii) **No**

(1) There is well understanding, which is also augmented by thorough due diligence

(2) The process involves international funders who bring international experience

(3) The deals are well structured so the risk is minimal

- c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?

i) Yes

ii) **No**

(1) Not locally



(2) There is however a requirement for all the deals to be ZAR denominated which put a strain in the financial market

iii) Please explain

d) In your experience, what do you think is the role of donor funding in the renewable energy development?

i) **Promoting**

(1) Especially small IPP's and other local players who can't get funding for development stage

ii) **Supplementing**

iii) To drive the price down

iv) Other

6) Technology

a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?

i) Yes

ii) **No**

(1) They must complement each other

(2) The country still currently need all the sources of energy to close the energy gap

7) General

a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?

i) **Yes**

(1) There is a good collaboration

(2) The process is well structured

ii) No

iii) Please explain



- b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?
- i) **Profit Margins**
 - ii) Project Life cycle
 - iii) Associated financial risks
 - iv) Other
- c) Do you think renewable energy can be an important part of the energy solution in South Africa?
- i) **Yes**
 - (1) By its nature, the country need RE**
 - (2) Doesn't need much resources**
 - ii) No



INTERVIEW 11

The following schedule serves as an outline that will prompt the researcher during the interview process.

1) **Background Information - Interviewee**

- a) Name of the Company: **Withheld.**
- b) Industry: **Energy.**
- c) Role in Industry: **Advisory.**

2) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)

i) **Project Development and advisory**

- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?

i) **Only Solar**

- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?

i) **Yes**

ii) **No**

(1) **RSA need base load energy**

(2) **Cost of storage for RE is very high**

(3) **There are capacity factor challenges with RE**

3) **Pricing and Costing**

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

i) **Yes**

ii) **No**

(1) **The current increase in the electricity prices are making RE competitive**



- b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?
- i) **No need**
- c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
- i) **Yes**
- ii) No
- d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges? There is no fixed price, it's a competitive bidding process
- i) **Yes**
- (1) But the tenure must be longer**
- ii) No
- e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
- i) **Yes**
- ii) **The current tariff is lower than RE**
- iii) No
- 4) Legal and regulatory**
- a) Do you think the current incentives and regulations are favourable for promoting renewable energy development?
- i) Yes
- ii) **No**
- (1) It is only favourable for those with deep pockets**
- (2) The timelines are ridiculous e.g. to get the EIA takes about 18 months, by the time you get the EIA the process would have been close**
- (3) It favours those who were already ahead, if you are a small IPP starting from the beginning the timelines are against you**
- b) Based on your experience, would you describe the current regulations as effective?



i) Yes

ii) **No**

(1) Unrealistic

c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?

i) **Yes**

ii) No

5) Market Performance

a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?

i) **Yes**

(1) The current industry structure is politically driven

ii) No

b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?

i) **Yes**

(1) They know what they are doing

(2) Have done it before in other countries

(3) Have a very good advisory team

ii) No

c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?

i) Yes

ii) **No**

(1) Need international funders

d) In your experience, what do you think is the role of donor funding in the renewable energy development?

i) Promoting



- ii) Supplementing
- iii) To drive the price down

iv) **Other**

(1) Using their country of origin suppliers locally

6) Technology

a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?

i) Yes

ii) **No**

(1) They can't compete, need to complement each other

7) General

a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?

i) Yes

ii) **No**

(1) DoE is integrating but the integration is per project based

b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?

i) **Profit Margins**

(1) It's a nice marketing tool but ultimately it has to make good business sense

(2) The financial backing is based on the strength of the project

ii) Project Life cycle

iii) Associated financial risks

iv) Other

c) Do you think renewable energy can be an important part of the energy solution in South Africa?



- i) **Yes**
- ii) No



INTERVIEW 12

The following schedule serves as an outline that will prompt the researcher during the interview process.

8) **Background Information - Interviewee**

- a) Name of the Company: **Withheld**
- b) Industry: **Energy**
- c) Role in Industry: **Advisory**

9) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)

i) **Facilitating informed decision making on the energy**

(1) **Promoting the correct information**

- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?

i) **All**

- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?

i) **Yes**

ii) **No**

- (1) **The problem is the nature of the Renewable Energy technologies, it can't provide base load electricity**

- (2) **RSA is a very energy intensive sector, RE can't sustain the industry. E.g. can't dedicate a RE plant to supporting a mine**

10) **Pricing and Costing**

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

i) **Yes**

ii) **No**

- (1) **Subsidies can only work to a point, they are not sustainable**



- b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?
- i) **By focusing in rural areas with a small scale approach**
- c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
- i) **Yes**
- (1) But only time will tell if it will be sustainable**
- ii) No
- d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges?
- i) **Yes**
- (1)**
- ii) No
- e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
- i) Yes
- ii) **No**
- 11) Legal and regulatory**
- a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
- i) **Yes**
- ii) No
- b) Based on your experience, would you describe the current regulations as effective?
- i) **Yes**
- ii) No
- c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?
- i) Yes
- ii) **No**



- (1) There is too much paper work involved**
- (2) The process of putting up a 1000MW or a 50MW plant is exactly the same**
- 12) Market Performance**
 - a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?
 - i) **Yes**
 - (1) Heavily**
 - (2) The economics of RE development don't make sense therefore something else must drive RE**
 - ii) No
 - b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?
 - i) Yes
 - ii) **No**
 - (1) They have priced in the risks**
 - (2) In fact I think they have overpriced it**
 - c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?
 - i) **Yes**
 - (1) Provided the process is clear and efficient external funding will always be there**
 - (2) The problem in South Africa for RE development is not going to be funding, the problem will be on the logistics e.g. we might not have enough cranes to lift these heavy machines, transporting it might be a challenge**
 - ii) No
 - d) In your experience, what do you think is the role of donor funding in the renewable energy development?



- i) **Promoting**
- ii) **Supplementing**
- iii) To drive the price down
- iv) Other

13) Technology

a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?

- i) Yes
- ii) **No**

(1) Not competing but complementing

(2) RSA need a healthy mix e.g. 15% RE

14) General

a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?

- i) **Yes**
- ii) No

b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?

- i) **Profit Margins**
- ii) Project Life cycle
- iii) Associated financial risks
- iv) Other

c) Do you think renewable energy can be an important part of the energy solution in South Africa?

- i) **Yes**

(1) To provide system stability

- ii) No



INTERVIEW 13

The following schedule serves as an outline that will prompt the researcher during the interview process.

8) **Background Information - Interviewee**

- a) Name of the Company: **Withheld**
- b) Industry: **Energy**.
- c) Role in Industry: **Project Development**.

9) **Identification**

- a) What is your interest in renewable energy (Buyer, Seller, financial/technical advisor, other.)

i) **Full value chain**

ii) **Project development and execution, operation**

- b) Which form(s) of renewable energy (Biomass, Solar, Wind) is the most viable renewable energy solution as the in South Africa?

i) **All the RE options**

- c) Do you think Renewable energy will eventually replace the conventional energy sources in South Africa in the long run, and by when?

i) **Yes**

ii) **No**

(1) It can only complement

10) **Pricing and Costing**

- a) Do you think the introduction of strong subsidies to the renewable energy market will make it more competitive and more sustainable to fossil fuels and will make it easier to implement?

i) **Yes**

ii) **No**

(1) We need to promote the free market principles

(2) We need to make sure its sustainable

- b) What do you think could be other incentives to make the renewable energy less costly and more sustainable?



- i) **At an initial stage**
- ii) **IDC providing favourable rates and favourable contracting terms**
- c) Is the financial return from the renewable energy investment profitable and competitive with other technologies?
 - i) **Yes**
- (1) That's why there are lot of foreign investors**
- ii) No
- d) Does the current proposed selling price for the renewable energy making it a viable sustainable solution for the current energy challenges? There is no fixed price, it's a competitive bidding process
 - i) **Yes**
- (1) There is a good path for RE e.g. 20yrs**
- ii) No
- e) Do you agree that the current nature of the electricity tariff undermines renewable energy efforts in South Africa?
 - i) Yes
 - ii) **No**
- 11) Legal and regulatory**
- a) Do you think the current incentives and regulations are favourably for promoting renewable energy development?
 - i) **Yes**
- (1) There is a very good policy direction**
- ii) No
- b) Based on your experience, would you describe the current regulations as effective?
 - i) **Yes**
 - ii) No
- c) Does the process of approvals in the South Africa's renewable energy development cumbersome and time consuming as a direct result of too many approvals and permits that are required in the approval process?
 - i) Yes



ii) **No**

(1) The process is very clear if you know what you are doing

(2) It is a well consulted process

12) Market Performance

a) Are the investment decisions in the renewable energy market in South Africa influenced by political influence?

i) **Yes**

(1) RSA have economics needs but are hugely driven by political agenda

ii) **No**

b) Does the lack of finance in programmes for renewable energy development in South Africa due to financial institutions not fully understanding the key issues at stake as well as the risk profiles for the renewable energy?

i) **Yes**

ii) **No**

(1) Most of the investors fully understand the risks

c) Do you think there is sufficient availability of local funding to develop renewable energy in South Africa?

i) **Yes**

(1) There is sufficient global funding

(2) There has been a lot of JV

ii) **No**

d) In your experience, what do you think is the role of donor funding in the renewable energy development?

i) **Promoting**

ii) **Supplementing**

iii) **To drive the price down**

iv) **Other**

13) Technology



a) Do you think the investment or lack of it in the renewable technology is due to it competing with the conventional energy technologies such as fossil fuel?

i) Yes

ii) **No**

14) General

a) Do you think Renewable Energy development approach in RSA should be a multi-disciplinary approach identifying all the inter-connected nature of the RE development (Technology, Funding, Policy and regulatory, pricing and costing) and the need for inter-connected and inter-disciplinary solutions?

i) **Yes**

(1) DoE is coordinating but there is sufficient cooperation

ii) No

b) What, in your opinion do you think economically differentiates between renewable energy projects and conventional energy projects?

i) **Profit Margins**

ii) Project Life cycle

iii) Associated financial risks

iv) Other

c) Do you think renewable energy can be an important part of the energy solution in South Africa?

i) **Yes**

(1) Job creation

(2) Carbon emissions

(3) FDI's

ii) No