AN ENABLING ENVIRONMENT FOR INDEPENDENT POWER PRODUCERS IN RENEWABLE ELECTRICITY

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Abstract

The increasing demand for electricity, the rising price of energy from conventional sources and limited electricity supply are a global concern. The demand on electricity generation could be alleviated by diversifying the sources from which electricity is obtained to achieve the goals of long-term electricity supply. Diversification implies finding alternative sources of energy such as renewable energy for the production of electricity.

The South African electricity system is under increased pressure to provide and maintain electricity supply to its users. Electricity production may be regarded as a key contributor to the social and economic development of South Africa. The challenges are so serious that it will gradually become increasingly difficult to extract sufficient resources to satisfy increasing electricity demand. Growth in the electricity and industrial sectors signifies profound changes in the entire energy industry. The South African power utility Eskom, supplies 94% of South Africa's electricity but the risk of inadequate supply because of increasing electricity demand is mitigated through the employment of Independent Power Producers (IPPs) which supply to the grid. However, although a limited number of IPP entrepreneurs sell electricity to the Eskom grid, there is no enabling entrepreneurial environment in which they can thrive. There is no positive movement to inaugurate policies and processes. This has created an opportunity for Smart Grid access as a viable option to accommodate IPP entrepreneurs into the grid.

Investing in renewable electricity sources may provide feasible alternatives for the electricity industry, it would alleviate pressure on current supply whilst creating an enabling entrepreneurial environment for IPP entrepreneurs and increase entrepreneurial activity. This study investigates a proposed model for an enabling entrepreneurial environment for IPPs in the RE sector that can be utilised to ensure increased entrepreneurial activity within the electricity industry. Establishing such an enabling environment would contribute positively to the alleviation of the electricity demand crisis, result in lower carbon emissions and create a sustainable, more diverse electricity generation mix. This proposed IPP industry model for an enabling entrepreneurial environment is presented to address the problems experienced at the different levels of the electricity industry. The model can be utilised to increase entrepreneurial activity while eradicating major electricity challenges at different levels in the South African electricity industry.

The results indicate that that RE, in the form of solar and wind, has the potential to expand the South African electricity industry significantly. Therefore, in order to reform the South African electricity industry, stakeholders need to embrace entrepreneurship as IPP entrepreneurs. This can be done effectively by the incorporation of IPP entrepreneurs into the electricity network. However, an enabling entrepreneurial environment in which to operate must be ensured. In this study, five important variables support the establishment of an enabling entrepreneurial environment for IPP entrepreneurs. These have been identified as; Smart Grids, Entrepreneurship, Renewable electricity environment, SA policy and Stakeholder theory. An important contribution has been made towards Stakeholder Theory. This has proven to be instrumental within the RE sector of the electricity industry in South Africa, as the mentioned role players have a reciprocal role to play.

Three surveys were conducted at three levels of the electricity industry, namely, at organisational, legislative and entrepreneurial levels and included Eskom Management, National Energy Regulator (NERSA) Management and Approved and Non-approved IPPs. Both qualitative and quantitative research methods were utilised in this research study. The results indicate that SA Policy is instrumental in assisting stakeholders to facilitate the IPP process and feed the power from RE generation into the network. Most respondents were positive about the role of Smart Grids in future electricity generation and their contribution towards creating an enabling entrepreneurial environment for IPP entrepreneurs. Respondents indicated that by policy decisions, greater emphasis can be placed on the results of climate change and environmental challenges. Emphasis on the incorporation of stakeholders proved imperative to this group (IPPs). The results indicated that stakeholder management is a key factor contributing to the establishment of an enabling entrepreneurial environment. The major contribution of this study is a proposed entrepreneurial model that can improve future sustainability of the electricity supply.

Keywords: Electricity Industry, Renewable Electricity, Independent Power Producers, Stakeholder Management, Entrepreneurial Model.

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Declaration

I, Vivian Julian Palmer 207081175, hereby declare that the thesis for the degree Doctorate Business Administration is my own work and that it has not previously been submitted for assessment or completion of any postgraduate qualification to another University or for another Qualification.

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CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

The turn of the twenty first century has seen the world's human energy consumption at its highest point. Literature reveals that correlations between changes in energy use and advances in human economic welfare exist (Hajat, Banks, Aiken and Shackleton, 2008). According to Freris and Infield (2008), the demand for energy is growing as it is driven by the explosion in consumer electronics, associated industrial activity and the widening of access to consumers in the developing world.

Energy is regarded as the key to economic development worldwide, but the way in which it is sourced, produced and used has resulted in major challenges. Globally, energy systems have been very inefficient, resulting in major environmental and social problems (Winkler, 2009). Energy is a critical factor in economic and social development and any energy generation system impacts on the environment (Junginger, 2005). Current global energy demand has continued to increase, with major developing countries acting as the main driving force behind such increases. Relating to energy generation, it is important to note that to date, the world energy balance is dominated by fossil fuels. One major issue raised is how to change the future energy matrix towards renewable sources of energy to generate electricity. The availability of energy sources to satisfy energy and electricity demand has been important to mankind ever since the age of industrialisation (Junginger, 2005). Thus, the fundamental objective of any country should be to address its energy challenges and to provide access to electricity or alternative modern energy sources for people who presently lack access (Ward, 2007).

Electricity production has been and still is one of the main contributing factors to the social and economic development of South Africa (Davidson, Winkler, Kenny, Prasad, Nkomo, Sparks, Howells and Alfstad, 2006). Therefore, electricity production has secured prosperity and security for the country by providing heat and power for industry, transportation and household use. The sector has been largely driven by economic and political forces, which impact on the electricity sector (Winkler, 2009).

The South African economy is energy-intensive, meaning that the country uses a large amount of energy for every Rand of economic output. Eskom, a state-owned utility, is the only national supplier of electricity in South Africa. This national body supplies 94% of demand with the remainder coming from small inputs from local authorities (Davidson, et al., 2006). Eskom is the single, vertically integrated and state-owned utility in South Africa. Eskom owns, operates and maintains the national transmission grid and is still a de facto monopolist on both the generation and the transmission level. Currently, Eskom’s network is made up of more than 371 000 km of power lines, 28 200 km which constitute the national transmission grid (Posorski and Werner, 2009).

Eskom disposes of 94% of installed capacity in South Africa and generates more than 45% of electricity produced in the whole of Africa. The remaining capacity of South Africa is provided by South African municipalities (2.5%) and entrepreneurial Independent Power Producers (IPPs) who account for 3.4% of the total electricity generation (Posorski and Werner, 2009). In South Africa, the risk of increasing electricity demand is mitigated through the appointment of IPPs. A limited number of IPPs do sell electricity to Eskom but an enabling, entrepreneurial environment in which they can thrive is lacking. IPPs would need a return on investment of approximately 15%, which would require electricity prices to be much higher than they are at present.

Ljung (2007) contends that for overall benefits and acceptable costs, successful small-scale entrepreneurial schemes should be demand driven and the solution lies in creating a demand for low-carbon energy incentives. Various innovative approaches to provide incentives to (IPPs) are needed to assist in the spread of off-the-grid electricity and in some cases, provide subsidies to end users (Ljung, 2007).

Foster-Pedley and Hertzog (2006) posit that with the rising price of fossil fuels and the continued emphasis on global warming, entrepreneurs are exploring the potential of Renewable Electricity (RE) with great interest. The critical question, according to Moore and Wüstenhagen (2003) however, is how growth through entrepreneurial activity in the RE sector can be facilitated and accelerated. A considerable part of rural South Africa is without access to grid electricity and the cost associated with grid extension has resulted in an increased use of small-scale, renewable generation sources such as photovoltaics and micro-hydro (Davidson, et al., 2006). Investing in increased IPP entrepreneurial activity would stand South Africa’s electricity generation initiatives in good stead as alleviation of high demand on the network is a priority. Ensuring a mix of energy sources remains a focal point for most countries, thus RE plays a pivotal role in developed and in emerging economies (Winkler, 2009).

At the core of this study is the proposition that innovation is at the heart of the entrepreneurial spirit. RE provides an opportunity for entrepreneurs to become innovative in this sector (Kell and Berthon, 2011). The study investigates the need for the electricity industry to take advantage of the innovations entrepreneurs may provide to the sector and to allow even greater business opportunities for IPP entrepreneurs to contribute to the industry.

This study aims to propose a model for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector. This could be affected through mentorship and by partnering existing entrepreneurs; access to financial aid for entrepreneurs; research and development transfer and government facilitation. The development of RE offers an opportunity to establish an enhanced electricity industry within the South African economy. RE, in the South African electricity industry, is a relatively untapped sector where entrepreneurial activity can be enhanced and developed. Current integrated RE provision includes wind, solar and hydro-electricity. It is noteworthy that entrepreneurial activity and specifically IPP power generation in this sector remains problematic. The development of this industry makes available a variety of export and service-led commercial opportunities, not only in South Africa but also within Sub-Saharan Africa (Ljung, 2007).

In countries where the electricity industry is dominated by monopolies, non-utility generators in the form of IPP entrepreneurs find it difficult and challenging to sell directly to consumers since limited or no incentives exist to give IPP entrepreneurs access to distribution networks of the monopoly holders. Thus, with the exception of large hydro-electric plants, utilities rely almost exclusively on production technologies that burn fossil fuels such as coal. Although IPP entrepreneurs explored alternative electricity-generating technologies, the utilities’ monopolistic position allowed them to lock IPP entrepreneurs out of the market for electricity generation (Sine, Haveman and Tolbert, 2005).

IPP entrepreneurs who seek to enter the RE sectors, must therefore shoulder a double burden as they incur both RE sector and technology-specific risks (Sine, et al., 7: 2005). These risks include, not recovering initial capital outlay, no further financial support after the first number of years, no access to the grid and the administration of the IPP process. These combined risks seriously limit the entrepreneur's willingness and ability to act, in part since the primary stakeholders are unwilling to supply strategic resources to emerging IPP entrepreneurs. Moreover, when government reduces the RE sector risk, either directly by providing incentives or indirectly by increasing the sector's legitimacy, these measures are of less benefit to entrepreneurs who seek to explore RE technologies in an emerging RE sector.

Turkenburg (2000) states that the South African electricity industry will benefit from entrepreneurial innovation by making the electricity market more accessible to IPP entrepreneurs in the RE sector. RE is expected to provide suitable alternatives to the electricity industry for several reasons. Amongst others, RE can be particularly appropriate for developing countries and a number of RE technologies are well suited to small-scale, Off-Grid applications and hence can contribute to improved access of energy services in rural areas. In addition, RE may contribute to and improve the development of local economies and create jobs (Turkenburg, 2000).

RE may also be considered as an important component in the future energy supply of the electricity industry in the South African economy (Boyle, 2009). This study proposes a model for an enabling an entrepreneurial environment that can be established for IPP entrepreneurs. RE presents a superior alternative for minimising the risk of fuel interruptions and shortages, helping to improve the fragile transmission network and reducing environmental harm. These smaller and more environmentally friendly generators cost less to construct, produce power in smaller increments and need not rely on continuous government subsidies (Sovacool, 2010). Alternative forms of energy are becoming vital in modern electricity generation. Schellekens and Finlay (2010) suggest that alternative forms of energy are well positioned to play a significant role in the future to address both energy security and climate change concerns.

1.1.1 Diversification and alternative forms of energy

The demand on electricity generation could be alleviated through a process of diversification and the introduction of alternative forms of energy. Diversification implies finding alternative forms of energy sources for the production of electricity. Increased resource depletion, import dependence, climate change and air pollution put pressure on the choices of technology in the energy system. In terms of alternative energy sources, the new technologies for energy production and conversion that are currently being developed and applied are mostly aimed at a cleaner and more independent supply of energy (Van Ruijven, 2008).

The process of diversification caters for RE, thus creating an opportunity for the alleviation of rising demand for energy and lessening competition on the international oil market that is triggered by economic development in many developing countries (Posorski and Werner, 2009). One of the pathways to follow in order to achieve the goals of long-term energy supply is an increased reliance on RE (Hoogwijk, 2004). Renewables are expected to be suitable alternatives in the creation of an enabling environment for continued electricity production (Hoogwijk, 2004).

1.1.2 RE as an option for diversification in the electricity industry

It is recognised that conventional energy production will have to compensate for the irregularity or intermittency which inadvertently is a feature of this form of power generation (Boyle, 2009). Compared to the total energy used the world over, the usage of RE is still regarded as relatively small. Eskom's RE Independent Power Producer Procurement Programme (REIPPP) was initiated by government and of these projects; three were connected to the Eskom grid in 2013 bringing 121.5 MW of RE production to the national grid to date (Boyle, 2009).

Initiatives undertaken by the South African government include targets for RE and liquid fuels. Two wind farms (Eskom and IPP) were built and the potential in biomass and solar thermal technologies is also significant. The government expects that by the end of 2014, solar and wind may contribute significantly more than 2013's 4% of power generation in the country. Already 9 wind turbines situated in the Van Stadens and Blue Horizon Bay communities in the Eastern Cape of South Africa will produce enough power to meet almost 50% of Nelson Mandela Bay Municipality's target, generating 10% of electricity from RE sources (Jooste, 2014). Thus through concerted efforts, such as increased energy, security and diversity, economic development, job creation and environmental benefits can be achieved (Davidson and Winkler, 2003). All energy forms including sun, wind and biomass will be increasingly important sources of future electricity (Alganahi, Kamaruzzaman, Mohamed, Ahmed, Haidar and Abdalla, 2009) and of particular relevance for electricity supply in South Africa.

1.1.3 Entrepreneurship and ecopreneurship in the electricity industry

The adoption of environmentally responsible business practices can conceivably, open up an additional range of opportunities for entrepreneurs. The move to a sustainable business paradigm provides numerous niches that enterprising individuals and firms can successfully identify and service (Schaper, 2002). In a market-based economy, entrepreneurs play a critical role in the eventual adoption of green business practices by the wider business community through the lead role that they provide to other organisations.

1.1.4 Existing entrepreneurial activity through IPPs in the RE sector

Entrepreneurship in the electricity industry stems from the actions of individuals and organisations seeking new business opportunities (Hokkanen, 2009). In the private sector, local entrepreneurs, global power developers, domestic capital markets and multinational financial institutions have a definite role to play in providing both skill and financing (Ljung, 2007).

Entrepreneurial opportunities do exist. Individuals just need to recognise them. If they have the willpower and decide to exploit an existing opportunity, this will lead to economic growth (Mueller, 2007). This is particularly the case in South Africa as the electricity industry is dominated by a monopolistic governmental policy that proves to be problematic and cumbersome for entrepreneurial opportunities as barriers to entry into the industry are rigid. Access to the electricity market with the aim of stimulating increased entrepreneurial activity is dependent on an enabling entrepreneurial environment. The RE sector presents itself with great opportunities for IPP entrepreneurs to seize. Such an enabling entrepreneurial environment would not only aid the industry with greater product delivery but also with increased economic contributions to the country. Relevant policy ensuring that such an environment is realised, then becomes crucial in this process. Ljung (2007) states that the maintenance of stable micro-economic policies, removal of price distortions, trade barriers and the liberalisation of the investment climate will help to create an environment conducive to investments in energy services by foreign and local firms as well as by households and micro-entrepreneurs.

In South Africa, the risk of increasing electricity demand is mitigated through the appointment of IPPs. New power supply units could possibly be built by using loans, with lower returns and smaller electricity price increases. In the circumstances, it seems likely that Eskom will be asked to build new stations, or at least to build them in partnership with others (Davidson, et al., 2006).

1.1.5 Challenges in the South African electricity industry

Electricity production has been and still is one of the main pivots of the social and economic development of South Africa. It has lent prosperity and security to the country by harnessing energy to provide heat and power for industry, transportation and households, despite political problems (Davidson, et al., 2006). Ensuring electricity supply security requires a deeper understanding of network-related issues rather than those related to energy supply availability and generation (Boyle, 2009).

South Africa’s coal reserves are being re-assessed by the Department of Mineral and Energy (DME) and the result will be of great importance for forward planning. In view of the rising demand for coal worldwide, especially because of demand from China, coal prices are likely to rise markedly in the medium term, which will have significant effects for South Africa’s energy economy, particularly in electricity generation (Davidson, et al., 2006).

South Africa’s energy intensity is relatively high and this, combined with the dominance of coal in the local fuel mix, results in high levels of local emissions and greenhouse gases

(Davidson, et al., 2006). At the same time, compared to other middle-income countries, there is room for improvement of energy intensities in South Africa. Interventions to lower the level of energy intensity can assist basic development needs in the residential sector and provide major energy savings in the industrial and transport sectors. On the demand side, two areas of demand for cleaner energy supply, that are receiving particular attention, are solar water heaters and green electricity. RE technologies for electricity generation are primarily a supply issue, but demand for 'green power' products is also a significant factor.

The RE generation is a key deliverable to diversify electricity generation in aid of improved quality of supply and the ever-increasing demand for electricity. The real challenge exists in feeding electricity generation into the existing grids as it necessitates strict regulation and control.

The shortage of supply in South Africa has led to an expansion programme which consists of planning and constructing various additional coal, gas and nuclear power plants and transmission lines (Posorski and Werner, 2009). Despite the declining cost of new connections, as shown by Eskom, the cost of connecting urban areas and rural areas will be very high. Unless the users can afford to pay for electricity supplied, it will be difficult to recover a meaningful share of the investments (Davidson and Winkler, 2003). To this end, a number of RE models are in operation worldwide. In the next section a detailed discussion of applicable models is provided.

1.1.6 Exploring RE models in the electricity industry

The growing importance in recent years of RE world-wide requires South Africa to develop a model within which the market has to produce, sell, or distribute a certain amount of electricity from renewable sources. The adoption of renewables and increasing pressure for more, clean distributed generation models, accelerates the need for continuous communication and innovation in the RE arena (Posorski and Werner, 2009). Off-Grid electricity supply in the context of this study is defined by Davidson and Winkler (2003) as a stand-alone electricity system not dependent on a conventional grid connected network. Renewable energy is mostly for Off-Grid electricity systems using photovoltaic, as well as solar cooking and water heating. Photovoltaic (PV) systems are used as stand-alone sources of electricity in areas remote from the grid (Davidson and Winkler, 2003).

It stands to reason that the South African electricity industry requires a feasible model in which RE generation could be harnessed similar to that of leading countries which rely on RE generation. Norway, a leading producer of electricity from renewable resources, employs a green certificate model in aid of development of environmentally friendly production and use of energy. A green market with a sufficiently high quota and well-defined regulations, might provide a cost-efficient way of subsidising the most competitive renewable technologies, otherwise producers will not be able to enter the market (Goldstein, 2010). In sharp contrast, South Africa has limited activity in the RE sector coupled with limited entrepreneurial activity.

Worldwide, models such as small-scale stand-alone power sources for use in remote areas or in Off-Grid locations is yet to reach a commercial stage (Dutton, Bleijs, Dienhart, Falchetta, Hug, Prischich and Ruddell, 2000). Given the demand on electricity supply networks, Off-Grid electricity might be most appropriate for un-served urban and peri-urban areas where population densities are high and the cost of building distribution networks is correspondingly low (Ljung, 2007).

As an example, Finland's recent development of global green stimulus programmes has demonstrated the great interdependence of the electricity sector and innovation (Hokkanen, 2009). Furthermore, the need for more efficient co-operation of public and private operators is seen as a key factor in the creation of growth companies in the electricity sector, development of the electricity industry and ultimately the economic development of a country. In general, business managers and private business developers promoted two distinct factors with a positive influence on business development: a competent labour force and sector-specific networks of export-oriented businesses (Hokkanen, 2009).

In terms of electrification in South Africa, the extent of generation and supply in the urban and rural areas is determined by the multiplier effect of grid electricity which can be significant if well planned. Supplying grid electricity to rural areas is more difficult because of remoteness and low population density, meaning that cost is prohibitive and the weak and non-cash economy makes recovery even more difficult. However, policy approaches based on "taking electricity to the people or bringing the people to electricity" should be explored, as has been done elsewhere (Afrane-Okese and Muller, 2003).

Figure 1.1 provides an outline of Chapter 1. It provides the background to the study of energy and electricity generation globally and in the South African context. Section 1.2 provides the research problem for this study. Section 1.3 discusses the research objectives and research questions. Section 1.4 provides the thesis statement. Section 1.5 discusses the research design and methodology. Sections 1.6 to 1.10 deal with ethics, definition of concepts, other similar studies, contribution of the study and an outline of the structure of the thesis respectively.

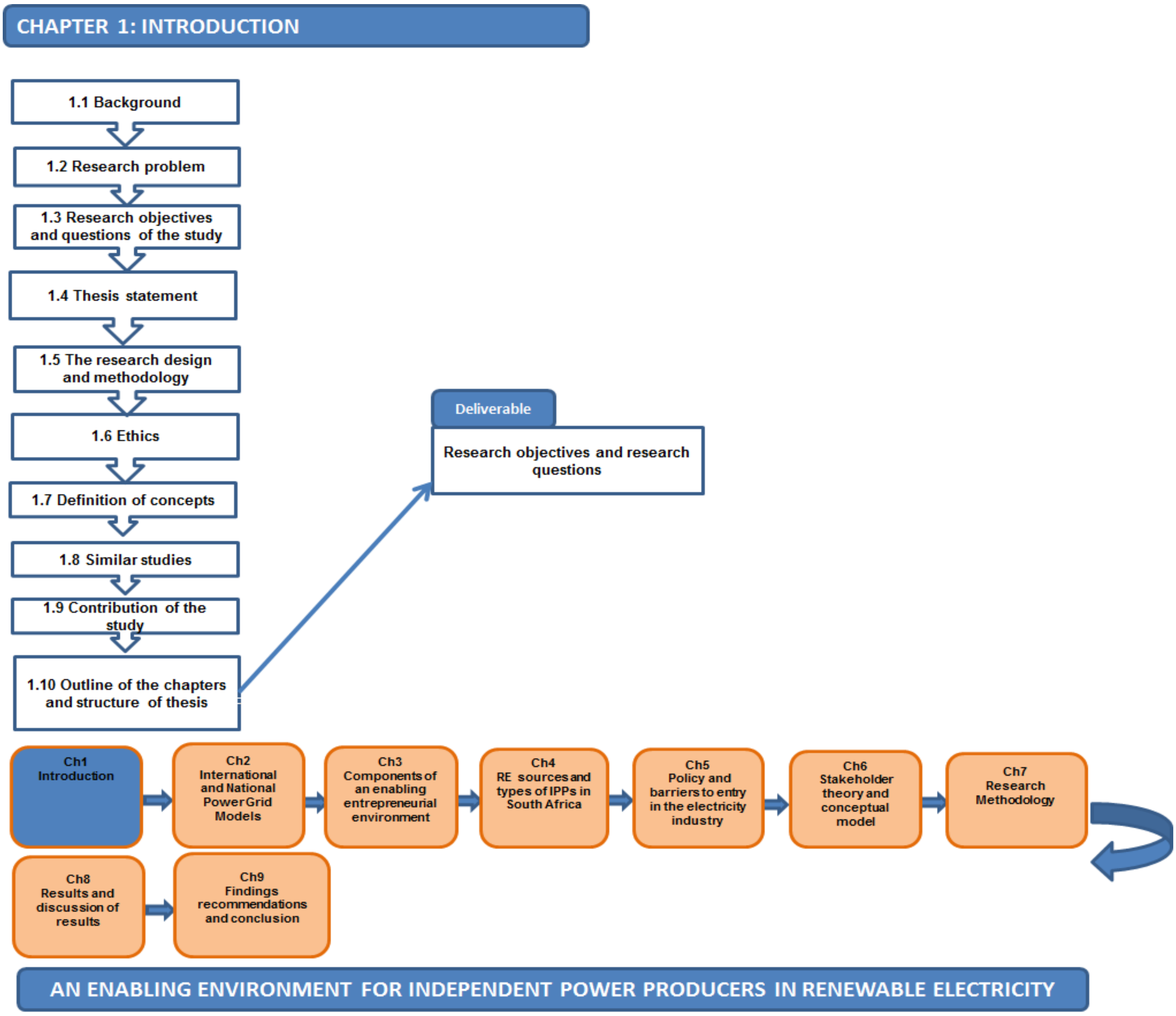


Figure 1.1: Outline of the chapter.

1.2 RESEARCH PROBLEM

Increasing electricity demand due to the rising price of conventional energy sources and their limited supply is of great concern (Winkler, 2009). The electricity generation and supply challenges highlighted in the introduction accentuate the need to create an enabling environment for entrepreneurs to flourish in the RE sector.

Junginger (2005) indicates that these challenges are so intense that it will become increasingly difficult to extract resources to satisfy an increasing global electricity demand. Growth in the electricity and industrial sectors signify profound changes in the entire energy sector (Davidson, et al., 2006).

Bearing these views in mind, although alternative forms of electricity exist, the electricity industry does not enable entrepreneurial activity therefore the need for an enabling entrepreneurial environment for entrepreneurs is imperative. In an attempt to contribute to a battling South African electricity industry and economy, this study proposes the development of an enabling entrepreneurial environment for the RE sector. This should be constructed with the explicit purpose of providing entrepreneurial opportunities for entrepreneurs in the RE sector. The development of such an enabling entrepreneurial environment is essential because South Africa has been slow to develop its RE potential. This may be due to its reliance on cheap electricity from coal-fired plants (Winkler, 2009). A case in Eskom, as South Africa's power utility for electricity generation, will be conducted. However, it will still incorporate major stakeholders such as the National Energy Regulator of South Africa (NERSA), Government and IPPs.

Incorporating entrepreneurial activity through the use of IPPs in the South African electricity industry is not without challenges. In the RE sector, the lack of sector legitimacy was a significant obstacle for IPP entrepreneurs. Traditionally, entrepreneurs and potential investors remain sceptical of the sector, particularly when power utilities refuse to interconnect and purchase electricity from qualifying IPP entrepreneurs (Sine, Haveman and Tolbert, 2005). Further, it is found that the development of regulative institutions and cognitive institutions, which serves to increase the legitimacy of the RE sector for IPPs as a whole, does not fully serve as a catalyst for IPPs entrepreneurs and power utilities. The impact of such relations is most pronounced, however, on IPPs entrepreneurs founding organisations tentative engagement in the RE sector as it is seen as a high risk environment. This is consistent with general arguments that increased IPP activity is needed through the establishment of an enabling entrepreneurial environment in the RE sector (Sine, Haveman and Tolbert, 2005).

The problems experienced at different levels are experienced at organisational, legislative and entrepreneurial levels. The aim of the study is to propose an enabling entrepreneurial environment for IPPs in the RE sector through the eradication of such problems. The author has developed an IPP Model for the electricity Industry (Figure 1.2). This diagram indicates the RE sector layout. The problems experienced by each of the three components at each stage are indicated in the diagram. The proposed research and deliverables from the research at each stage are indicated at the base of the Industry IPP Model. The research focus in this study is to propose a model for an enabling entrepreneurial environment which may promote entrepreneurial activity for IPPs in the RE sector of the electricity industry, by exploring problems experienced at organisational, legislative, institutional and business entrepreneurial levels. The problems experienced are:

At organisational level, business and industry leaders indicate that:

- Existing structures of the electricity industry do not accommodate IPPs in RE sector;
- No alignment of IPP initiatives with organisational imperatives;
- No integration of RE entrepreneurship into Eskom's existing strategy; and
- Electricity policies are not aligned to RE generation (Wisuttisak, 2012).

At legislative level, the problems faced are:

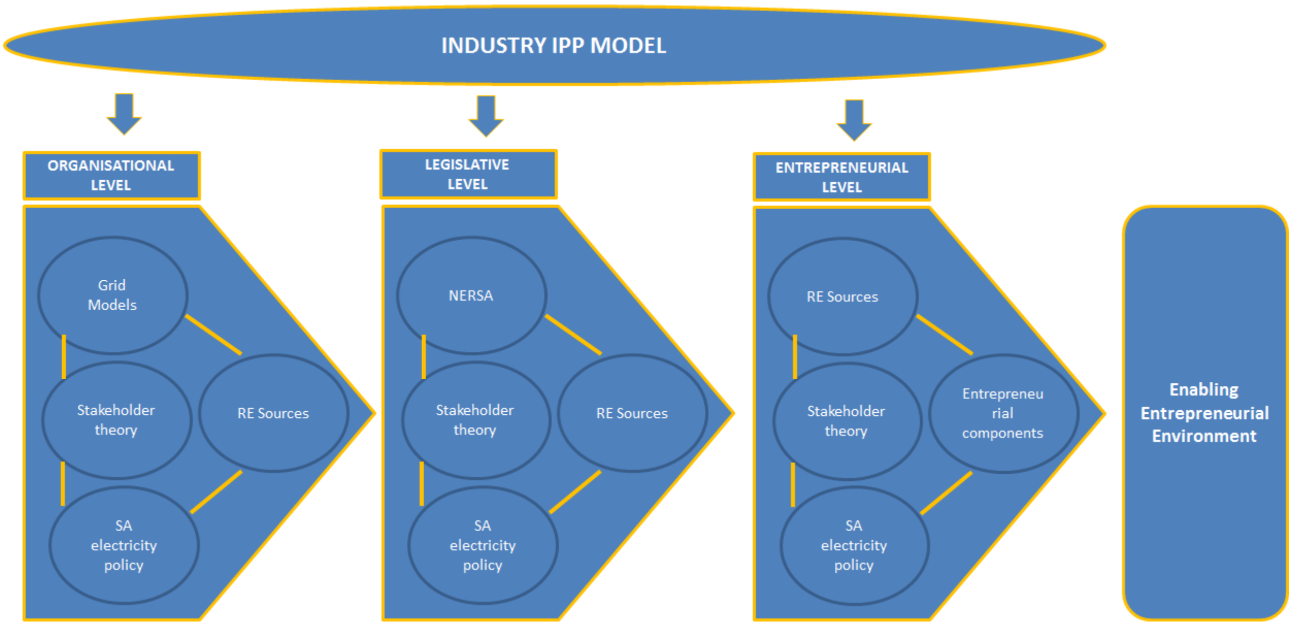
- Restrictive legislation that does not aid entrepreneurial activity;
- A lack of operational objectives governing IPP activity;
- RE policy creating barriers to entry; and
- Inappropriate policy geared more towards coal generation than to RE (Booth and Segon, 2008).

At entrepreneurial level, the problems faced are:

- Limited industry and governmental facilitation for IPPs to gain access to the grid;
- Unrealistic industry requirements for entrepreneurial activity;
- Start-up finance for IPP entrepreneurs; and
- Poor stakeholder facilitation (Booth and Segon, 2008).

The research problems identified have led to the proposal of a model (Figure 1.2), which forms the basis of this study, towards an enabling entrepreneurial environment in the RE sector of South Africa.

Figure 1.2: Proposed Industry IPP Model.



Source: Own construction, 2014.

Figure 1.2 depicts the problems at the different levels of the proposed IPP Model. The Industry IPP Model starts at the Organisational level where no appropriate Grid models exist for the power utility. This proves it is imperative to ascertain if RE sources will be effectively utilised and encouraged within the electricity industry. Stakeholder Theory, in turn, has challenges in determining how such stakeholders will be managed within the RE sector. Policy, and specifically South African policy, is not enabling whereas the electricity industry is battling to ensure an enabling entrepreneurial environment for IPP entrepreneurs who want to explore RE source power generation alternatives.

At the legislative level faces challenges are faced where the National Energy Regulator of South Africa (NERSA) regulation for RE sources is in its infancy stage. Since the electricity industry is predominantly driven by coal generation, the South African electricity policy is not fully embracing RE sources of power generation. At entrepreneurial level, IPP entrepreneurs are embattled with a combination of problems at organisational level and legislative level.

The expectation is that the outcome of this study will:

- Support current electricity generation;
- Alleviate demand strain on the current electricity network; and
- Most importantly, provide a model for an enabling entrepreneurial environment for IPPs in the RE sector.

Against the background to the problems elaborated upon above, the main research problem for this thesis reads as follows:

The electricity industry does not provide an enabling entrepreneurial environment for IPP entrepreneurs.

1.3 RESEARCH OBJECTIVES AND QUESTIONS OF THE STUDY

1.3.1 The Main Research Objective

The main research objective (RO_m) is:

RO_m: To propose a model for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector.

Following this main research objective, the Secondary Research Objectives below apply.

1.3.2 Secondary Research Objectives

- RO_1 - To identify the type of grid models which exist in RE;
- RO_2 - To identify the components of an enabling entrepreneurial environment;
- RO_3 - To identify RE sources applicable for increased IPP entrepreneurial activity;

- RO_4 - To determine and describe the type of IPPs in the South African electricity sector;
- RO_5 - To describe policy and best practice in the South African RE sector;
- RO_6 - To describe stakeholder theory and stakeholder management in the South African RE sector;
- RO_7 - To propose a model for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector; and
- RO_8 - To evaluate the proposed enabling entrepreneurial model for IPP entrepreneurs in the RE sector.

1.3.3 The scope

The scope of this study will be limited to the RE sector in the South African electricity industry and also limited to Eskom as a case study.

1.3.4 The research questions

Based on the purpose of the research and the research objectives, the main research question can be phrased as:

Main Research Question (RQ_m):

What components need to be included in a model to promote an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector?

Sub-research questions:

- RQ_1 – What type of grid models exist in the RE sector?
- RQ_2 – What are the components of an enabling entrepreneurial environment?
- RQ_3 – What RE sources are available that IPP entrepreneurs can utilise in the RE sector?
- RQ_4 – What type of IPPs are required in the South African electricity sector?
- RQ_5 – What are best practice policies that the South African RE sector could consider?
- RQ_6 – How do stakeholder theory and stakeholder management influence the South African RE sector?

- RQ_7 – What model can be proposed for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector?
- RQ_8 – What are the electricity industry's results of an evaluation of the proposed enabling entrepreneurial model for IPP entrepreneurs in the RE sector?

Table 1.1 illustrates the layout of the study addressing research objectives and questions.

Table 1.1: Chapters addressing research questions.

Research Objectives	Research Questions	Research Strategies	Thesis Chapters
RO_m	**RQ_m**	Overview of the research	Chapter 1
RO_1	**RQ_1**	Literature study: International and National IPP Grid models	Chapter 2
RO_2	**RQ_2**	Literature study: Components of an enabling entrepreneurial environment	Chapter 3
RO_3	**RQ_3**	Literature study: Renewable electricity sources	Chapter 4
RO_4	**RQ_4**	Literature study: Types of IPPs in South Africa	Chapter 4
RO_5	**RQ_5**	Literature study: Policy and best practice in the South African RE sector	Chapter 5
RO_6	**RQ_6**	Literature study: Stakeholder Theory and conceptual model for an enabling entrepreneurial environment	Chapter 6
RO_7	**RQ_7**	Implementation research design	Chapter 7
		· Eskom Managers, NERSA Managers and Approved and Non-Approved IPP questionnaires	
		· Industry expert – qualitative method (interviews)	
RO_8	**RQ_8**	Analysis of results, discussion and evaluation	Chapter 8
RO_m	**RQ_m**	Conclusions, recommendations and future research	Chapter 9

1.4 THESIS STATEMENT

RE remains a reasonably untapped source in the South African electricity industry. Since considerable advances have been made, entrepreneurial activities in the RE sector remain a feasible business option for industry expansion. South Africa and the electricity industry in general may therefore be aided through the increase in RE activity (Ward, 2007).

Winkler (2009) supports this view indicating that entrepreneurship in the South African electricity industry is equally underdeveloped as the government strives to partner the existing power utility Eskom with IPPs in the quest towards energy diversification. South Africa is rapidly running out of generation capacity and should invest in new power stations and explore ways to diversify electricity production through private sector partnering.
The thesis statement reads as follows:

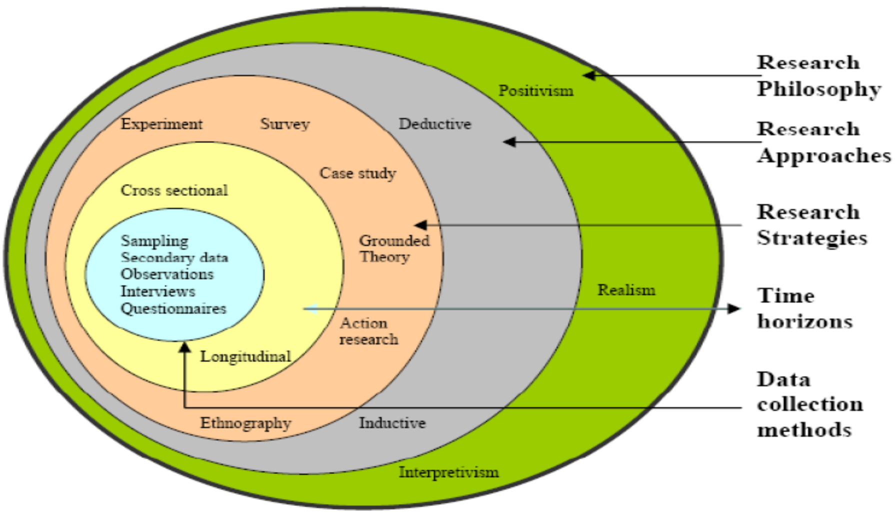
A model which proposes an enabling entrepreneurial environment in the electricity industry of South Africa will improve IPP participation through RE.

1.5 THE RESEARCH DESIGN AND METHODOLOGY

The research philosophies, approaches, strategies and choice of survey methods will be discussed in this sub-section. A well-structured research design and methodology is of vital importance, as in research the study provides the information by which a study's validity is judged. Therefore, it requires a clear and precise description of how an experiment was done and the rationale for why specific experimental procedures were chosen. The research design and methodology should describe what was done to answer the research question, describe how it was done, justify the experimental design and explain how the results were analysed. Scientific writing is direct and orderly. Therefore, the methods section structure should: describe the materials used in the study, explain how the materials were prepared for the study, describe the research protocol, explain how measurements were made and what calculations were performed and state which statistical tests were done to analyse the data (Kallet, 2004).

The research process is used to define the research strategy of this study in detail. Figure 1.3 is a diagram illustrating a generic research process onion showing the relationship between the various aspects of the research process. The research philosophy is firstly identified, followed by the research approach, the research strategy selected, the time lines and the data collection methods.

Figure 1.3: The research onion.



Source: Saunders, Lewis and Thornhill, 2009: 13.

1.5.1 Research Philosophy

Historically, the positivistic paradigm (quantitative research) in the social sciences is based on the approach used in the natural sciences, such as biology, botany and physics. The positivistic approach seeks the facts or causes of social phenomena, with little regard to the subjective state of the individual. Thus logical reasoning is applied to the research so that precision, objectivity and rigour replace hunches, experiences and intuition as the means of investigating research problems. Positivism is founded in the same way as studies conducted in the natural sciences. It is based on the assumption that social reality is independent of individuals and exists regardless of whether one is aware of it (Collis and Hussey, 2003).

According to Denzin and Lincoln (2003), interpretivists contend that only through the subjective interpretation of and intervention in reality can that reality be fully understood. The study of phenomena in their natural environment is essential to the interpretivist philosophy, together with the acknowledgement that scientists cannot avoid affecting the phenomena they study. They admit that there may be many interpretations of reality, but maintain that these interpretations are in themselves a part of the scientific knowledge they are pursuing. Interpretivism has a tradition that is no less glorious than that of positivism, nor is it shorter.

Realism takes a number of forms depending on how ‘the real’ is understood. All approaches to knowledge that endorse realism accept that a world exists which is in some respect independent of the knowing subject. This real external world may be a purely empirical reality so that what has not yet been observed will at some point appear to us. Alternatively, it may be a reality that is concealed from us in some way beyond appearances and independent of our knowledge of the world. These different ontological assumptions about what really exists have produced corresponding epistemologies – the first associated with empiricism and idealism and the second with critical realism – that are central to the social research world. Realism refers to an external reality as consisting of structures that are themselves sets of interrelated objects and of mechanisms through which those objects interact (Sobh and Perry, 2005).

Critical realism is a specific form of realism whose manifesto is to recognise the reality of the natural order and the events and discourses of the social world (Bryman and Bell, 2003). The critical realist's position that the social world is constantly changing is in line with the purpose of business research which is to understand the reason for phenomena as a precursor to recommending change (Bhaskar, 1978). Business, entrepreneurship and electricity provision encapsulate the social world in which humans live. In the case of South Africa, addressing electricity demand challenges necessitates a change in approach. This study deems the consideration of an environment that considers entrepreneurial activity through alternative RE sources as an appropriate response.

This study will adopt a mixture of positivism and realism as a research philosophy and will take the approach of a critical realist. The critical realist's position, that the social world is constantly changing, is in line with the purpose of business research which is to understand the reason for phenomena as a precursor to recommending change.

1.5.2 Selection of a Research Approach and Strategy

Cohen, Manion and Morrison (2011) outline a general paradigm of enquiry that underpins a scientific approach, consists of either deductive proof (deduction) or inductive discovery (induction). Deduction begins with a universal view of a situation and works back to the particulars; in contrast, induction moves from fragmentary details to a connected view of a situation. The deductive approach moves towards hypothesis testing, after which the principle is confirmed, refuted or modified. Collis and Hussey (2003) posit that deduction involves the development of a theory that is subjected to a rigorous test. As such, it is the dominant research approach in the natural sciences where laws present the basis of explanation, allow the anticipation of phenomena, predict their occurrence and therefore permit them to be controlled.

Through the inductive approach, plans are made for data collection after which the data are analysed to see if any patterns emerge that suggest relationships between variables. Through induction, the researcher moves towards discovering a binding principle, taking care not to jump to hasty inferences or conclusions on the basis of the data. To ensure a degree of reliability, the researcher often takes multiple cases or instances, multiplying observations rather than basing conclusions on one case.

According to Cohen, et al. (2011), inductive and deductive processes, however, are not mutually exclusive as combinations can be utilised in research studies. The research conducted in this study, required a combination of both approaches due to the number of surveys conducted.

A survey research strategy was followed in this study. Gable (1994) states that a survey research strategy refers to a group of methods which emphasise quantitative analysis, where data for a large number of organisations are collected through methods such as mail questionnaires, telephone interviews, or from published statistics and these data are analysed by using statistical techniques. A survey strategy is usually associated with a deductive approach and is used in business and management questions relating to what, how and how many (Saunders, et al., 2009). Saunders, et al. (2009) further state that this strategy is largely employed to allow mainly quantitative data analysis. For the purpose of this study, surveys will be distributed for Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Approved and Non-Approved IPPs. Interviews will be conducted with Industry experts as part of the qualitative method.

1.5.3 Data Collection Methods

Qualitative and quantitative research methods such as questionnaires and personal interviews will be utilised in this research study. Qualitative research requires the use of qualitative data to understand and explain social phenomena (Saunders, Lewis and Thornhill, 2000). Quantitative techniques require that data be obtained in a quantitative manner, i.e. observations measured on a naturally occurring numerical scale. Quantitative methods require the use of methods, including case studies, interviews and observations and provide insights into cultural aspects, organisational practices and human interactions (Saunders, et al., 2000). The techniques utilised in this research study required the use of both qualitative and quantitative techniques.

As part of qualitative research, personal interviews will be conducted with subject matter experts in industry to gain understanding about start-up businesses within the electricity industry. A key question that will be asked is: “How accessible and conducive is the RE sector to small business?” The findings of the personal interviews will be fused into the development of a model. The aim of using such interviews is not to replace individual interviewing, but to gather information that can perhaps not be collected easily by members participating in of individual interviews (Welman, Kruger and Mitchell, 2005). The personal interviews aim to obtain an understanding of the patterns of behaviour of entrepreneurs and how these, in turn, may shape entrepreneurial processes in the electricity industry.

This study will follow a mixed-method approach – this is when both qualitative and quantitative methods complement each other and allow for a more complete analysis of the research situation (Maree, 2010). A mixed-method design is useful to capture the best of quantitative and qualitative methods. As a result, researchers learn more about the world when they have both quantitative and qualitative methodologies at their disposal than when they are limited to only one approach (Creswell, 2003). The mixed-method approach is usually applied when a researcher tends to base knowledge on practical foundations. Both quantitative and qualitative data will therefore be collected at the same time (McMillan and Schumacher, 1993).

In this research design, both quantitative and qualitative methods were utilised in order to best understand the phenomenon of interest. In particular, an understanding of the power utility Eskom and the inclusion of IPP entrepreneurs in the RE sector will be investigated as well as how this may contribute to the electricity industry in South Africa. This thesis will follow a mixed-method approach in order to determine how an enabling entrepreneurial environment for IPPs can be established to address demand and supply challenges the South African electricity industry. Questionnaires (quantitative method) and personal interviews (qualitative method) with will be used to collect data.

For the purpose of the study, fixed response questionnaires will be distributed to Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Approved and Non-Approved IPPs, to gain insight into the supply challenges faced in the electricity industry and the current entrepreneurial activity in the RE sector. Further, Approved and Non-Approved IPPs will be furnished with a questionnaire to gain insight into the demand challenges faced, to assess the feasibility of entrepreneurial opportunities in the RE sector. These would ideally be entrepreneurs with tenure between zero and two years in the industry as they will be able to provide insight into entrepreneurial activity and the sense for venturing into business opportunities in the RE sector. This forms part of the quantitative method of data collection. Personal interviews will be conducted with NMMU academics of the Science and Engineering Faculties to gain insight into challenges and opinions on alternative forms of electricity production. After the empirical study and data collection, the Statistical Consultancy Services of the NMMU will assist with the analysis of the data obtained by means of the use of questionnaires. To this end a hypothesised model for an enabling entrepreneurial environment for IPP entrepreneurs will be proposed.

A purposive sample will be drawn from the population which includes: Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Approved and Non-Approved IPPs to the electricity industry. IPPs are specifically entrepreneurs and ordinary businessmen, exploring business opportunities in the electricity industry, who are registered and affiliated to the power utility Eskom.

1.5.4 Questionnaire Results Analysis

The following questionnaires will be utilised in this study:

- Eskom Management questionnaire (Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers);
- NERSA Management questionnaire (NERSA Managers); and
- Approved and Non-Approved IPP questionnaire (IPP owners).

Each questionnaire will be validated and checked for reliability by means of a pilot study (also known as field testing). The questionnaires will be distributed both manually and electronically. A combination of descriptive statistics and inferential statistics will be used to analyse the data. Descriptive statistics will be used to describe what the data in the study show and to summarise a large amount of data in a simple way. Univariate and multivariate techniques will be utilised for the analysis of the data obtained from the questionnaires. The statistical analysis and interpretation of results will be conducted with the NMMU statistical research consultant.

1.5.5 Development and evaluation of the model

Through the preliminary research, literature study, personal interviews and questionnaires described above, data will be gathered and the information collated on current entrepreneurial RE business practices and on areas that were identified that can be improved upon. The focus will be on the RE business process, gaps in current processes, gaps in knowledge and also on enablers to the RE environment, with the objective of proposing a model for an enabling entrepreneurial environment for IPPs entrepreneurs in the RE sector. As illustrated, Figure 1.2 depicts the levels of problems experienced in the RE sector namely:

- Organisational level;
- Legislative level; and
- Entrepreneurial level.

These levels form the basis of the proposed enabling entrepreneurial model proposed for the RE sector which will relate to the RE sector in the South African electricity industry. These levels form part of the questionnaires (Eskom Management, NERSA Management and Approved and Non-approved IPPs) as mentioned previously. The participants will be asked to rate the model by means of a 5-point Likert Scale, in terms of the following categories:

- Applicability of Grid models to electricity industry;
- Appropriateness of the components of an enabling entrepreneurial environment;
- Usability and applicability of RE sources for entrepreneurship in the RE sector;
- Type of IPPs appropriate to the RE sector;
- Application of current RE policy in the RE sector; and
- Relevance of the industry IPP Model for the RE sector.

1.6 ETHICS

Ethical issues that specifically apply to this thesis are as follows:

- The participants are to remain anonymous and the information supplied by them, treated confidentially;
- The researcher will make sure that the collected data is not used to the detriment of those involved in the research project: the data will only be used to inform this study in an anonymous manner;

- Interviews will be conducted only with people directly and professionally associated with the electricity industry and the researcher assures confidentially of information to all participants;
- The researcher will ensure that the consent of the participants is voluntary and informed;
- The transcription of the interviews will be done in an ethical manner, taking care that the transcriptions are only to be used for the purposes of this research; and
- The researcher will apply for ethics clearance (Form E attached as Appendix A).

Questionnaires utilised in this study, the consent forms for Eskom Managers, NERSA Managers and letters to relevant parties and bodies were approved by the NMMU Research Ethics Committee.

1.7 DEFINITION OF CONCEPTS

Electricity demand: South Africa's strong economic growth, rapid industrialisation and mass electrification programme led to electricity demand far outstripping supply in early 2008, resulting in a national power crisis characterised by severe electricity outages. There is a risk of fresh shortages for residential and business customers, especially in 2011-12, before new base-load plant comes on stream in 2013/14 and beyond (The Economist Intelligence Unit Limited, 2010).

The electricity industry, according to The Economist Intelligence Unit Limited (2010), is reliant on coal for the bulk of electricity generation and has above-average energy intensity in South Africa. The national energy supply is secure and well structured. As stated, it is dominated by coal, which contributes predominantly to the country's primary energy. Currently, 33% of the coal mined in South Africa is exported. Of the total domestic supply, 55% is transformed into electricity, 21% into petroleum products, 4% into gas and the remaining 20% is used directly. The industrial, commercial, transport and residential sectors all consume coal directly. The electricity industry is thus characterised by an energy supply that is highly carbon dioxide-intensive. Under-investment in generating capacity and rapid growth in energy demand over the years resulted in severe electricity shortages in late 2007 and early 2008 (Winkler, 2006). In terms of electricity supply, Eskom is the leading company in the South African electricity market, supplying about 96% of electricity needs. Around 90% of South Africa's electricity supply comes from coal-fired power stations (The Economist Intelligence Unit Limited, 2010).

Off-Grid electricity supply, in the context of this study, is defined by Davidson and Winkler (2003) as a stand-alone electricity system not dependent on a conventional grid-connected network. Renewable energy mostly is for an Off-Grid electricity system using photovoltaic. Photovoltaic (PV) systems are used as stand-alone sources of electricity in areas remote from the grid (Davidson and Winkler, 2003).

Renewable Electricity (RE) is defined by Davidson and Winkler (2003) as electricity generation by making use of renewable energy sources such as wind, solar thermal and biomass. Renewable energy sources make up around 9% of South Africa's primary energy supply and are likely to become increasingly important as the government strives to reduce reliance on coal in order to bring South Africa's emissions of carbon dioxide (and other pollutants) under control. New clean coal technologies could help to reduce emissions, but the technologies are at an early stage of development and are neither fully efficient nor cost effective at present (Davidson and Winkler, 2003).

1.8 SIMILAR STUDIES

There has been limited contemporary academic, or government examination of integrated renewable electricity policy in most developing countries. South Africa, especially in terms of how it should be designed to facilitate major reductions in the country's greenhouse gas emissions and how the electricity industry should be supported, depends on RE generation. This can only be supported with the aid of entrepreneurial vehicles in the form of IPPs (Buckman, 2011). Lessons from similar studies in other developing countries remain important in the quest to a greater RE footprint globally.

1.9 CONTRIBUTION OF THE STUDY

The importance and value of an enabling entrepreneurial environment for IPPs in the RE sector of South Africa lies in the fact that barriers exist which make it problematic and unfeasible for entrepreneurial activity in this industry. If South Africa had such an environment higher levels of success will be reached by IPP entrepreneurs and in the process will aid power utilities such as Eskom to deal with rapid electricity demand hikes which are a challenge to contend with.

The study makes both a theoretical and practical contribution. The theoretical contribution is outlined as follows:

- Entrepreneurship in the new electricity sectors was explored;
- Innovative grid models for electricity generation;
- Policy improvement for IPPs in the electricity industry; and
- The value of stakeholder management in the electricity industry.

The practical contribution is outlined as follows:

- Improved entrepreneurial activity in the RE sector; and
- An Industry IPP Model for implementation in the RE sector.

1.10 OUTLINE OF THE CHAPTERS AND STRUCTURE OF THESIS

The layout of this thesis is presented in the format of a diagram (Figure 1.4) and indicates the links between the different chapters.

Chapter 1: Introduction

This chapter introduces concepts related to the topic and provides an overview of the topic. The purpose of the research is motivated and the problem statement, research questions and research objectives are presented. The thesis statement, scope of the research and the thesis structure are described. The Main Research Objective (RO_m) and Main Research Question (RQ_m) are presented.

Chapter 2: International and National electricity Grid models

A review of research relating to international and national IPP Grid models will address Research Objective 1 (RO_1) and Research Question 1 (RQ_1).

Chapter 3: Components of an enabling entrepreneurial environment

This chapter identifies the components of an enabling entrepreneurial environment and will address Research Objective 2 (RO_2) and Research Question 2 (RQ_2).

Chapter 4: RE sources and types of IPPs in South Africa

Renewable forms of electricity will be increasingly important in world electricity production. Exploring such sources is of utmost importance for South Africa. This chapter identifies the feasible electricity sources where feasible opportunities exist and will address Research Objective 3 - 4 (RO_3 - RO_4) and Research Question 3 - 4 (RQ_3 - RQ_4).

Chapter 5: Policy and best practice in the electricity industry

This chapter discusses policy and best practice in South African RE sector. This chapter will address Research Objective 5 (RO_5) and Research Question 5 (RQ_5).

Chapter 6: Stakeholder Theory and a conceptual model for an enabling entrepreneurial environment

This chapter discusses stakeholder theory and stakeholder management the South African RE sector. This chapter will address Research Objective 6 (RO_6) and Research Question 6 (RQ_6).

Chapter 7: Research methodology

This chapter discusses the administration of questionnaires, data gathering and statistical analysis utilised in all of the studies. The statistical results obtained from all the questionnaires administered are discussed and the results are compared with the results of relevant literature. This chapter will address Research Objective 7 (RO_7) and Research Question 7(RQ_7).

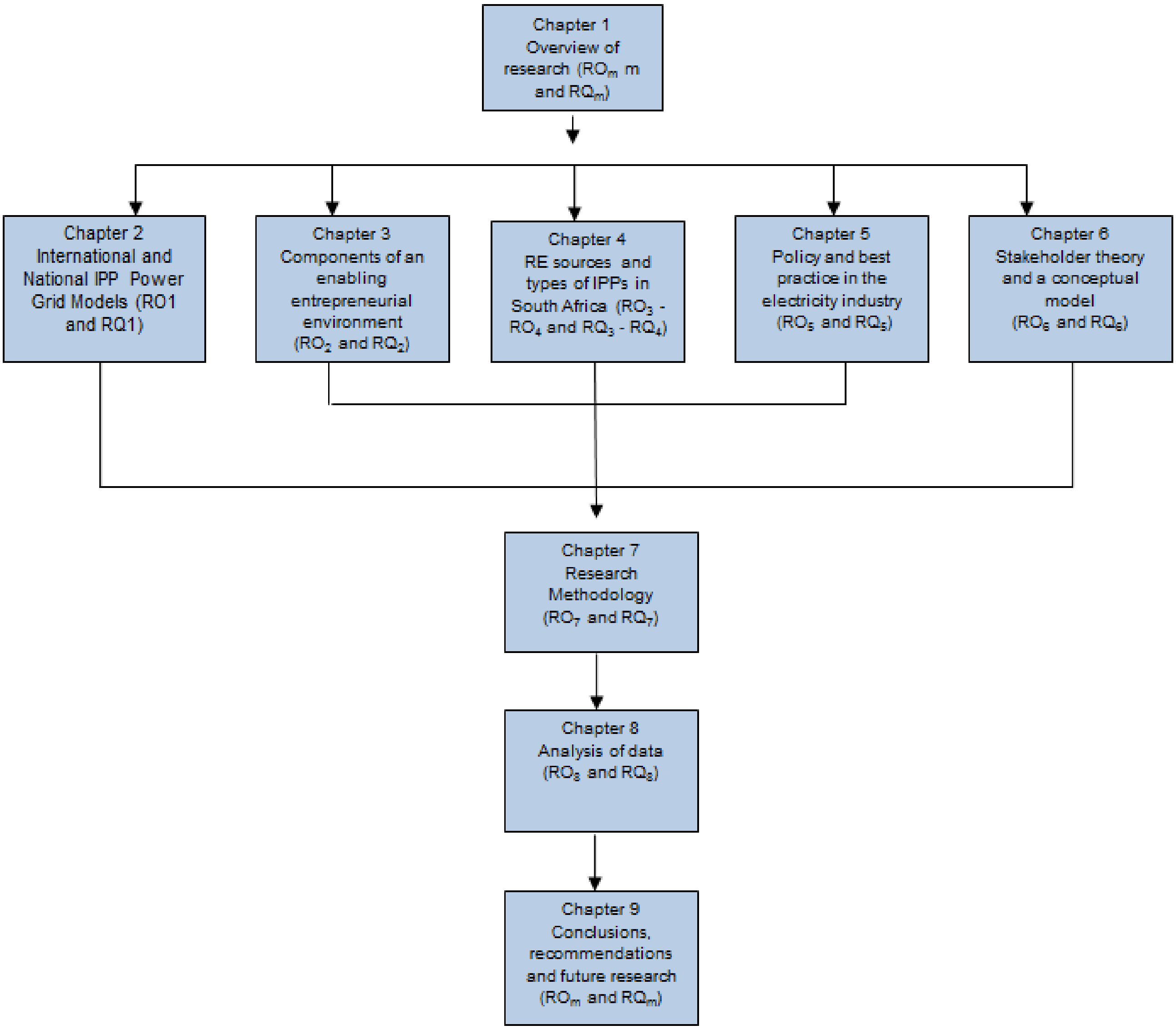
Chapter 8: Results and discussion of results

This chapter discusses how the model will be evaluated. Research Objective 8 (RO_8) and Research Question 8 (RQ_8) will be addressed.

Chapter 9: Conclusions, recommendations and future research

This chapter will summarise the results of the research and present proposals how an enabling entrepreneurial environment for IPPs in South Africa may utilise the model to improve entrepreneurial activity in the RE sector. Limitations of the research and future work will be identified and discussed. The Main Research Objective (RO_m) and Main Research Question (RQ_m) will be addressed.

Figure 1.4: Conceptual thesis designs.



The current chapter provided an overview of the study, identified the research problem and objectives, introduced the thesis statement, specified the research questions and provided a layout of the thesis structure. In Chapter 2, national and international grid models will be discussed. The chapter will conclude with an overview of the current South African grid model.

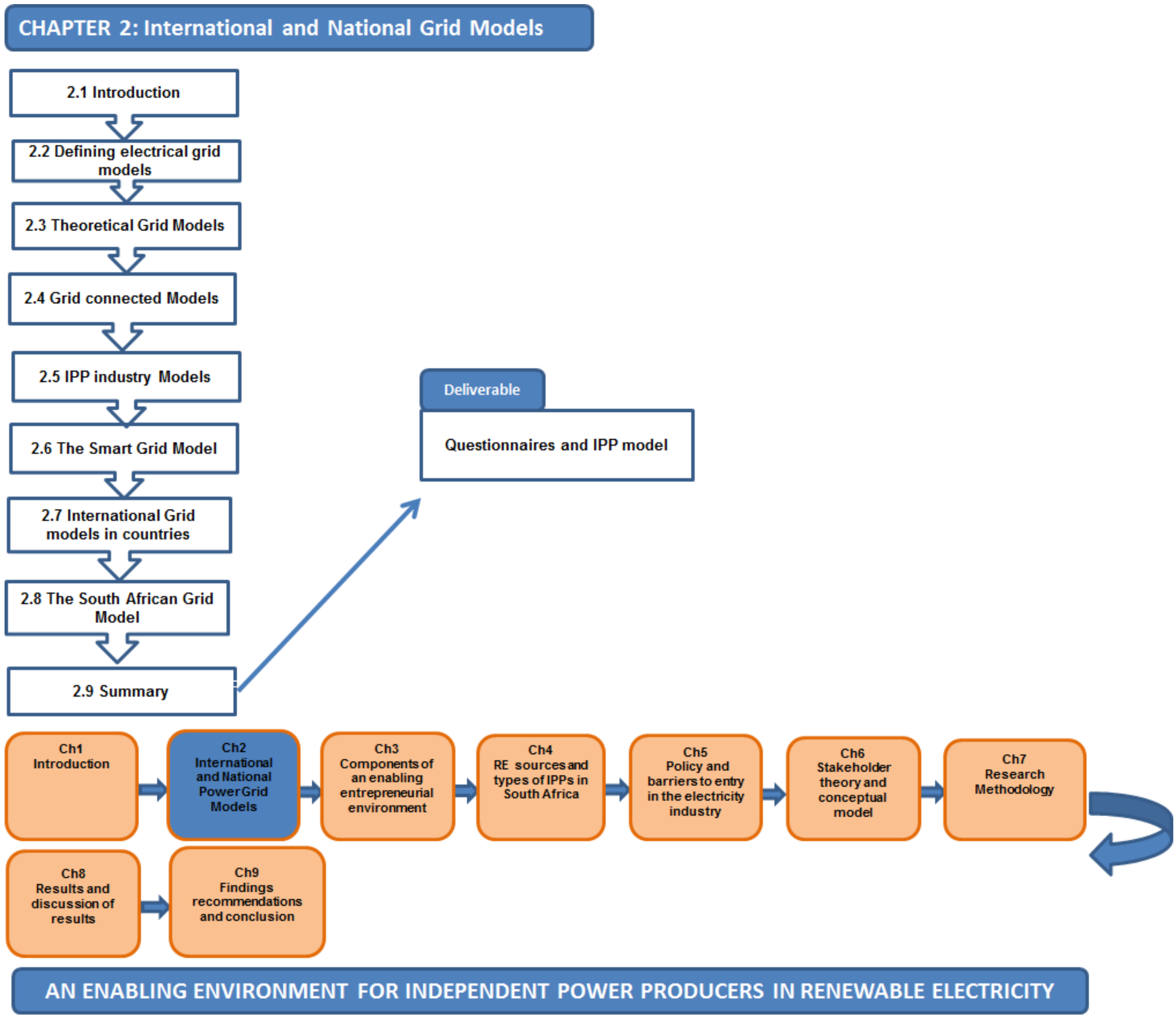


Figure 2.1: Outline of the chapter.

CHAPTER 2
INTERNATIONAL AND NATIONAL ELECTRICITY GRID MODELS

2.1 INTRODUCTION

Globally, electricity generation and consumption have become a very contentious issue. Addressing the ever-increasing demand for electricity necessitates the need to generate and transport electricity in a smarter and more diverse manner through existing power stations and power grids (Jallad, 2010).

In the 20th century, power grids originated as local grids that grew over time, which were eventually interconnected for economic and reliability reasons (Anghel, Werley and Motter, 2007). By the 1960s, the electricity grids of developed countries had become very large, mature and highly interconnected. Thousands of central generation power stations delivered power to major load centres via high-capacity power lines which were then branched and divided to provide power to smaller industrial and domestic users over the entire supply area. The topology of the 1960's grid was the result of the strong economies of scale of the current generation technology: large coal-, gas- and oil-fired power stations in the 1 GW (1 000 MW) to 3 GW scale and are still found to be cost-effective due to efficiency-boosting features that can be cost-effectively added only when the stations become very large (Anghel, et al., 2007).

In the past, power stations were located strategically to be close to fossil fuel reserves in either the mines or oil-wells themselves, or else close to rail, road or port supply lines. The setting of hydro-electric dams in mountain areas also strongly influenced the structure of the emerging grid. Nuclear power plants were sited where there was availability of cooling water. Finally, fossil-fired power stations were initially very polluting and were situated as far as economically possible from population centres once electricity distribution networks permitted it. By the late 1960s, the electricity grid reached an overwhelming majority of the population of developed countries, with only outlying regional areas remaining Off-Grid (Anghel, et al., 2007).

Through the 1970s to the 1990s, growing worldwide demand led to increasing numbers of power stations in countries. Electricity supply, especially at peak times, could not keep up with this demand, resulting in poor power quality including blackouts, power cuts and brownouts. Increasingly, industry, heating, communication, lighting and entertainment depended on electricity. As a consequence, consumers demanded ever higher levels of reliability (Kaplan, 2009).

As electricity demand patterns were established, domestic heating and air-conditioning led to daily peaks in demand that were met by an array of peaking power generators that could only be turned on for short periods each day (Fedoruk, 2009). The relatively low utilisation of these peaking generators (commonly, gas turbines are used due to their relatively lower capital cost and faster start-up times), together with the necessary redundancy in the electricity grid, resulted in high costs to the electricity companies which were inevitably passed on to the customer in the form of increased tariffs. The importance of electricity generation and transport through electrical grids remains critical as this forms the backbone of a power utility (Fedoruk, 2009).

The aim of this chapter is to provide an understanding of generation and distribution issues and presents the model of an electricity grid. In the first section, the introduction to the chapter is presented (Section 2.1). Figure 2.1 outlines the chapter as follows: In Section 2.2, defining electrical Grid models is discussed. In Section 2.3 Theoretical Grid models of electricity generation, transmission and distribution are presented. Section 2.4 discusses the function of Grid-Connected models. A wider literature review of current IPP industry models on electricity generation is presented in Section 2.5 which covers common IPP industry models and the international legal and policy frameworks. Section 2.6 provides an outline of the Smart Grid Model. Section 2.7 highlights International Grid models in countries. The second last section of this chapter will deal with the South African Grid model and recent research in the on-going effort towards RE (Section 2.8). A summary of the chapter will then be presented (Section 2.9). Figure 2.1 outlines the chapter with the sections mentioned above. The research question addressed in this chapter is:

RQ_1 - What type of grid models exist in the RE sector?

The research objective addressed in this chapter is:
RO_1 - To identify the type of grid models which exist in RE.

In particular, the chapter presents Smart-Grid models as its deliverable.

2.2 DEFINING ELECTRICAL GRID MODELS

In this study, the term electrical grid is described as an interconnected network for delivering electricity from suppliers to consumers. It consists of three main components, namely:

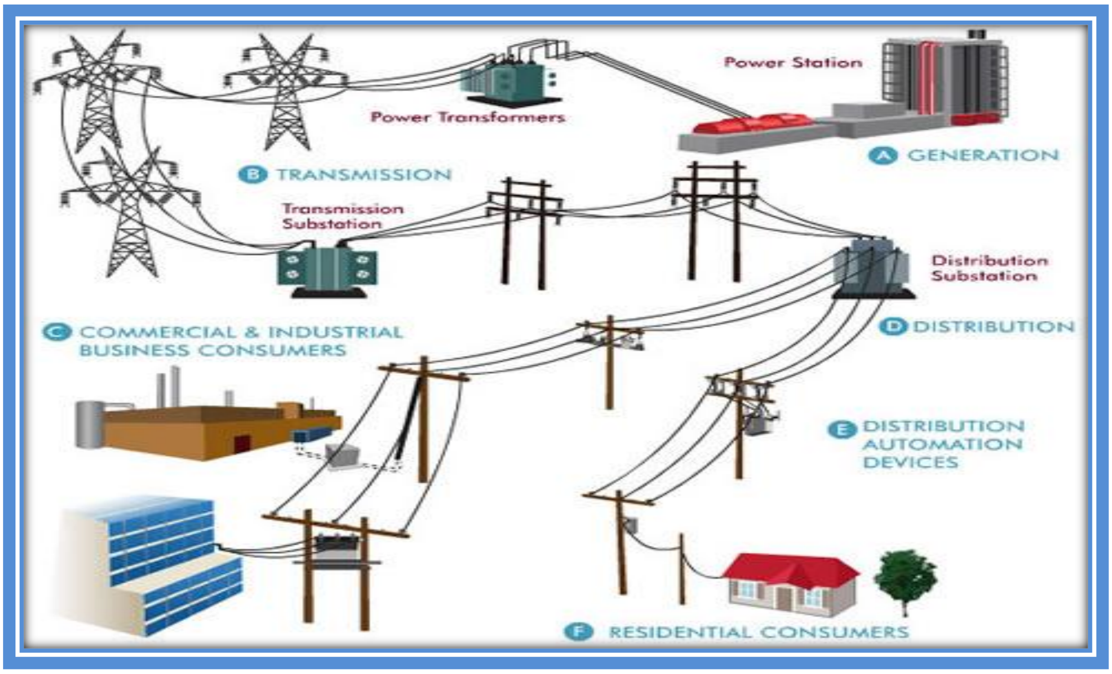
- Power stations that produce electricity from combustible fuels (coal, natural gas, biomass) or non-combustible fuels (wind, solar, nuclear, hydro power);
- Transmission lines that carry electricity from power plants to demand centres; and
- Transformers that reduce voltage so that distribution lines carry power for final delivery (Sinha, 2012).

According to Sinha (2012), in the electricity industry, an electrical grid is a term used for an electricity network which includes the following three distinct operations:

- Electricity generation - Generating plants are usually located near a source of water and away from heavily populated areas. They are usually quite large to take advantage of the economies of scale. The electric power which is generated is stepped up to a higher voltage at which it connects to the transmission network;
- Electric power transmission - The transmission network will move (wheel) the power long distances – often across state lines and sometimes across international boundaries until it reaches its wholesale customer (usually the company that owns the local distribution network); and
- Electricity distribution - Upon arrival at the substation, the power will be stepped down in voltage from a transmission level voltage to a distribution level voltage. As it exits the substation, it enters the distribution wiring. Finally, upon arrival at the service location, the power is stepped down again from the distribution voltage to the required service voltage(s). Electricity distribution is the final stage in the delivery (before retail) of electricity to end users. A distribution system's network carries electricity from the transmission system and delivers it to consumers. Typically, the network would include medium-voltage (less than 50 kV) power lines, electrical substations and pole-mounted transformers, low-voltage (less than 1 kV) distribution wiring and sometimes electricity meters (Sinha, 2012).

These operations function in a grid commonly termed the electricity grid. Figure 2.2 depicts the global electricity grid.

Figure 2.2: The Electricity Grid.

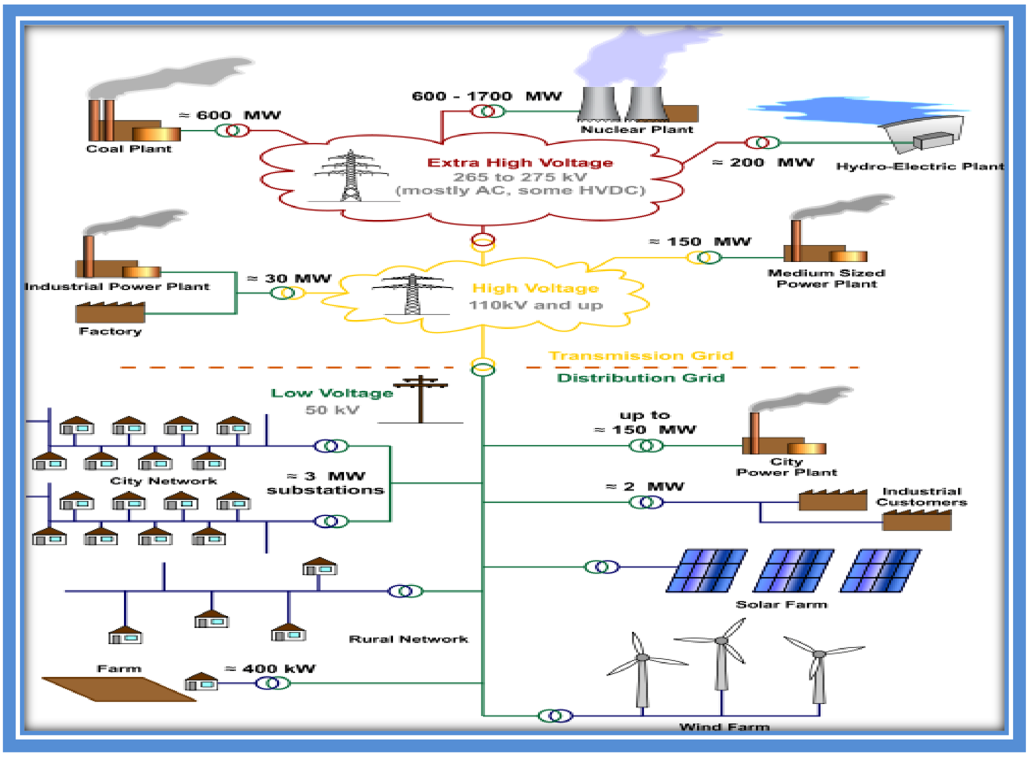


Source: Byrne, 2011: 3.

Figure 2.2 indicates the value chain of electricity from generation to the residential customer. First, there is energy generation, requiring both a fuel source (e.g. coal, nuclear, natural gas, wind energy) and a power plant to convert that fuel source into electricity. Second, electricity transmission involves both transforming generated electricity into electricity that can be transmitted over power lines and matching end-user requirements (demand) with energy availability (supply). After transmission, electricity must be distributed to individual end users via a vast network of power lines and substations. Lastly, there is delivery where electricity is transformed again and delivered directly to an end user (Matt, Ghandi and Middendorf, 2008).

Electricity plays a crucial role in the development of economies and their people. The electricity system, considered as the whole of the energy supply sector, which converts the primary energy to energy carriers and the end-use technologies needed to convert these energy carriers to deliver the demanded electricity services (see Figure 2.3), has developed significantly over time (Hoogwijk, 2004). Figure 2.3 also indicates the introduction of alternative forms of electricity sources to the network.

Figure 2.3: Alternative forms of electricity on the grid.



Source: Kaplan, 2009: 5.

2.3 THEORETICAL GRID MODELS

Electricity is vital for social and economic development of any nation. However, with increasing agricultural and industrial activities as a trademark of all countries, the demand for electricity will inevitably increase. Formulating a power grid model will help in the allocation of widely available RE sources such as solar, wind, bio-energy and small hydro-power in meeting future electricity demand (Jebaraj and Iniyan, 2006).

Anghel, et al. (2007) indicate that power grids are amongst the largest and most complex technological systems ever developed. These systems suffer periodic disturbances of varying severity and sometimes these disturbances are so large that they affect a considerable fraction of the power grid and induce considerable economic and social costs. For this reason, the vulnerability of power grids and more generally of interconnected transportation and communication networks has gained significant attention recently (Anghel, et al., 2007).

Providing reliable power grid delivery is an essential requirement in the design and maintenance of any power generation and distribution system. In its simplest form, the power grid consists of generators, transmission lines and corresponding loads. With increasing pressure on the power grid due to increased load and increased power transfers caused by deregulation, more intelligent and distributed control is required to continue providing reliable power delivery (Faza, Sedigh and McMillin, 2010).

In securing reliable electricity delivery, the scale and nature of the access gap and locations involved means that electricity will need to be provided through both centralised and decentralised energy technologies and systems. In order to ensure efficient functioning, a combination of the following three general power Grid models which are discussed below is used (Advisory Group on Energy and Climate Change, 2010):

- *Grid extension model*. This is an extension of the existing transmission and distribution infrastructure to connect communities to power;
- *Mini-Grid access model*. Linking a local community to a small, central generating capacity, typically located in or close to the community. The power demand points are linked together in a small, low-voltage grid that may also have multiple smaller generating sources; and
- *Off-Grid access model*. Generating capacity provides power for a single point of demand, typically a solar household system (Advisory Group on Energy and Climate Change, 2010).

Building greater electricity capacity, lowering carbon emissions and diversifying the current electricity supply proves paramount to the electricity industry. The mentioned models are important to the industry as innovation is sought after in the electricity generation process. The following sub-section provides an exposition of each power grid model.

2.3.1 Grid extension model

Considering grid extensions in any electricity network is challenging because different characteristics and rules apply to commercial and physical electricity exchanges between two areas (Wolak, 2003). Globally, grid extension is often the least-cost option in urban areas and rural areas with high population densities. If pursued at the regional level, it also offers an opportunity to tap into significant hydro-power potential, providing low-cost clean energy (Fürsch, Hagspiel, Jägemann, Nagl and Lindenberger, 2004).

A number of factors underpin successful grid extension including, strong government commitment, a clearly defined role for national utilities, sufficient central generating capacity to allow for the increase in demand and a focus on reducing capital costs, inter alia by increasing the economies of scale of the connections (Advisory Group on Energy and Climate Change, 2010). Thus, the value of a grid extension is higher, the more pronounced electricity generation cost differences are between regions, and the more demand curves between different regions in the system are negatively correlated (Fürsch, et al., 2004).

Grid extension in a network, the exact location and size of transmission line extensions and thus the cost required to achieve a certain extension of commercial transfer capacities, are specific to the particular structure of the generation system at a certain point of time and have to be identified by load-flow analysis (Szabó, Bodis, Huld and Moner-Girona, 2011). Grid extensions are beneficial for two reasons. Firstly, a highly intermeshed network can help profitability from the comparative cost advantages of supplying electricity from RE sources. These advantages mainly arise because of different meteorological conditions, which lead to substantial differences in generation cost. Also, generation options which are available only in some countries due to natural or political restrictions, can lead to comparative cost advantages. Secondly, an increasingly intermeshed network can help to balance demand (Fürsch, et al., 2004).

2.3.2 Mini-Grid access model

Increased access to electricity can only be achieved by means of tailored approaches and mechanisms. The unique circumstances in developing countries, coupled with the lack of energy capacity to produce electricity, lack of experience and finance, etc. have denied communities access to reliable, affordable and environmentally sound electricity for their respective development activities (Mario, 2009).

Mini-Grid systems especially, sometimes experience additional challenges related to operating complexity and load-balancing costs. In many cases, however, the value of aggregating supply in a Mini-Grid at the community level so that it is available for productive use during non-peak hours for household use will outweigh any additional costs. Mini-Grids played an important part in Chinese rural electrification and there are more recent success stories in Sri Lanka and Mali (Advisory Group on Energy and Climate Change, 2010).

Ensuring that the technology is forward compatible with later grid connections is an important consideration if Mini-Grids are to be viewed as an incremental step on the energy access pathway. For Mini-Grid solutions, it is critical that consumers are charged relative to their level of consumption. Finally, there is a need for awareness and confidence amongst end users in the solution itself and acceptance within the local community is also essential before implementation (Advisory Group on Energy and Climate Change, 2010). The slow pace of grid extension reflects the inefficiency of this electrification model when it is applied inappropriately.

In order for RE-based Mini-Grids to be economical and sustainable, there is a need to break away from the stringent technical standards placed on the grid system. The principles behind the design of Mini-Grid should be safety, adequacy of power, expandability, local maintenance and efficiency. Therefore to avoid the complexity and high costs that can quickly place the Mini-Grids beyond the reach of the typical village, standards that take into account the local circumstance, resources and low cost technologies that depend on rural skills should be encouraged (CAMCO, 2010).

Contrary to the Off-Grid access model, the consumer (e.g. a household) in a Mini-Grid system does not perform maintenance or manage the equipment. Instead, system maintenance and management are the responsibility of the private investor or the management committee elected by the members in a group or cooperative (CAMCO, 2010).

2.3.3 Off-Grid access model

The term *Off-Grid* refers to not being connected to a grid, it is mainly used in terms of not being connected to the main or national transmission grid in electricity. In terms of electricity, Off-Grid may imply stand-alone systems or Mini-Grids typically to provide a smaller community with electricity. Off-Grid electrification is an approach used in countries and areas with little access to electricity due to scattered or distant population. It can be any kind of electricity generation (Saghir, 2008). Off-Grid or stand-alone service provision has emerged as a viable alternative for increasing access to electricity especially in remote and dispersed communities (Saghir, 2008).

It is accepted that in many countries, especially in the rural communities, an alternative to grid-connected power is required (Moner-Girona, 2009a). Reiche, Covarrubias and Martinot (2000) posit that, although rural electricity users will be served by conventional grid connections during the next decade, large numbers will remain unconnected because of the high costs of grid extension when serving new loads.

Off-Grid electrification can provide an alternative solution for low-demand users, at a lower cost than grid extension and will provide a growing market niche for small types of rural energy service companies (Reiche, et al., 2000). In recent years the costs of Off-Grid technologies have decreased significantly since the introduction of new RE sources such as solar, wind and modern bioenergy. According to Niez (2010), RE has only officially been accepted as real power in recent years.

The push to privatise electricity generation and distribution in developing countries during the 1990s has, in some ways, exacerbated the problem of reaching those living in Off-Grid areas. Private distribution utilities, driven by bottom-line considerations have concession contracts that limit their service obligation to households located a relatively short distance from the grid. Utilities have little incentive to connect consumers located beyond this limit because unit connection costs are higher and consumers, who are generally poorer, can only be charged tariffs that are below the marginal cost of service (Saghir, 2008).

The access to electricity has marked significant improvements in welfare in developing countries. There are millions of rural households in the developing world without access to electricity. A substantial portion of this population resides in small or dispersed communities or far from the national grid. Sustainable Off-Grid electrification serves the dispersed and poorer communities, although costs required to reach these classes of unserved populations remain substantially high. It is however believed that Off-Grid electricity will remain a feasible solution to the unserved population (Saghir, 2008).

Off-Grid extension seems overwhelming in cases where sufficient generation capacity exists on the grid households. The main advantage is the shift from traditional to modern lighting systems, typically from kerosene lamps to the superior quality electric lighting (Saghir, 2008). Although prices for grid extension differ from country to country, in many of them, extension to an isolated village is viable only at a certain distance and as long as the village has a large enough demand to reach critical mass (Alliance for Rural Electrification, 2011). Otherwise, Off-Grid electrification is the most cost-effective option. The connection to the national grid has some well-known advantages (including reliability, cheaper costs and economies of scale) in comparison with Off-Grid systems. However, it is important to bear in mind there may be lack of security of supply, long waiting periods for electrification and increases in the price of electricity.

It stands to reason that with Off-Grid projects, poorer community members benefit indirectly from the power provided to schools, health centres, water-supply systems and communication facilities. However, where community conditions are favourable, Off-Grid electrification stimulates the creation of micro-enterprises that increase overall economic benefits. For this reason, some Off-Grid electrification projects have cost-benefit ratios that may exceed those of grid extension (Saghir, 2008).

It can therefore be argued that Off-Grid systems pose a viable option for the RE sector internationally. Small-scale decentralised, distributed generation avoids bureaucratic complexities and hence is widely used to supply electricity to local entrepreneurs (Terrado, Cabraal and Mukherjee, 2008). RE supplied in this manner remains a niche application, although several projects by government and other agencies have demonstrated its distinct advantages (Chakrabarti and Chakrabarti, 2002). Although this may be the case, research indicates that distinct obstacles have to be overcome to derive full benefits from these advantages.

According to Rysankova, Persson and Mostert (2010), an obstacle to rural electrification in countries with low access rates is insufficient generation capacity from the main electricity system. One such country is South Asia where permanent load shedding is experienced in various regions. More than 30 countries in Sub-Saharan Africa suffer from systematic generation shortages (Foster and Briceño-Garmendia, 2010). It is unrealistic to expect these countries to make more than modest gains in increasing electricity access by means of grid extension until the capacity constraint is eased. Off-Grid electrification has the advantage of not being affected by this capacity constraint.

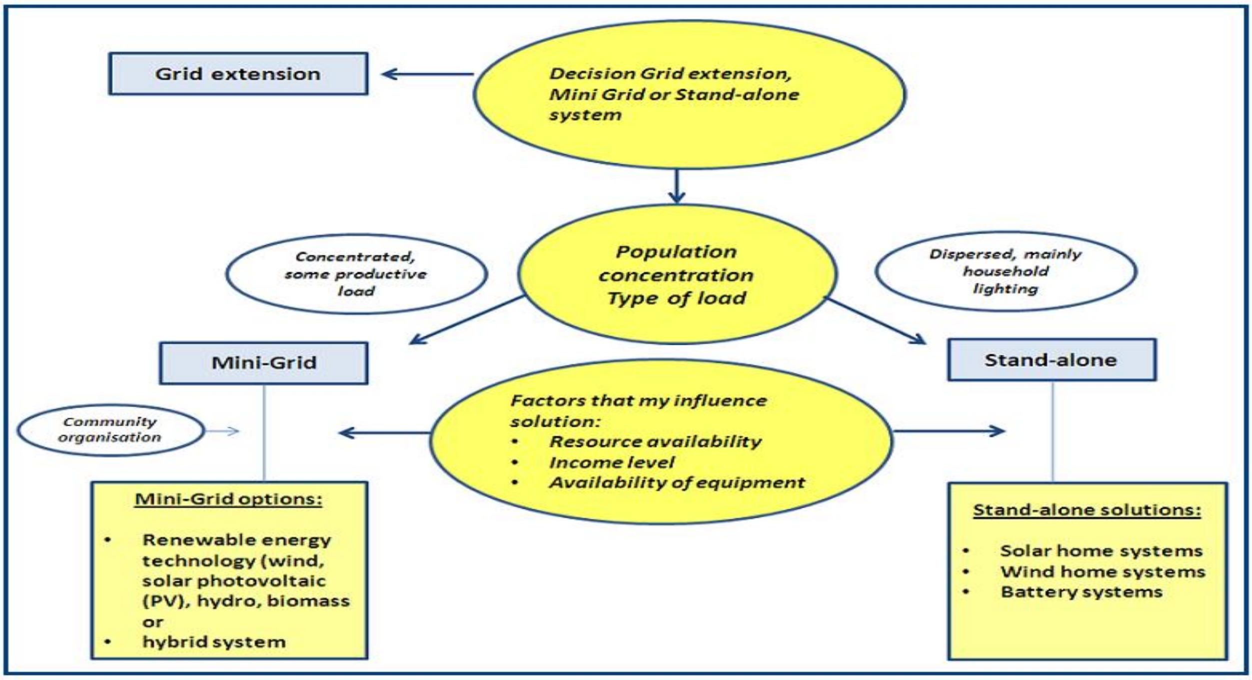
Rapidly changing customer needs for electricity supply is one of the biggest challenges facing the electricity industry. Eventually, every part of the electric power value chain will be digitally monitored and managed. There will be visibility and control from generation through every section of the grid all the way down to individual devices in factories, offices and homes (Smart Grid Information Report, 2011).

The transition from a traditional grid to a Smart Grid depends on the deployment of an integrated communication platform. The platform is necessary to create the support required to exchange data in real time between plant devices, customers and intelligent software analysing the network (Smart Grid Information Report, 2011).

Figure 2.4 indicates how different types of grid-model systems operate independently of and dependently on an electric transmission and distribution network. In this model, the need for electricity is addressed depending on the conditions. Grid extension has major cost and economic values of different technologies. There is also security of supply, RE targets and the capacity of extensions to consider. Though mostly preferred as it allows the full exploitation of system integration, it has the potential to substantially increase the average system cost of electricity (Fürsch, et al., 2011).

A first option is simply to extend the national grid. In many countries, however, extending the national grid can be extremely costly (see Figure 2.4). Rural areas are normally located far from the national grid, therefore the high cost of extending the transmission lines usually make these projects unfeasible. The terrain also increases expansion costs significantly. Mountainous areas with difficult access for machinery require more time and resources to install transmission lines. The size of the demand, determines the cost per kWh of expanding the grid (Alliance for Rural Electrification, 2011). A critical mass is necessary for a project to be viable. A Mini-Grid model proves to be feasible as it can provide centralised electricity generation at the local level, using a village-wide distribution network. Mini-Grids provide capacity for both domestic appliances and local businesses and have the potential to become the most powerful technological approach for accelerated rural electrification. Mini-Grids also offer an optimal solution for utilising localised RE resources (Alliance for Rural Electrification, 2011).

Figure 2.4: Types of Grid Models.



Source: CAMCO, 2010: 25.

For this reason, Off-Grid electrification could be seen as feasible, offering an optimal solution for utilising localised RE resources as a means for electricity generation.

2.3.4 Other Off-Grid business models

As a means of providing alternative electricity supply and to cope with increased electricity demand, Off-Grid systems may pose a viable option for the RE sector (Terrado, et al., 2008). Small-scale decentralised distributed generation avoids bureaucratic complexities and hence is widely used to supply electricity via local entrepreneurs. RE supplied in this manner remains a niche application, although several projects by government and other agencies have demonstrated its distinct advantages (Chakrabarti and Chakrabarti, 2002). Notably, the need for such Off-Grid initiatives becomes increasingly important to serve this end of the market.

The World Bank Group has implemented a number of projects with Off-Grid rural electrification components. New project design approaches are being tested for the first time. The basic components of this new generation of projects are similar. Their goal was to help build sustainable local markets that would persist beyond the development assistance phase, which helped to initiate them. Examples of rural Off-Grid projects in the World Bank Group’s portfolio include, amongst others, countries such as India and Indonesia (Reiche, et al., 2000).

According to Saghir (2008), the World Bank initiated the implementation of Off-Grid electrification projects primarily aimed at improving electricity access for populations in remote areas that were unlikely to be reached by grid extension within a reasonable time frame. Intertwined with this goal were the objectives of having players other than governments to implement the work, thus mobilising additional human and financial resources and reducing pressure on already overextended utilities. The key was to develop a system of incentives sufficiently attractive for these players to do business in Off-Grid areas.

The traditional model of large, remote power stations with central dispatch, long transmission lines and a distribution system primarily designed to deliver power from transmission substations to load centres with established load profiles, may be evolving into a new approach. This new approach will accommodate greater levels of demand-side management; generation and storage resources on the distribution system; generation closer to the loads, greater flexibility for islanding and micro-grids and considerably higher levels of intermittent generation, especially on the transmission system. These changes may not only require changes to the power system capacity and capabilities, but they also will have a significant impact on the IT needed to monitor and control the reliable operation of the power system in the most economical fashion (IEEE Power and energy, 2010).

The model under which IPPs sell, allows for electricity sales where IPPs are engaged in long-term contracts with minimum offtake and tariff setting provisions. Projects that deviated from this norm often fared poorly. For example, all IPPs in China faced annual tariff reviews that allowed local authorities to change tariffs easily, with little recourse for investors. Often, Chinese authorities succeeded in having a plant built and then squeezed the tariff down, leaving bitter memories for the foreigner but paying substantially less in the long run (Woodhouse, 2005a).

IPP industry models which have proven successful may be fully adapted to exploit RE resources. Local requirement of IPPs operating in small grids and needing to meet variables can also be mirrored by a Renewable IPP, in which several renewable technologies and projects can be run independently or aggregated to provide a fully distributable electricity supply. In absolute terms, RE generation provides the lowest cost supply option, the lowest emissions and the highest employment creation compared to coal and oil. In order to offset the natural tendency of the electricity retailers to maximise sales, it is possible to set up independent, energy-efficiency provider companies to operate in a deregulated market (Sawin, 2013).

2.4 GRID CONNECTED MODELS

According to the Hamrin (2008), Grid-Connected models which include a synopsis of RE technologies and discussions of economic factors and policy strategies are necessary to overcome barriers common to most large Grid-Connected renewables. Large Grid-Connected models include five types of RE technologies such as:

- Biomass;
- Geothermal;
- Hydro-electric;
- Solar electric (both PV and CSP); and
- Wind power.

Any national electricity system should focus on RE resources that are locally available, have established themselves commercially, are cost-effective in the long-term and fit the needs and characteristics of the country's electricity market. These resources should be included in an enabling legal and regulatory framework that governs and encourages private-sector investment in renewable resources and technologies. Large, Grid-Connected RE facilities usually require a special framework of promotional strategies that are different from what is required to support small, distributed and non-grid connected renewables (Hamrin, 2008).

Thus, Grid-Connected models, commonly known in the electricity sector as IPPs, have now become increasingly recognised as an important predictor of success in RE advancement world-wide. Many of the IPP industry models have tended to be introduced in unreformed sectors and can be regarded as a reform option which, in principle, could play a key role in triggering the vast RE potential in a country (Energy Operations Policy Paper, 2006).

It is emphasised that a growing need for RE, as a result of the substantial growth in the industrial sector is evident. The important role of RE in global economic development is dependent on the availability of accommodative RE models for IPP participation (Sarraf, (Decker, Fayad and Gardner, 2010). IPP industry models should be active enablers of market evolution. By making adjustments to the existing models, governments and existing traditional power producers will continue to rely on private generation as a source of cost-competitive power and provide a liberating alternative to the capital-intensive power projects of the past (Sarraf, et al., 2010).

The need for such Off-Grid IPPs thus becomes increasingly important to serve this end of the market. The way IPPs are structured in this section of RE is imperative as it can preserve the benefits of the IPP Model while substantially reducing the risk of conventional connection to certain sections of the population (Sarraf, et al., 2010).

2.5 IPP INDUSTRY MODELS

IPPs epitomise the wholesale competitive model, where IPPs can include both RE and thermal energy developers who, among other things, have a well-earned reputation for driving innovation in the electricity industry. Perceived as 'risk takers', IPPs assume considerable risks. A non-utility developer assumes the development, permitting, financing, and construction and operating risks. Therefore, most future and current IPPs will no longer take the sole market risk (Kahn and Nguyen, 2006).

IPPs were originally conceived as re-sellers of co-generated electricity and other small-scale power resources, but a report for the (US) National Association of Regulatory Utility Commissioners specifically addressed the ability of conservation and load management programmes and RE developers to bid as IPPs (Woodhouse, 2005a). Recent reports indicate that developing countries started opening their power sectors to IPPs some ten years ago and IPPs have now developed into a large market. IPPs thus include both RE and thermal energy developers who, among other things, have a well-earned reputation for driving innovation in the energy sector (Kahn and Nguyen, 2006). Woodhouse (2005a) indicates that private investment in electricity generation is done through IPPs. The need for new power capacity along with a halting reform of the power sector has produced enterprises for filling the gap which Woodhouse (2005a) refers to as IPPs.

The IPP approach is becoming a progressively feasible and popular solution to traditional public sector efforts in developing electricity infrastructure to meet escalating power demands and at the same time effectively meeting the major challenges for adequate, reliable and economic power supply in developing countries (Woodhouse, 2005b).

Globally IPP industry models provide a huge impetus to the electricity sector and in particular, the RE sector. Managers of private IPP plants, worldwide, testify to ongoing problems in the sector including high electricity prices and potentially looming power shortages. Externalities such as the volatile political environment continue to pose challenges for the IPP sector (Woodhouse, 2005b). The reason IPPs are likely to replace the traditional public power plants for new generation stems from the business model that IPPs employ and the distinct advantages the model offers to governments (Woodhouse, 2005b).

The advantages of the IPP approach may include:

- More potential developers and/or resources with which to develop RE projects;
- Private-sector ownership may be more politically feasible than public- sector investment; and
- Infrastructure (including transmission lines, substations and roads) can be developed to serve multiple plants (Woodhouse, 2005b).

The disadvantages of the IPP approach include:

- Many RE IPP development companies experience financial difficulties;
- An IPP requires an alliance between multiple players – developer, engineering, procurement, and construction (EPC) contractor, and lenders and equity investors – and this alliance may be difficult to build and maintain;

- An acceptable and financeable Power Purchase Agreement (PPA) needs to be negotiated with the electric utility or power off-take purchaser, which can be difficult and time-consuming; and
- A PPA acquisition price, reflecting profit and risk premiums to the developer, must be rolled into the acquisition cost of the power. Many countries have set this acquisition price at the purchasing utility's avoided cost, so that all stakeholders are indifferent to the rate impact. However, avoided cost is often well below a project's actual cost, thereby reducing the ability of the IPP to include actual risk and profit premiums.

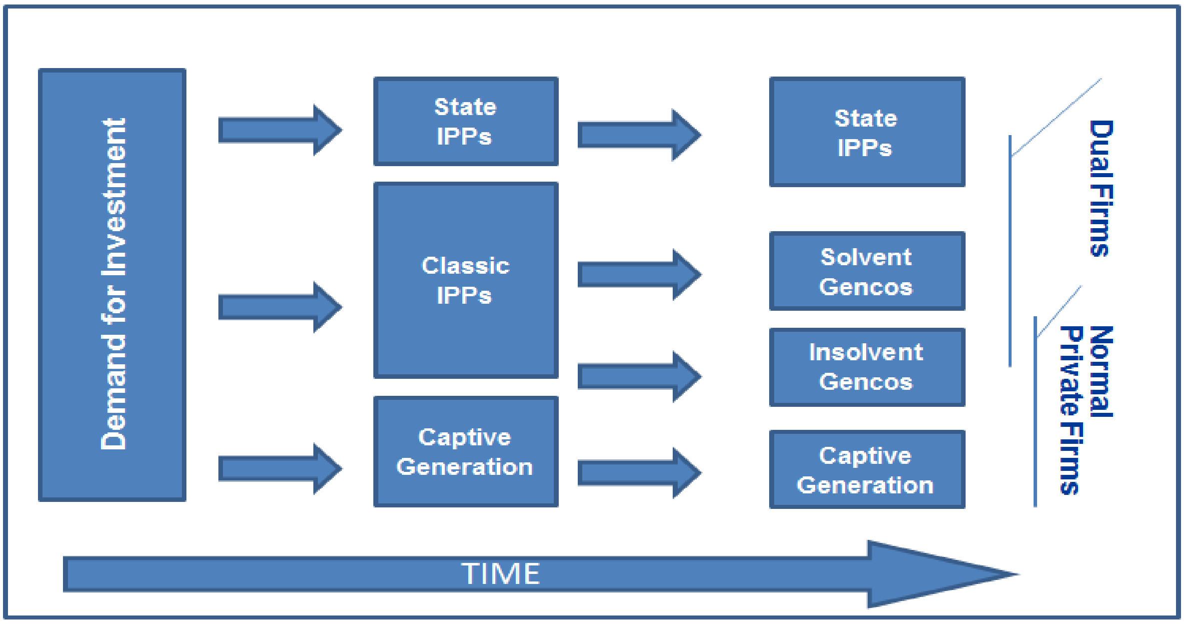
According to current IPP industry models, governments identify the need for a new plant, specify its characteristics and invite private-sector developers to compete for the right to finance, build and operate it. Once completed, the plant remains in private hands, but its output; the actual electricity and water produced are sold back to the government through a Power Purchase Agreement (PPA) at a predefined price (Sarraf, et al., 2010).

2.5.1 The IPP Model

The need for new power capacity along with a halting reform of the power sector has produced three types of enterprises that are often referred to as IPPs. Figure 2.5, summarises the situation schematically. At the top are state-dominated firms that masquerade as private firms and increasingly compete with their fully private brethren. These enterprises attract the name 'IPP' for various reasons, including the fact that some plants receive favourable tax or other treatment when they are viewed as IPPs (Woodhouse, 2005a).

Often these plants are managed by the 'dual firms' that emerged from a country's restructuring process and the desire to embrace something called an IPP is partly evidence of these firms' savvy in seizing the latest management concepts in the power sector. In the extreme, all five of the state-owned generation companies created in China's reform of the power sector are formally called 'IPPs' although each firm is actually state-owned and state-controlled (Woodhouse, 2005a).

Figure 2.5: Forms of private investment in the power sector.



Source: Woodhouse, 2005a: 44.

Thus, for any IPP business model to build a good foundation, emphasis needs to be given to key elements in the RE sector. The legal and policy framework of such business models play an integral part in an IPP business framework.

2.5.2 International legal and policy framework for IPPs

Government support has played a key role in encouraging IPP business in the RE sector with favourable policies and frameworks being implemented in many countries across the globe. However, it is still far from certain whether these will be sufficient to drive the scale of transition which will be required (Schellekens and Finlay, 2010). For the transition from a monopolised electricity system to an inclusive open market, the promotion of RE and higher energy efficiency is at the heart of the energy policies of industrial countries in the world (Saveyn, Ramírez and Wiesenthal, 2008).

The 1990s saw an explosion of energy policy changes around the globe. Driven by economic, environmental, security and social concerns, energy regulation has been in great flux. RE policy is having a profound influence on the RE sector, both from policies explicitly designed to promote RE and from other policies that indirectly influence incentives and barriers for RE (Beck and Martinot, 2004). Therefore, in developed countries, building a marketplace is underpinned by a series of government policies intended to encourage business and investment in RE. These incentives are long-term and developed to maximise the return on investments and encourage broad demand for RE (IEEE, 2004).

Current debates on the promotion of RE have focussed on the identification of policy instruments that are more effective in stimulating the production of RE. Given that private or internal costs of producing electricity are higher for RE than for fossil fuel energy, governments need to identify effective instruments to promote the production of RE. Thus, policy instruments currently in use in countries such as those in the European Union, are either investment focused, including rebates, tax incentives, competitive-bidding design, or are generation based, such as Feed-in-tariffs, rate-based incentives and tradable green certificates. Whatever instrument is chosen, it is clear that either consumers or the tax payer will have to pay for the extra cost of producing RE (Longo, Markandya and Petrucci, 2008).

In particular, Garcia (2009) states that prescribed policies revolve around eliminating economic barriers (barriers to investment related to insufficient revenue or excessive cost) by levelling the playing field of renewables vis-à-vis fossil fuels, as well as creating an enabling environment for IPPs to operate in. This is achieved through implementing support mechanisms that compensate for high costs, access to finance and creating sufficient demand for RE and new business operation viabilities (Garcia, 2009). Also, the prescribed institutions revolve around eliminating non-economic barriers (barriers to investment related with the institutional framework) by ensuring good governance on the part of the government and corporate competition. In other words, policies consist of regulations that intend to facilitate private investment via the perfection of market mechanisms and institutions. These institutions consist of liberal-market institutions which would also facilitate investment. The legal and policy framework forms the backbone of IPP connectivity to the grid (electricity network). If this framework were not in place, negotiations for IPPs cannot be established.

2.5.3 International IPP grid connectivity

Grid connection of IPPs poses a challenge to the RE sector. The livelihood of IPPs depends on an enabling environment for them to operate effectively. In most countries, the use of Feed-in-tariffs (FIT) facilitates this process by enabling the willing buyer, notably power utilities, to negotiate in good faith with the willing seller, the IPP (Garcia, 2009). Guidelines on how to promote the use of RE should also focus on the need to eliminate non-market or non-economic barriers. These non-economic barriers are identified as particularly damaging to the development of renewables, hence their elimination is seen as "a first priority to improve policy and market functioning" (IEA, 2008a: 25).

The need for enacting policies to support RE is often attributed to a variety of barriers or conditions that prevent investments from occurring. Often the result of barriers is to put RE at an economic, regulatory or institutional disadvantage relative to other forms of energy supply (Beck and Martinot, 2004). Non-economic barriers, at the risk of simplification, consist of features of the institutional framework that prevent greater investment in an increasingly cost-effective deployment of renewable technologies (Cory, Couture and Kreycik, 2009). The purpose of policy, therefore, should be to remove institutional barriers. The non-economic barriers identified by the literature exist in institutional features that impede the good functioning of markets and it is believed that as soon as suitable market-friendly institutions are in place, renewables will be deployed through increasingly cost-competitive investment (Garcia, 2009).

FITs are intended to increase the adoption of RE, encourage the development of the RE industry and provide significant economic development benefits. A well-designed Feed-in tariff can generate rapid growth for targeted RE technologies by creating conditions that attract capital to those particular sectors. By using a variety of design variables to incentivise production in different areas as well as projects of different sizes, FIT policies can help encourage a variety of RE technology types and different-sized RE projects (Cory, et al., 2009). FIT policies thus provide a base for IPPs and government to work from ensuring that these RE barriers are bridged and greater application to the sale of RE is applied.

2.5.4 Grid connected RE FIT system

FIT policies, defined before, encourage the development of new RE generation by offering open access to long-term purchase contracts for the sale of RE. The obligation to purchase electricity is established in law and enforced by the respective other regulatory bodies (IEA, 2008a).

FIT has proven to be the most effective policy instrument in overcoming barriers, such as competition from heavily-subsidised conventional energy, lack of consumer demand and political measures to facilitate access to the market. FITs turned several European countries into world leaders in the renewables sector. In particular, one of the benefits of a sound FIT can provide a long-term planning certainty for investors of RE installations. This is crucial to develop a healthy national RE sector and thus create real economic value in respective countries (Hamburg, 2009).

Cory, et al. (2009) state that FIT policies focus on estimates of the actual costs required in building renewable projects based on technology and other project-specific considerations. If designed well, the FIT can ensure that a variety of projects receive just enough to cover their costs and a reasonable return. At present, FIT schemes are considered to be most effective in stimulating the rapid deployment of RE and providing long-term financial stability for investors in RE (Wagner, 2010).

Defined by Cory, et al. (2009) as an energy-supply policy focused on supporting the development of new renewable power generation, FIT systems set two main methodologies for the overall return that RE developers receive through FIT policies. The first is to base the FIT payments on the levelised cost of RE generation and the second is to base the FIT payments on the value of that generation to the utility and society.

As with most policies, the FIT policy has some notable challenges. The first is the up-front administrative requirement. Detailed analysis is required to properly set the payment level at the outset. The payment level must ensure that revenues will be adequate to cover project costs. If the FIT payments are set too low, then little new RE development will result. If set too high, the FIT may provide unwarranted profits to developers. In order to achieve the right balance across a wide range of technologies and project sizes, many levels of differentiation are used. However, if the FIT policy is too complex with too many bonuses, exemptions and qualifications, it may hinder programme implementation. As costs change and markets shift due to technological innovation and increasing market maturity, the FIT policy needs periodic revision to reflect evolving costs and market conditions (Cory, et al., 2009).

The European experience proposes FITs as the most successful policy to promote RE generation. Emerging countries that have recently shown an increased interest in RE sources, however, they are experimenting with different schemes. While predetermined FITs are applied, they do not appear to play a dominant role (Becker and Fischer, 2012). In the following section, the researcher explores the Smart Grid model and how RE electricity and greater energy efficiency can be secured.

2.6 THE SMART GRID MODEL

Smart Grid involves the decentralisation of generation with the emergence of distributed generation and increased demand for micro grids (Hall and Soskice, 2001). Padmanaban (2010) defines a Smart Grid as an automated, widely distributed energy-delivery network characterised by a two-way flow of electricity and information, capable of monitoring and responding to changes in everything from power plants to customer preferences to individual appliances.

The National Institute of Standards and Technology (NIST) Smart Grid Conceptual Model provides a high-level framework for the Smart Grid that defines seven important domains namely, Bulk Generation, Transmission, Distribution, Customers, Operations, Markets and Service Providers (Advisory Group on Energy and Climate Change, 2010). It shows all the communications and electricity flows connecting each domain and how they are interrelated. Each individual domain in itself is consists of important Smart Grid elements that were connected to each other through two-way communications and electricity paths. These connections are the basis of the future, intelligent and dynamic power electricity grid (Advisory Group on Energy and Climate Change, 2010).

The Smart Grid Conceptual Model helps stakeholders to understand the building blocks of an end-to-end Smart Grid system, from generation to and from customers and explores the interrelation between these Smart Grid segments. At the Institute of Electrical and Electronics Engineers (IEEE), the Smart Grid is seen as a large system where each Smart Grid domain is expanded into three Smart Grid foundational layers namely: the Power and

Energy Layer, the Communication Layer and the IT/Computer Layer. The second and third layers are enabling infrastructure platforms of the Power and Energy Layer that makes the grid ‘smarter’ (IEEE Power and Energy, 2010).

Smart Grids include electricity networks (transmission and distribution systems) and interfaces with generation, storage and end users. According to the Smart Grid Information Report (2011), many countries have already begun to ‘smarten’ their electricity system and will require significant additional investment and planning to achieve a smarter grid. Smart Grids are an evolving set of technologies that could be deployed at different rates in a variety of settings around the world, depending on local commercial attractiveness, compatibility with existing technologies, regulatory developments and investment frameworks (Smart Grid Information Report, 2011). The different domains in the Smart Grid are described by Phan (2010) as follows:

- *The Bulk Generation domain* of the Smart Grid generates electricity from renewable and non-renewable energy sources in bulk quantities. These sources can also be classified as renewable, variable sources, such as solar and wind; renewable, non-variable, such as hydro, biomass, geothermal and pump storage; or non-renewable, non-variables, such as nuclear, coal and gas. Energy that is stored for later distribution may also be included in this domain (Phan, 2010);

  The Smart Grid Information Report (2011) states that Smart generation is capable of ‘learning’ the unique behaviour of power generation resources to optimise energy production and to automatically maintain voltage, frequency and power factor standards based on feedback from multiple points in the grid;

- *The Distribution domain* distributes the electricity to and from the end customers in the Smart Grid. The distribution network connects the smart meters and all intelligent field devices, managing and controlling them through a two-way wireless or wire-line communications network. It may also connect to energy storage facilities and alternative distributed energy resources at the distribution level (Phan, 2010);

  Smart distribution emphasises the ability of the network to self-heal, self-balance and self-optimise. It includes the ability of super-conducting for long-distance transmission lines as well as the ability of automated monitoring and analysis tools to detect or even predict cable failures or failures based on real-time data about weather and outage history (Smart Grid Information Report, 2011);

- *The Customer domain* of the Smart Grid is where the end users of electricity previously indicated are connected to the electric distribution network. Meters control and manage the flow of electricity to and from the customers and provide energy information about energy usage and patterns. Each customer has a discrete domain comprising an electricity premise and two-way communications networks. A customer domain may also generate, store and manage the use of energy as well as the connectivity with plug-in vehicles (Phan, 2010);

  The Smart Grid Information Report (2011) confirms that the customer-side systems, which are used to help manage electricity consumption at the industrial, service and residential levels, include energy management systems, energy storage devices, smart appliances and distributed generation. Energy efficiency gains and peak-demand reduction can be accelerated with in-home displays or energy dashboards, smart appliances and local storage;

- *The Operations domain* as described by Phan (2010), manages and controls the electricity flow of all other domains in the Smart Grid. It uses a two-way communications network to connect to substations, customer premises networks and other intelligent field devices. It provides monitoring, reporting, controlling and supervision status and important process information and decisions. Business intelligence processes gather data from the customer and network and provide intelligence to support the decision making;

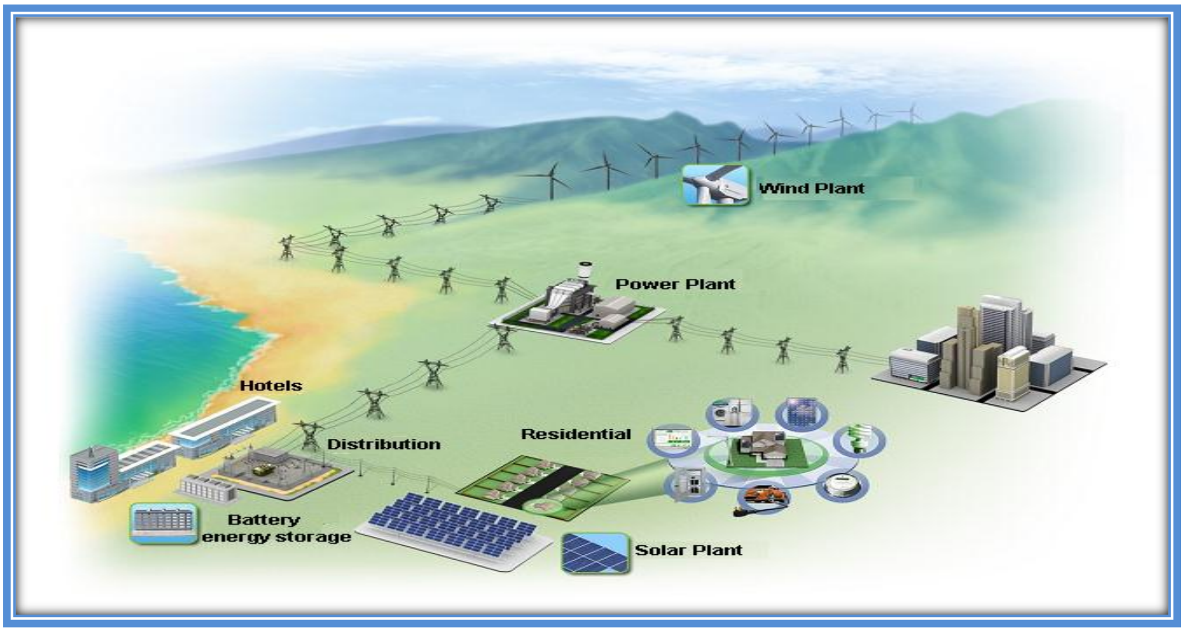
- *The Markets domain* operates and coordinates all the participants in electricity markets within the Smart Grid. It provides the market management, wholesaling, retailing and trading of energy services. The Markets' domain interfaces with all other domains and makes sure they are coordinated in a competitive market environment. It also handles energy information clearinghouse operations and information exchange with third-party service providers. Roaming billing information for example and inter-utility plug-in-vehicles fall under this domain (Phan, 2010); and

- *The Service Provider domain* of the Smart Grid handles all third-party operations (also known as IPPs) among the domains. These might include web portals that provide energy efficiency management services to end customers, data exchange between the customer and the utilities regarding energy management and regarding the electricity supplied to homes and buildings. It may also manage other processes for the utilities, such as demand response programmes, outage management and field services (Phan, 2010).

The advances in the field of Smart Grids have created a system need that gathers, distributes and acts on information about the behaviour of all participants, suppliers and consumers. Today, China and Tunisia have become leaders in energy technologies and systems (Advisory Group on Energy and Climate Change, 2010). China secured electricity access for almost 700 million people over the second half of the twentieth century to achieve electrification for over 98% of the population by 2000. Key factors in China's success were the government's ability to mobilise contributions at the local level and the domestic production of low-cost components. In Tunisia, the national government and the national utility are committed to making a steady long-term rural electrification effort as a national priority for over 30 years. The plan focused on creating local enterprises getting involved in the electrification effort (Advisory Group on Energy and Climate Change, 2010).

Figure 2.6 depicts a Smart Grid, including RE and conventional generation, in one grid. Smart Grid applications can be easily implemented to augment the existing utility capabilities. The model also provides the flexibility needed to add new capabilities as the requirements arise (IEEE Power and Energy, 2010).

Figure 2.6: Smart Grid.



Source: Ton, 2010: 24.

Goyal (2010) states that much of the Smart Grid is focused on other results, e.g.:

- Reducing carbon emissions;
- Improving the efficiency of the networks;
- Promoting RE electricity and energy efficiency; and
- Enhancing security of supply.

The Smart Grid Information Report (2011) further states that the benefits of a Smart Grid will add value towards a more intelligent network but the actual implementation and transition could pose serious difficulties in countries. Challenges include:

- Cost of deployment;
- Inadequate resources;
- Ageing infrastructure;
- Multiple stakeholders include Eskom, vendors, municipalities, IPP and consumers could feed energy back into the grid;
- Transition from legacy systems. Old legacy systems cannot always be retrofitted with new technologies and may need an entire technology solution;
- Compatible equipment. Some older equipment must be replaced as it cannot be retrofitted to be compatible with Smart Grid technologies. This may present a

problem since keeping equipment beyond its depreciated life minimises the capital cost to consumers. Early retirement of equipment may become an issue; and

- Security of the system.

Thus, customer uptake, including the promotion of RE and the reduction of carbon emissions, will be critical to achieving the benefits of Smart Grids as power utilities seek to diversify electricity generation. By using this model, new Smart Grid applications can be easily implemented to augment the existing utility capabilities. The model also provides the flexibility needed to add new capabilities as the requirements arise. In addition, the model creates the ability to dynamically manage all sources of power on the grid means so that more distributed generation can be integrated with the grid. While not all distributed generation is clean or efficient, the possibility for distributed solar and wind power is important. This would benefit utilities in managing distributed generation as well as firms that would benefit from improved reliability (Zheng, 2007).

Petri (2008) indicates that in the quest for striving towards cleaner and more reliable networks, power Grid models are used by a variety of stakeholders for planning, operational support, resiliency assessments, power market analysis and critical asset assessment. It is noteworthy that Grid models and their results, drive changes in policy, heighten awareness and provide operational insight in most countries. The following sections will analyse international Grid models in countries.

2.7 INTERNATIONAL GRID MODELS IN COUNTRIES

The electric power grid system is the heart of all critical infrastructures in any country. The rapid demand for electricity has traditionally been met by the theoretical grid extension model. As the years have passed however, with the lower consumer density in rural areas being served, the cost of bringing power to each new consumer has significantly increased. Not surprisingly, these new consumers have less disposable income and purchase less electricity. In view of increasing construction costs per consumer, low revenues and the logistical difficulties, and associated costs encountered in managing rural systems, electric utilities around the world have found it increasingly difficult to meet demand for electricity in rural areas (Inversin, 2000).

Larsen and Russo (2010) posit that to support the additional capacity, additional demand and to ensure recovery of costs, a well-functioning large-scale grid extension model is needed. In many cases, refurbishment of the existing infrastructure (generation and grids), improvement of the performance of the utilities through local capability building and implementing best practices for operational improvements (e.g. loss reduction programmes) are required.

There is no doubt that there are economic, social and environmental benefits to reap from any power grid interconnection, extension of existing grids, Mini-Grid systems and Off-Grid projects. Such projects will have such intangible benefits as strengthening electricity security and establishing regional ties with neighbouring countries (Yun and Zhang, 2005).

The general consensus amongst countries is that existing electricity grids are not sufficient in terms of capacity, efficiency, reliability, security and environmental impact to supply the electrical power needs of modern societies. Further, because of growing environmental concerns, grids need to become far more flexible; accommodating distributed power generation from RE sources and using several energy-efficiency techniques.

2.7.1 Top RE generating countries

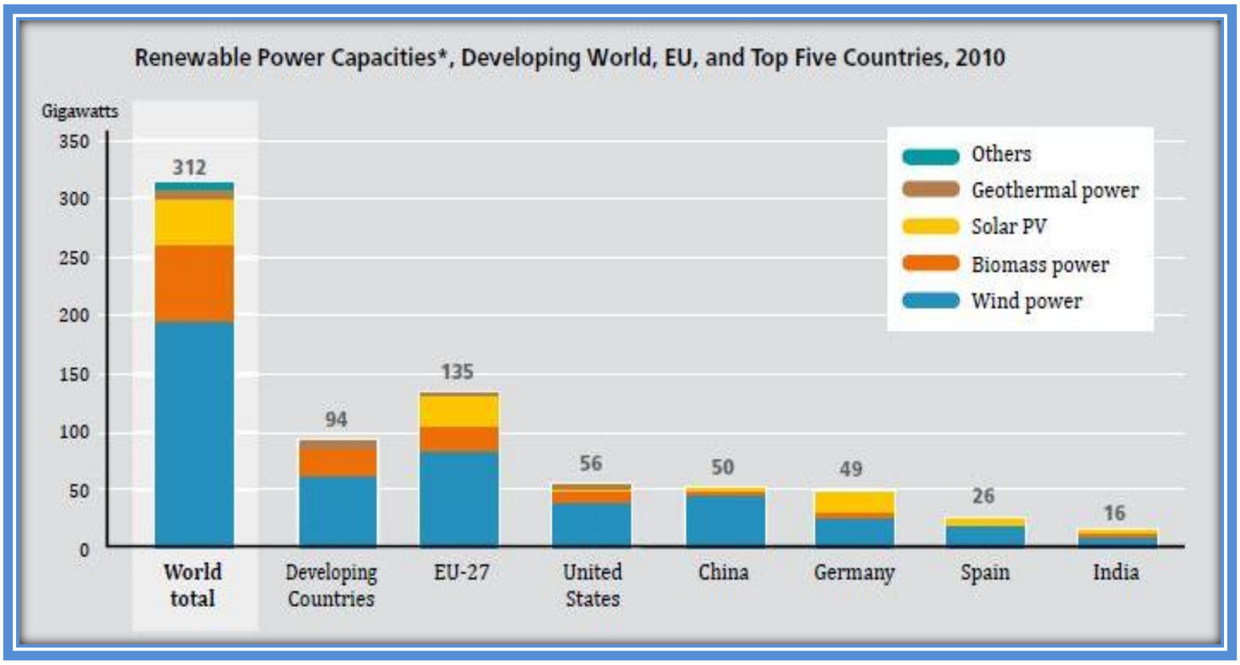
RE represents a rapidly growing share of energy supply in a number of countries and regions. In the European Union, RE accounted for more than 71% of total electricity capacity additions in 2011, bringing RE’s share of total electricity capacity to 31.1%. Solar Photovoltaic (PV) alone represented almost 47% of new capacity that came into operation. The renewable share of consumption is rising in parallel (although not as rapidly since much of the capacity are variables solar and wind). In 2010 (latest available data), the renewable share of total electricity consumption was 19.8% (up from 18.2% in 2009) and renewables represented 12.4% of gross final energy consumption (compared to 11.5% in 2009). Germany continues to lead in Europe being at the forefront globally by remaining among the top users of many renewable technologies for power, heating and transport. In 2011, renewables provided 12.2% of Germany’s final energy consumption, 20% of electricity consumption (up from 11.6% in 2006), 10.4% of heating demand (up from 6.2%) and 5.6% of transport fuel (REN 21, 2012).

In the United States of America, RE made up an estimated 39% of national electricity capacity additions in 2011. The share of U.S. net electricity generation from non-hydro-power renewables has increased from 3.7% in 2009 to 4.7% in 2011. Nine states generated more than 10% of their electricity with non-hydro renewables in 2011, up from two states a decade ago. All renewables accounted for about 11.8% of U.S. primary energy production in 2011, up from 10.9% in 2010. China ended 2011 with more renewable power capacity than any other nation, with an estimated 282 GW; one-quarter of this total (70 GW) was non-hydro. Of the 90 GW of electric capacity newly installed during the year, renewables accounted for more than one-third and non-hydro renewables were more than one-fifth (Renewable Energy Policy Network, 2012). It seems that RE is increasing globally through increased focus by governments globally.

China has been working steadily towards rural electrification for decades, with a number of government initiatives. In 2008, however, there were still an estimated two million households, or nine to ten million people, primarily in villages and farming areas in Western China, lacking electricity, according to the National Energy Administration. Chinese Western provinces are characterised by dispersed rural settlements. Remaining villages without electricity are far from load centres and from existing electricity generation and transmission infrastructure (UNIDO, 2008a).

Figure 2.7 provides a comparison of RE power capacities globally. Among all renewables, global wind power capacity increased the most in 2010. The top five countries for non-hydro renewable power capacity were the United States, China, Germany, Spain and India (REN 21, 2012).

Figure 2.7: Renewable Power Capacities.



Source: REN 21, 2012: 24.

Although China is a leader in RE technologies, particularly PV and small hydro systems, most of the enterprises involved in those industries are based in the developed, eastern part of the country. System integrators who designed a particular Mini-Grid system are only responsible for three years of operating and maintenance. Beyond the length of that initial contract, local technicians capable of operating and maintaining the Mini-Grids to maximise efficiency would be required in future.

Due to the successful stimulation of solar PV installations in such markets as Germany, Spain and the U.S., Chinese solar PV production almost exclusively focused on exports. By making use of cost advantages, process innovations and economies of scale, the country became, within less than ten years, the world's major supplier of solar PV panels (Rigter and Vidican, 2010). In 2010, Chinese manufacturers managed to serve more than 50% of the global market (EPIA, 2011). Before 2011, China had only very modest support schemes for solar PV deployment in place, as scepticism prevailed whether comparatively expensive solar energy should be supported for on-grid electricity generation.

Figure 2.8: Top 5 RE countries.

TOP FIVE COUNTRIES – Existing capacity as of end-2010

	Renewables power capacity (not including hydro)	Renewables power capacity (including hydro)	Wind power	Biomass power	Geothermal power	Solar PV	Solar hot water/heat[2]
1	United States	China	China	United States	United States	Germany	China
2	China	United States	United States	Brazil	Philippines	Spain	Turkey
3	Germany	Canada	Germany	Germany	Indonesia	Japan	Germany
4	Spain	Brazil	Spain	China	Mexico	Italy	Japan
5	India	Germany/ India	India	Sweden	Italy	United States	Greece

Source: REN 21, 2012: 67.

Figure 2.8 illustrates the Chinese dominance and progress pertaining to current RE generation currently. Environmental concerns pose very different risks and benefits for China and for the rest of the world. For the Chinese, the heavy, coal-use scenario would have the merit of greater energy autonomy, given China's very extensive coal resources. In the worst case, the heavy environmental toll inflicted by today's vast coal mining, shipping and burning operations, already by far the world's largest, would grow much worse if China's use of coal doubled or even tripled over the next 25 years (Lester and Steinfeld, 2007). Further, because of these growing environmental concerns, Asian grids need to become far more flexible than they are today, accommodating distributed power generation from renewable sources and using several energy-efficiency techniques.

Within Asia, the demand for Smart Grid capability is quite diverse in nature ranging from reflecting the sophisticated nature of electricity demand in developed nations such as Japan and South Korea, to the need for first deployment of grids and grid upgrades in the developing economies of India and China (Becker and Fischer, 2012). Yet, there is also general consensus that existing electricity grids in Asia are not sufficient in terms of capacity, efficiency, reliability, security and environmental impact to supply the electrical power needs of modern societies (Smart Grid Analysis, 2009). Emerging countries show strong interest in greening the electricity sector as risks from fossil-fuel dependence and climate change are therefore much more substantial for these countries (Becker and Fischer, 2012).

2.7.2 Models in emerging countries

Increasingly, emerging countries are adopting policies to promote the deployment of RE. Encouraging an early transition to RE is decisive to exploit the mitigation potential and to contain climate and resource risks. For this purpose, large numbers of RE installations are needed. However, as electricity is central to development, additional costs from a transition to renewables are a socially and politically sensitive issue which underscores the need for smart policies that encourage installations at reasonable prices (Becker and Fischer, 2012).

India and South Africa have recognised the importance of RE for their future development. Greening the electricity sectors of emerging economies is particularly important and challenging. First, economic growth is strongly correlated with electricity demand (Yoo and Lee, 2010), which leads to the danger of greater fossil-fuel dependence, but also the chance to initiate the deployment of RE (WBGU, 2011). Second, emerging countries have limited capacities to respond to major external shocks (Naudé and Santos-Paulino, 2009). Hence, encouraging an early transition to electricity from renewable energy sources is decisive to exploit their mitigation potential and to contain climate and resource risks. For this purpose, large numbers of RE installations are needed.

The transition to RE and the expansion of India's strongly subsidised, coal-based electricity sector has provided the country with affordable electric power, thereby facilitating the country's social and economic development. Within a decade, installed capacity increased from 109 GW to over 176 GW in 2009 (EIA, 2011a, 2011b). Hydro and wind energy have already come to play a more important role in the country's electricity portfolio. Solar PV provided a mere 119 MW in 2011, accommodated in an Off-Grid model (MNRE, 2011). Fossil-fuel based technologies continue to constitute the lion's share – about 67% – of the electricity system's capacity (IEA 2011b). India has focused largely on grid extension, however one goal of the Jawaharlal Nehru National Solar Mission is to reach 2 GW of Off-Grid solar by 2022, including 20 million solar lighting systems for rural areas.

This is followed by four policy recommendations to ensure that UN rural energy projects are effective in complementing efforts and attending to the basic energy needs of the most poor in rural India. These recommendations are: to provide micro-credit and consulting for the promotion of Off-Grid RE; to include capacity building in energy projects by creating partnerships with the community and by providing technical assistance and to financial support to local entrepreneurs who could either benefit from energy access or supply their communities with energy services (Lacayo, 2006).

In further efforts to expand rural electricity from the central grid, independent providers have played an important role in making electricity accessible in rural India. These providers, known as IPPs or Rural Electric Cooperatives (RECs), are inefficient because the government has imposed strict regulations on them. Two of these regulations are low tariffs and forced supply of free electricity for street lighting and irrigation pumping (Rizvi, 2004). Furthermore, licenses for new providers are complicated and difficult to obtain (Rizvi, 2004). These issues must be considered because even if UN projects for energy in rural India have the right approach, technologies and finance mechanisms, government impediments can drastically limit their ability to effect change. There is a similar situation in South Africa where reserves dropped to below 10% in recent years. Government recognises the potential of RE to support the country’s socio-economic development and initiate environmentally sustainable growth (Becker and Fischer, 2012).

South Africa’s economy has benefited greatly from the exploitation of its rich domestic coal reserves upon which it based its electricity production (IEA, 2011). South Africa has identified RE as a key element to satisfy its future energy needs. This strategy crystallised in the country’s second Integrated Resource Plan, which was published in 2010 and provided a roadmap for the next 20 years (Department of Energy, 2011). According to the plan, South Africa seeks to double its installed on-grid capacity by adding 45 GW of new installations, of which almost 20% (8.4 GW) is expected to come from solar PV plants. Coal-based energy production is expected to contribute no more than 6.2 GW to the added capacity (DME, 2001).

Therefore with electricity as a key facilitator of development, all three countries face the challenge of an ever-increasing electricity demand and the need to overcome an unsustainable reliance on fossil fuels. This is intensified by the central role affordable electricity plays in economic and social development - but the goal of universal access to electricity, remains, in particular, a substantial challenge in South Africa. RE can be cost-competitive in many Mini-Grid situations. Although fossil fuels remain the lowest cost option for feeding power into the grid, renewables are often cost-competitive in Mini-Grid situations (Kabaka and Gwang'ombe, 2007).

2.7.3 Models in other countries

In Brazil, Off-Grid solutions are the only practical way to bring power to remote areas in the Amazon. However, by the end of 2006 Brazil had installed only 3 100 solar home systems under the Luz para Todos ('light for all') programme, even though it had been estimated that this would be the most practical way to supply power to 17 500 locations, which would represent a total of 130 000 systems (Ton, 2010).

The Brazilian electrification model is primarily based on extending the grid (Reiche, Tenenbaum and Torres, 2006; Zerriffi, 2007; Andrade, 2009). At least, during the first years, grid extensions were often the least costly option for the Brazilian utility (Zerriffi, 2007). Heavy reliance, however, on grid extension to attain universal rural access proved to not be economical. Providing electricity to the marginally more remote and dispersed consumers, away from the existing distribution lines, became increasingly difficult and thus mini grids became more feasible (IEA, 2009).

Indonesia was an early pioneer in the wide use of Off-Grid PV systems, which is not surprising given the nation's geographical problems with grid extension. Between 1988 and 1993, 1 600 Off-Grid PV systems were installed in West Java as pilot projects and between 1992 and 1997 the government distributed 30 000 Off-Grid PV systems. In 1997, the government launched a 50 MWp One Million Roof programme, with assistance from international companies and institutions. However the number of installations distributed, as of the latest studies, was still small in comparison to the total potential market, which is calculated at 900 MW (Ton, 2010).

Figure 2.9 shows how a sample of thirteen countries has scored on the two dimensions used to measure grid performance, the experience of investors and that of hosts. The richness of each country experience will emerge, but for now, four general observations will be made about the variation in outcomes.

Figure 2.9: IPP statuses in developing countries.

	Country Outcome POSITIVE	Country Outcome NEGATIVE
Investor Outcome	Thailand Egypt Mexico Brazil (Hydro IPPs) Argentina (Pre Crisis)) Turkey Philippines	Malaysia Turkeu (BOTs)
Investor Outcome	India (Gujarat) China Kenya India (Maharashtra)	Poland Argentina (post crisis) Brazil (Thermal IPPs) India (Tamil Nadu)

Source: Woodhouse, 2005b: 34.

Figure 2.9 further indicates the status of IPPs in developing countries. First, there is a large group of countries that, in general, populate the upper left corner. These countries have successfully attracted investment and have built largely stable relationships between government and investors. This group notably includes Mexico, Thailand and Egypt. In each of these countries, most of the IPP projects that led to completed contractual agreements (PPAs) have actually become commercial operations and the original contracts have largely held (Woodhouse, 2005b).

Kenya and Bangladesh have also had success with Off-Grid PV. More than 5% of households in Kenya use PV for a portion of their power and in Bangladesh a micro-credit bank has set up more than 700 technical centres which sell, install and maintain PV systems (SolarServer, 2013). Pegels and Stamm (2010) posit that it has become increasingly clear that a limited number of countries, notably the large anchor countries such as China, India and South Africa, whose infrastructure heavily relies on coal as main source of energy generation are responsible for the increase in contributions to the greenhouse effect in developing countries. Suitable FIT models, especially in the case of South Africa, need to be explored in the effort to meet the supply challenge. Accordingly, the next section presents a South African grid model.

2.8 THE SOUTH AFRICAN GRID MODEL

In South Africa, electricity generation is dominated by the state-owned power company Eskom, which in 2010 produced 96.7% of power used in the country. Eskom's total installed electricity capacity for the year 2010 was 44 175 MW. According to the South African Energy Department, South Africa needs over 40 000 MW of new generation capacity by 2025.

To generate most of its electricity, South Africa uses coal, its major indigenous energy resource and a significant proportion of its liquid fuels. As a result, South Africa is the 14th highest emitter of greenhouse gasses. Energy contributes about 15% of South Africa's gross domestic product (GDP). Eskom is one of the world's ten biggest electricity generators and is in the top eleven in terms of sales. It generates around 94% of the electricity used in South Africa, as well as exporting power to other African countries. In addition to the functioning generation capacity, a number of previously-mothballed generating facilities are being re-commissioned, including a further 3 800 MW of coal-fired capacity (Renewable Energy and Energy Efficiency Partnership, 2013).

Pegels (2010) states that South Africa is well endowed with RE resources, especially solar energy. Tapping into this resource would help meet both the emissions and the energy supply challenges. In addition, the deployment of RE can lead to considerable job creation – even if South Africa will most likely not be able to repeat the first-mover countries' growth in 'green' jobs.

The relaxing of the monopoly of the state's power utility, Eskom, to allow outside players has been widely welcomed in both public and private sectors. This is a concerted effort not only to diversify electricity generation, but to lower carbon emissions and to alleviate the increasing electricity strain currently encountered. Eskom will buy the output generated by the IPPs and is not allowed to take part in the bidding process. Power Purchase

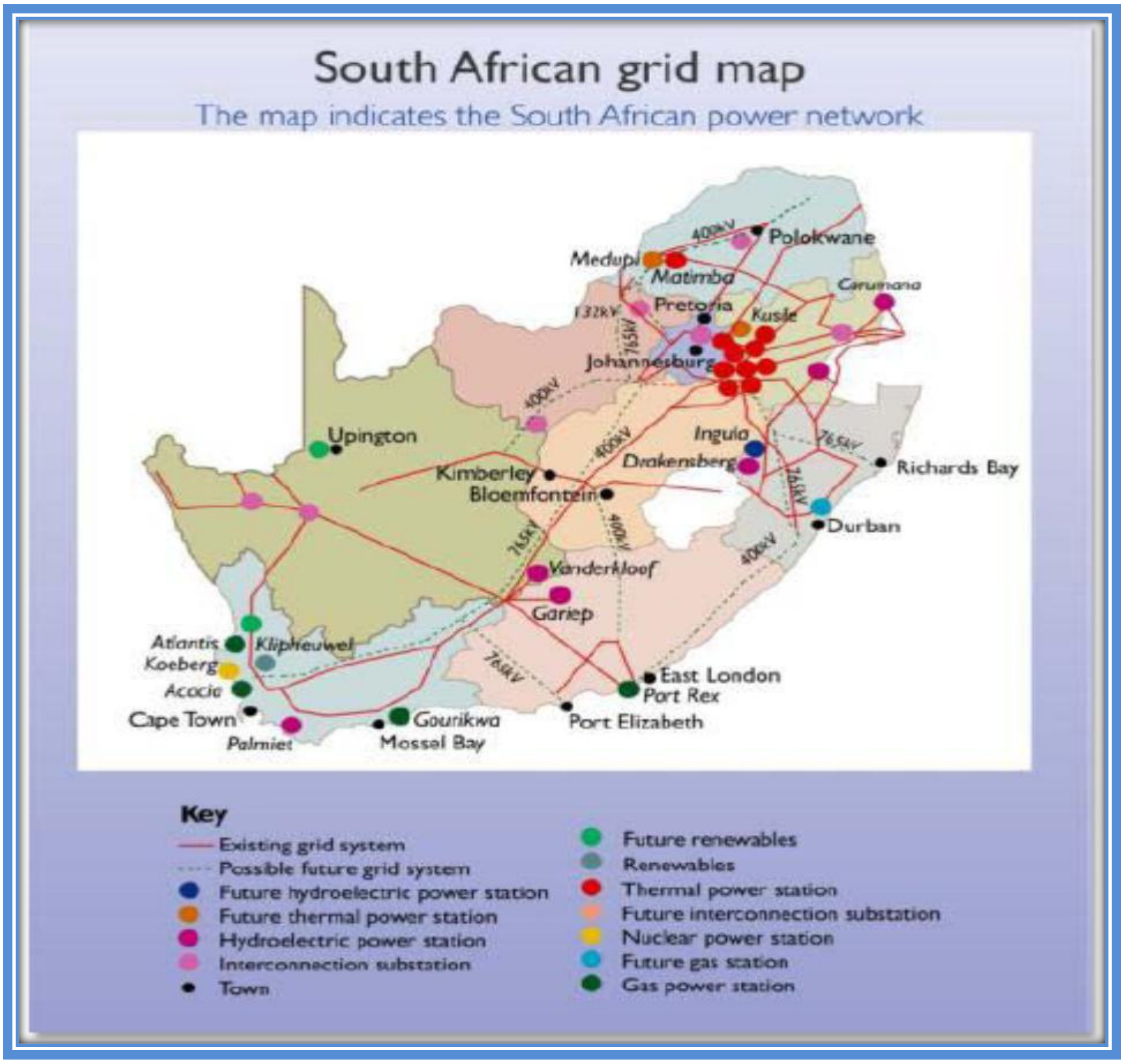
Agreements form an integral part of the IPP agreements. This arrangement was intended to bring new players into the market (Dinica, 2006).

Eskom is committed to facilitating the entry of IPPs and acknowledges the role that IPPs should play in the South African electricity market. Eskom continues to pursue IPP opportunities and made the following signed PPA agreements for 376 MW with IPPs, including Sasol, Sappi, Ipsa and Tangent. Short-term agreements for 515 MW with municipal generators with the aim of extending these agreements are in place (Nakedi, 2012).

The South African Government's IPP Procurement Program is the centrepiece of its drive to stimulate RE and maintain environmentally sustainable electricity generation in terms of economic development and employment growth outlined in its National Integrated Resource Plan (Nakedi, 2012). The country envisages using the IPP programme to address another chronic domestic issue besides the high and rising cost of fossil fuel energy, namely job creation. As an initial step to address this crisis, the SA government increased the percentage of local content required to develop RE projects following the second round of IPP program bidding (Nakedi, 2012). In any electricity generation system, grid connectivity is a precursor to electricity supply.

To gain insight into how grid connectivity functions, Figure 2.10 depicts the South African grid model and shows the flow of electricity from generation to consumer. Figure 2.10 depicts the South African grid map ranging from coal to RE networks.

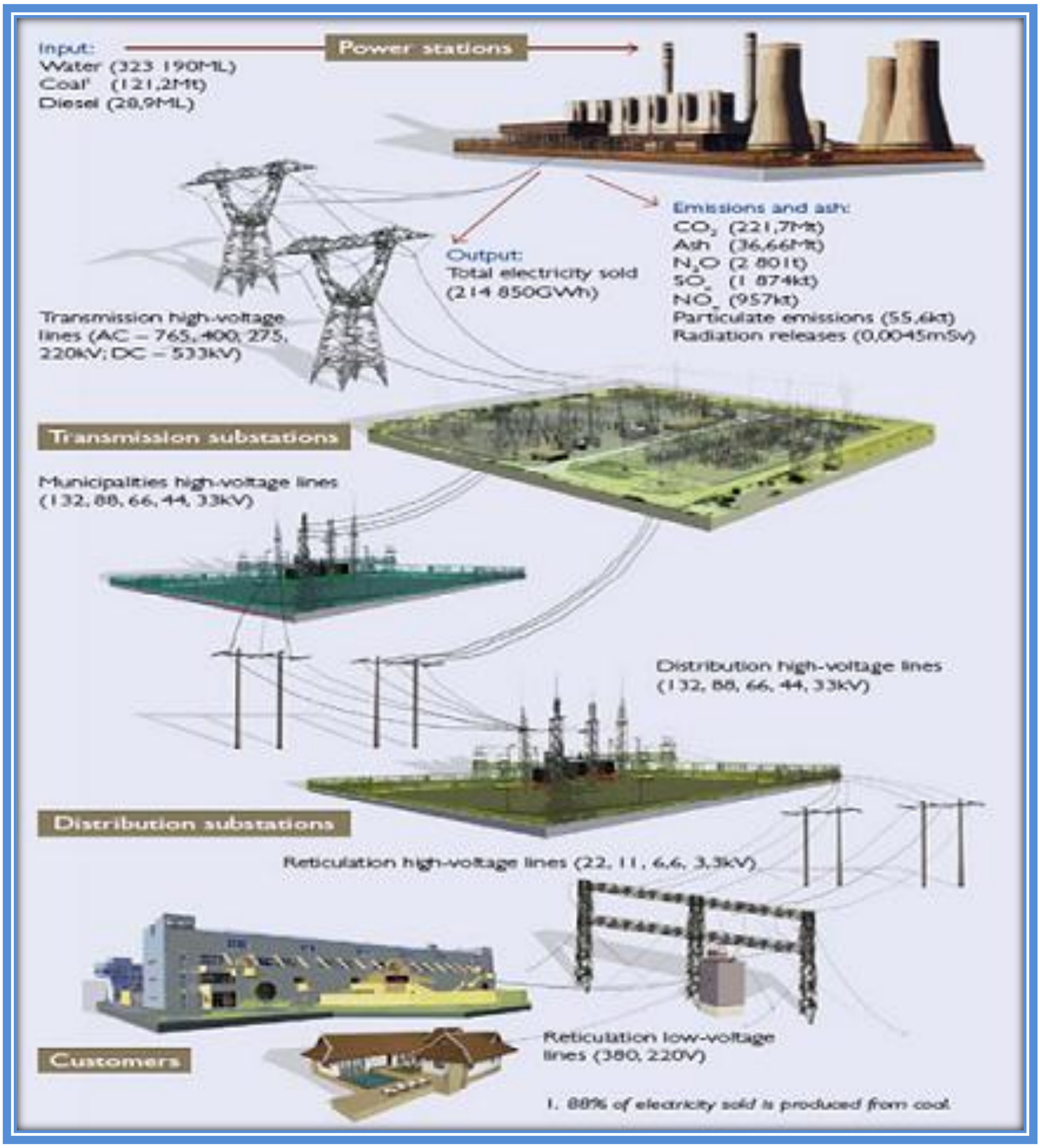
Figure 2.10: The South African Grid map.



Source: Eskom, 2011a: 1.

Eskom operates South Africa's only nuclear power station, Koeberg (1 800 MW), two gas turbine generators (340 MW), six conventional hydro-electric plants (600 MW) and two hydro-electric pumped-storage stations (1 400 MW). Electricity production, mainly from thermal generation, was estimated at 258 TWh in 2008. RE production in South Africa is estimated at approximately 1% of the total electricity generation. In contrast, coal production stands at 94%, necessitating coal reserves of 48 000 million tonnes. South Africa is amongst the top coal producers and exports approximately 28% of all coal mined (Eskom, 2011).

Figure 2.11: The South African Grid Model.



Source: Eskom, 2011a: 2.

2.8.1 SA Government and other institutional interventions

Eskom has initiated a number of IPP procurement processes since 2006, most of which have been abandoned (Wagner, 2010). The utility has also entered into negotiations with a number of cross-border IPP developers. Three years in the making, none of these unsolicited proposals have been finalised and in the course of 2009 Eskom also announced that all such initiatives had been put on hold, pending the resolution of its funding model and the implementation of government's policy on new generation capacity (Pickering, 2010). Thus, creating an enabling environment for IPPs to operate and alleviate the ever-increasing demand for electricity and lower carbon emissions remains a priority as the need for diversification becomes progressively imperative.

Addressing the increased electricity demand and carbon emissions, the president of South Africa Jacob Zuma stated: *"We will establish an independent system operator, separate from Eskom Holdings. Eskom will continue to build additional generation capacity and improve the maintenance of its power stations" (*Zuma, 2010).

2.8.2 National IPP Plan of Action

Eskom has pledged full commitment to facilitating the entry of IPPs and acknowledges the role that IPPs must play in the South African electricity industry (Nakedi, 2012). The South African Government has repeatedly made positive policy statements about its intent to open the power system to IPPs, starting with the Energy White Paper of 1998 (DME, 1998).

As per Section 34 of the Ministerial Determination, *Eskom has been designated the buyer of the electricity produced under the renewable energy procurement programme. Eskom also provides the grid connection where Eskom is the owner of the network. In these roles, Eskom has actively participated and supported the Department of Energy in their procurement process* (Nakedi, 2012).

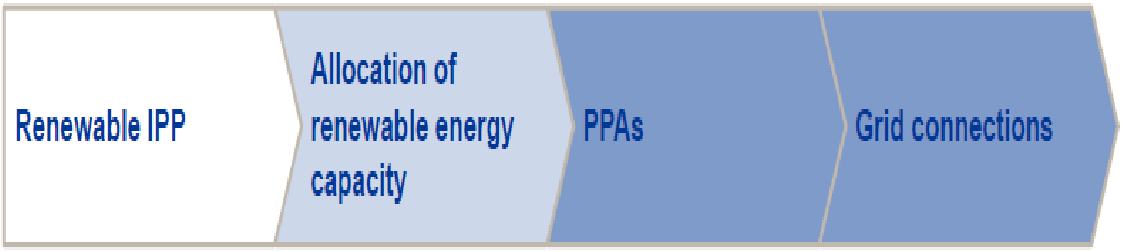
The Eskom process, related to grid access, has key action areas:

- Enabling and facilitating generators and IPP grid access and making commercial options more viable, requires service relationship, stakeholder and interface management and communication;
- Management and integration of the development of relevant and appropriate standards, processes and frameworks;
- Possibility of various connection, grid access and commercial options, IPP pricing frameworks (costing of connection, network strengthening and costs to feed into the network);
- Technical capability for integration of the IPP generators;

- Process and system capability and facilitation thereof, to enable grid access
- Quotation and contracting capability and management; and
- Sufficient data and information, to effectively facilitate, enable, plan and support.

Eskom remains an important contributor to the development of South Africa and more importantly to the electricity sector. Obtaining a better electricity mix through an IPP grid access initiative proves a priority whilst ensuring integration and high standards are maintained. Figure 2.12 represents the IPP process followed in South Africa to date. Figure 2.12 depicts the steps followed for grid connection of an IPP.

Figure 2.12: IPP process in South Africa.



Source: Haffajee, 2011: 22.

The South African Government plays a vital role in the IPP process and the process in underpinned by the Integrated Resources Plan (IRP). An Integrated Resources plan was established by the Department of Energy with the objective of developing a sustainable electricity investment strategy for generation capacity and transmission infrastructure for South Africa over the next 25 years. The investment strategy includes implications arising from demand-side management and pricing and capacity provided by all generators (Eskom and IPPs) (NERSA, 2012).

The IRP is intended to:

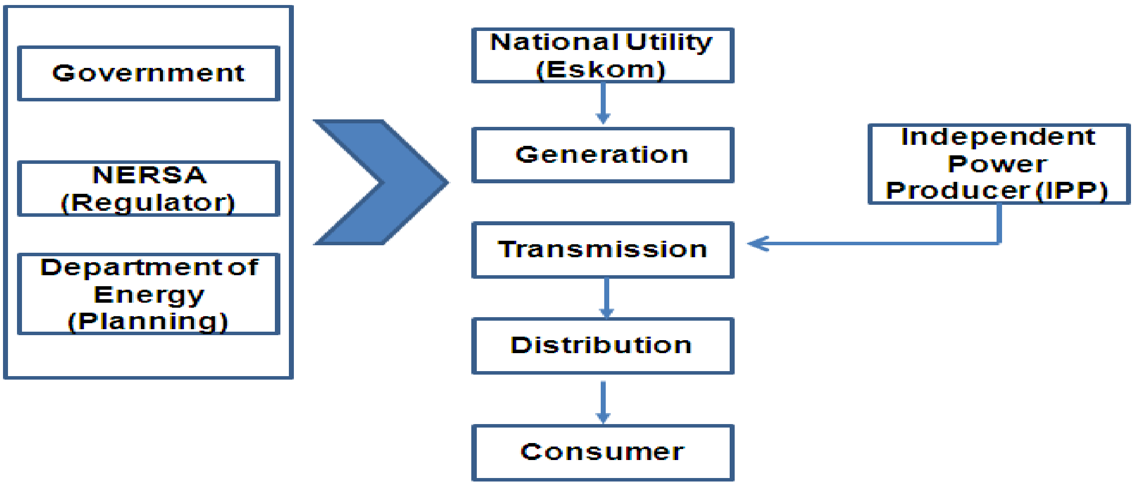
- Improve the long-term reliability of electricity supply through meeting adequacy criteria over and above keeping pace with economic growth and development;
- Ascertain South Africa's capacity investment needs for the medium-term business planning environment;
- Consider environmental and other externality impacts and the effect of RE; and

- Provide the framework for ministerial determination of new generation capacity (inclusive of the required feasibility studies) as envisaged in the new generation capacity regulations.

The growth of distributed generation has a bearing on the development and operations of the network (predominantly the distribution network), especially if some, if not most, of the distributed generation is variable technology. The development opportunity of Smart Grids and storage solutions, which can help to integrate variable renewable technologies, should also be considered, alongside the system's balancing capability (and ancillary services). There could be an initial focus on smart metering and the ability to manage demand. Off-Grid activities should be considered especially as there is an impact on potential future demand through 'suppressed demand' which has occurred as a result of lack of grid access for a number of potential consumers (Department of Energy, 2011).

Figure 2.13 illustrates a typical IPP connection to power utility Eskom. Currently grid connection remains the only form of third party power generation in South Africa receiving high priority attention. It is clear that research needs to be undertaken regarding Off-Grid initiatives (Alliance for Rural Electrification, 2011).

Figure 2.13: Typical South African IPP Grid-connected Model.



Source: Own construction, 2014.

2.9 SUMMARY

Numerous international and national Grid models are in operation that stimulates IPP involvement in an effort to address the challenge of high carbon emissions and the spiralling electricity demand through the use of RE technologies. Pegels (2010b) posits that the carbon intensity in countries such as South Africa is among the highest in the world. The amount of CO_2 emitted per million international dollars generated reaches almost twice the world average. Providing reliable power generation and supply has always been an essential requirement in the design and maintenance of the power generation and distribution system. In its simplest form, the power grid consists of generators, transmission lines and corresponding loads. With increasing stress on the power grid due to increased load and power transfers caused by deregulation, more intelligent and distributed control is required to continue providing reliable power delivery (Faza, Sedigh and McMillin, 2007).

In many developing countries, the public's general awareness of environmental issues is rather low. This is especially true of the poorer sections of the population, where understandably, the issues of daily life are of greater concern than the impacts of climate change expected to occur in several decades to come. However, renewable energies may also provide solutions to the problems arising in the daily lives of the poor (Pegels, 2010b). The South African Government has not advanced much after efforts in the late 90s and such efforts thus need to be re-addressed. Currently, there is limited co-operation and co-ordination of RE initiatives. To this end, national institutions and government have acknowledged this and consequently have taken measures to support private investment in RE and other clean technologies (Pegels, 2009).

The problems experienced internationally and nationally are similar. The research question addressed in this chapter is: *RQ_1 - What type of Grid models exist in the RE sector?* RE and the need to diversify electricity generation remain a worldwide challenge. The South African power utility Eskom, is experiencing increasing electricity demand and together with government, needs to ensure IPPs have an enabling environment within the RE sector in order effectively to diversify the energy mix and alleviate strain on the national grid.

The research objective addressed in this chapter is:
RO_1 - To identify the type of Grid models which exist in RE

This chapter discussed the different power grid models and they are listed below:

- Mini-Grid access model;
- Grid extension model;
- Theoretical Grid model;
- Off-Grid access model; and
- The Smart Grid model.

The deliverable to this chapter was the Smart Grid model. This model is an automated, widely distributed energy delivery network characterised by a two-way flow of electricity and information, capable of monitoring and responding to changes in everything from power plants to customer preferences to individual appliances (Padmanaban, 2010). The model makes the use of RE electricity generation sources feasible and accessible to IPP entrepreneurs.

The South African Government plays a vital role within the IPP process. Thus, the IPP programme stems from the government's desire to broaden the energy mix of the country. The Department of Energy promulgated an Integrated Resource Plan (IRP) as the country's blueprint on the energy mix for the power sector in the period running up to 2030. A critical part of the IRP is to bring private green energy producers into the fold, with the IPP programme aimed at doing just that and the bidding process forming part of this (Eskom, 2011b).

Therefore, with global sentiment moving ever more strongly towards RE, the South African Government should ensure that an enabling environment for IPPs in the RE sector is established so that this untapped section of the market flourishes. Smarter, cleaner and better-structured Grid models are needed to harness this end of the electricity market.

In the next chapter the components of an enabling entrepreneurial environment will be discussed.

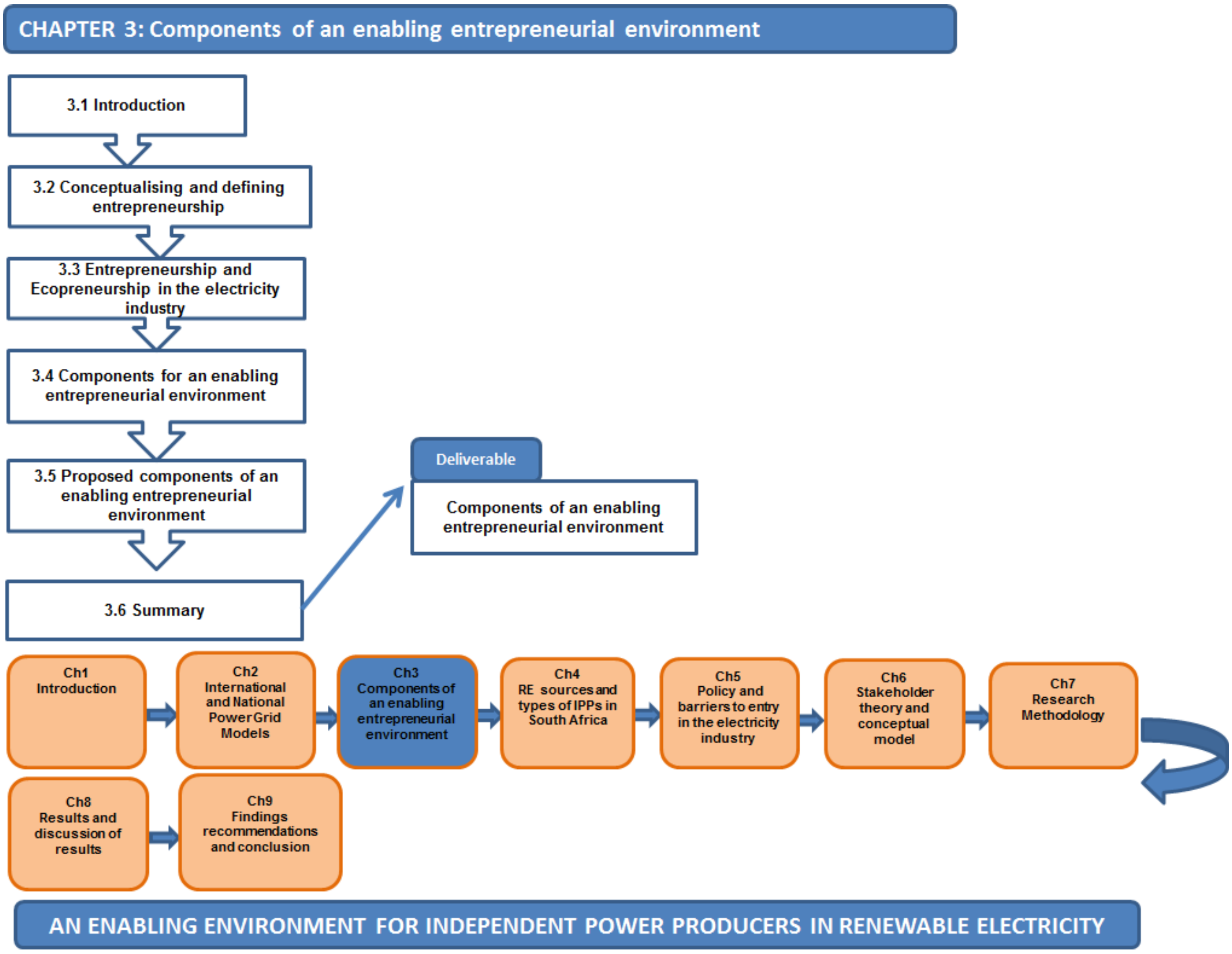


Figure 3.1: Outline of the chapter.

CHAPTER 3

COMPONENTS OF AN ENABLING ENTREPRENEURIAL ENVIRONMENT

3.1 INTRODUCTION

The previous chapter investigated power grid models in the electricity industry. Firstly, an understanding of distributed generation issues was presented and numerous definitions of electrical Grid models were provided. Furthermore, a discussion on the functions of theoretical, International and National Grid Models of electricity generation, transmission and distribution was presented, covering common IPP industry models and international and national Grid models. Lastly, an outline of the Smart Grid Model was introduced.

Entrepreneurship is critical to the development and well-being of society, including the propensity to create job opportunities (Clemensson and Christensen, 2010). In business, a strong need to develop entrepreneurial activity, as well as foster an entrepreneurial spirit exists. Clemensson and Christensen (2010) and Papoutsakis (2011) reiterate that the field of entrepreneurship is recognised as being of fundamental importance for the economy and entrepreneurs are driving a revolution that is transforming and renewing economies worldwide. It is evident, therefore, that encouraging an enabling entrepreneurial environment is an essential foundation for economic development and for advancing creative solutions for diverse challenges such as job creation.

A focus on entrepreneurship development may challenge the traditional approach to economic development (Markley and Dabson, 2006). Rather than investing significant resources in an outward-looking strategy, business leaders are looking inward, identifying the local assets that can be engaged to create economic opportunities. The GEM report (2011a) postulates that entrepreneurs create jobs, drive innovation and speed up structural changes in the economy. By introducing new competition, entrepreneurs contribute indirectly to a country's productivity and act as catalysts for economic growth and national competitiveness. An environment that nurtures, supports and welcomes entrepreneurs is a place where existing businesses thrive and where outside organisations seek to relocate (Markley and Dabson, 2006).

A prerequisite for nurturing entrepreneurship is the creation of an enabling entrepreneurial environment which is understood to be at the heart of economic, liberalisation initiatives. Markley, et al. (2006) state that the key parameters of an enabling business environment include the smooth flow of information; ease of starting a business and obtaining various clearances and permits; ease of filing taxes; an efficient legal system; enabling legislations and regulations; absence of corruption and world-class infrastructure facilities. This environment not only needs to support and welcome entrepreneurs, but the creation of the right conditions for entrepreneurs to thrive is paramount.

Anderson and Leal (2001) promote entrepreneurship as a means of resolving market failure and more specifically, environmental issues in an effort to stimulate economic growth. Given its contribution towards economic growth and entrepreneurial competitiveness, the role of entrepreneurship in resolving environmental challenges is emerging as an important subject of debate. Traditional theory from environmental and welfare economics largely concludes that the market failures, inherent in the economic system, prevent entrepreneurial action from resolving environmental problems. Indeed they often motivate environmentally degrading, entrepreneurial behaviours (Tietenberg, 2000). This position may be linked to the fact that there is a lack of entrepreneurial initiatives which address environmental issues. Tietenberg (2000) proposes that cognisance needs to be taken of factors required for entrepreneurs to succeed such as, among others:

- General entrepreneurship policy;
- Availability of financial capital and access to finance;
- Awareness and network building;
- Research and development transfer;
- Entrepreneurial education and skills;
- A culture that is tolerant of failure; and
- A stable regulatory environment.

York and Venkataraman (2010) assert that the entrepreneurial role incorporating environmental challenges is of vital importance in creating innovation and entrepreneurial opportunities. The aim would be for entrepreneurs to enter a market in a newly created sector. Entrepreneurial companies that do so tend to be in their infancy and the outcome of the events examined will involve necessitate the founding of a new organisation. This study proposes that the behaviour of entrepreneurs should involve taking risks and try to exploit new opportunities by offering services. They must realise, however, that they will compete in a new and innovative environment.

A key element in the field of entrepreneurship is the dialogue between individuals and new value creation, within an on-going process and within an environment that has specific characteristics. This emphasises the fact that the phenomenon of entrepreneurship will not always be understood if the individual, government and links between them are not fully understood over time (Clemensson and Christensen, 2010).

The purpose of this chapter is to develop a common understanding of the nature of entrepreneurship and ecopreneurship and their function in the RE sector. Furthermore, because entrepreneurship is considered to be an important catalyst for the well-being and robustness of the electricity industry, this chapter will examine the concepts related to entrepreneurship and ecopreneurship, provide insights into IPPs in the electricity industry and finally, present the components of an enabling entrepreneurial environment and its applicability to the electricity industry. This chapter is therefore addressing the second research question and the second research objective (RQ_2, RO_2).

The research question addressed in this chapter is:

RQ_2 – What are the components of an enabling entrepreneurial environment?

The research objective addressed in this chapter is:

RO_2 - To identify the components of an enabling entrepreneurial environment.

This chapter provides an outline of entrepreneurship and its components in an attempt to identify an enabling environment for entrepreneurs in the RE industry. Figure 3.1 outlines the chapter as follows: Section 3.2 conceptualises and defines entrepreneurship. Section 3.3 provides a background to entrepreneurship and ecopreneurship and the various approaches taken to foster South African business. Section 3.4 covers components of an enabling, entrepreneurial environment and Section 3.5 presents proposed components of an enabling, entrepreneurial environment in the RE sector. The last part will be a summary of the chapter (Section 3.6).

3.2 CONCEPTUALISING AND DEFINING ENTREPRENEURSHIP

Entrepreneurship is an elusive historical phenomenon, changing its very nature according to the many points of view from which it can be considered (Wennekers, Uhlaner and Thurik, 2002). Herrington, Kew and Kew (2008) indicate that generally, most researchers have consistently shown keen interest in defining the entrepreneur because they are regarded as occupying a vital role in the global economy. ‘Entrepreneur’ is a French word with its origin dating back to the 1700s (Herrington and Kew, 2009). It has since evolved to mean someone who ‘undertakes a venture’. Jean-Baptiste Say, a French economist of the 1800s, stated that: “an entrepreneur shifts economic resources out of an area of low productivity into an area of higher productivity and greater yield” (Herrington, Kew and Kew, 2008: 11). Ireland, Hitt and Simon (2003: 36) state that “Exploring entrepreneurial opportunities contribute to the organisation’s efforts to gain sustainable, competitive advantage and create wealth.”

In general, entrepreneurs are individuals who conceive new business opportunities and take the risks required to convert those ideas into reality. Schaper (2002) holds the view that they are people who are able to identify new commercial ventures which often involve a willingness to look outside the box and examine issues in fundamentally different ways. This ranges from more conventional approaches, incubating ideas and championing their adoption; assembling the resources needed to bring the idea to commercial reality (such as money, people and technologies); and finally, launching and growing the business venture. Subsequently, entrepreneurship arises when enterprising individuals identify an unsolved problem, or an unmet need or want, which they then proceed to satisfy. In the process, entrepreneurs transform the existing status quo into a future opportunity and turn ideas into a commercial reality (Schaper, 2002).

As an iterative, business-churning process, entrepreneurship may be regarded as an opportunity-obsessed approach which stimulates economic development and generates social wealth through opportunity discovery and innovation (Timmons and Spinelli, 2007). Innovation has been associated closely with entrepreneurship and can range from incremental to radical or synthetic blending of existing technologies into new designs (Mazzarol and Reboud, 2006). Often characterised as the ‘rock stars’ of the business world, entrepreneurs enjoy a reputation as freewheeling, innovative mavericks. They are assumed to have a level of freedom of which traditional managers can only dream and they are perceived to operate in a world far removed from the staid bureaucracy of corporate life (Ernst and Young, 2007).

Despite their positive influence on global prosperity and growth, entrepreneurs remain an often-misunderstood segment of the business world. With decades of academic research of the topic, there is no universal definition of entrepreneurship and no agreement about the precise traits and behaviours that characterise entrepreneurial leaders (Ernst and Young, 2007). In this study, entrepreneurship is defined as the process of perceiving and attempting to exploit new business opportunities as an essential part of an organisation’s ability to succeed in an ever-changing and increasingly competitive global marketplace (Timmons and Spinelli, 2012).

Literature reveals that market failures may be crucial factors leading entrepreneurs to exploit opportunities (Dean and McMullen, 2007; Nikolaoua, Lerapetritisb and Tsagarakisa, 2011). Towards this end, these market failures can create entrepreneurial opportunities for new business ventures. Such entrepreneurial opportunities reside in the RE sector where energy is the prime mover of economic growth and is vital to the sustenance of a modern economy. Future economic growth crucially depends on the long-term availability of energy and the provision of electricity that is affordable, accessible and environmentally friendly (Ram and Selvaraj, 2012).

Sarason, Dean and Dillard (2005) comment that while entrepreneurship fills market gaps, entrepreneurship and opportunity are a dual process but interdependent on each other. The exploitation of new business opportunities such as environmental problems, which are caused by different sectors, involves the creation of a subjective means-end framework which represents a more or less detailed or coherent scenario of the unfolding of market events (Zander, 2007). Several governmental and non-governmental organisations have developed a range of instruments, standards and tools to encourage, facilitate and force businesses to introduce some environmental concerns into their strategic management (Nikolaou, et al., 2011). Such enforcement comes via ecopreneurial processes. In other words, a positive relationship between the efforts of entrepreneurs to preserve the environment and innovation is sought after, therefore it is argued that resolution of this problem remains one of the priorities of the electricity industry.

According to Nikolaou, et al. (2011), environmental economics show that market failures are the main factor responsible for contemporary environmental problems and that ecopreneurship is the result of market failure. Furthermore, the current insufficient environmental regularity and the low level of awareness of modern societies about the environment are important reasons which explain growing environmental problems (Nikolaou, et al., 2011). Ram and Selvaraj (2012) propose that a clean energy economy underpinned by RE, is key as it expands clean electricity generation, reduces greenhouse gas emissions and pollution while generating jobs, businesses and investments. To exploit this sector of business in the electricity industry, entrepreneurship and ecopreneurship play a vital role in mobilising the industry through the application of components that ensure an enabling entrepreneurial environment.

Hence, for organisations to foster an enabling environment and for the purpose of this study, a discussion of the entrepreneurial process is deemed appropriate. Figure 3.2 outlines a typical entrepreneurial process from intention to value creation, seen as the outcome of such a process.

3.2.1 The nature of entrepreneurship and ecopreneurship

Firstly, it is important to explore the meaning of entrepreneurship and to clarify what lies at its core as this widely-used term connotes multiple meanings to different authors. Some suggest that the fundamental activity of entrepreneurship as a process is new venture creation (Timmons and Spinelli, 2007). This process is explained in Figure 3.2, where a typical entrepreneurial process is explained as starting with an intention in ideal business conditions, seizing on an opportunity, outlined as the process and ending at the functional endpoint, stated as the new value creation.

Figure 3.2: A process interpretation of entrepreneurship.

Source: Parrish, 2008: 9.

Parrish (2008) indicates that the resources, to which an entrepreneur has access, may be a vital determinant in the process of entrepreneurship. The process can be defined as intentional acts of new value creation by which opportunities are created and realised through various modes of organising (Figure 3.2). New value creation highlights the importance of the entire entrepreneurial process and makes explicit the fact that entrepreneurs take action in response to opportunities. Entrepreneurship has gained unprecedented importance on a worldwide scale as it is regarded as a substantial source of new employment, innovation and economic growth (Morales-Gualdron and Roig, 2005). Parrish reiterates that entrepreneurship has reinterpreted some of the long-running themes of the field, such as opportunity identification, unique entrepreneurial characteristics, risk or uncertainty-bearing and the link between entrepreneurs and enterprise success. In the same vein, Neuman (2008) further directs that the entrepreneurial process does not always begin with the absence of an organisation, as existing organisations can behave in ways similar to new organisations that provide the same benefits that may be attributed to entrepreneurship.

Shane and Venkataraman (2000) observe that entrepreneurship focuses on central questions concerning the entrepreneur; notably, why, when and how some people and not others discover and exploit opportunities. According to the authors, literature on the subject was most abundant in the 1970s, 1980s and 1990s. This was the time when growing numbers of researchers from a host of different disciplines, including many emerging disciplines in the humanities and administrative sciences, began to take an interest in entrepreneurs (Shane and Venkataraman, 2000).

Entrepreneurs are seen as agents of change (Audretsch, 2002) who exploit opportunities, contribute to innovation and consequently play an important role in market economies (Schaper, 2002). They are often agents of what one of the early researchers in the field, Schumpeter (1934), labelled as ‘creative destruction’: old ways of doing things are transformed, or overtaken, when enterprising individuals wreak change in business systems. In order to exploit such entrepreneurial opportunities, the entrepreneur must enter the market and use judgement with a degree of confidence (Zander, 2007).

According to Kuratko and Hodgetts (2007), essential ingredients for entrepreneurial success include the willingness to take calculated risks in terms of time, equity or career; the ability to formulate an effective venture team to marshal needed resources; the fundamental skill of building a solid business plan; and finally, the vision to recognise opportunity where others see chaos, contradiction and confusion. For this reason, pinning down a definition for the entrepreneur has been an elusive act. However, for the purposes of this study, a working definition of the term is an imperative.

Table 3.1 presents a historical definition of entrepreneurship (Kuratko, 2002) against a more contemporary definition offered by Mokaya, Namusonge and Sikalieh (2012).

Table 3.1: Definitions of entrepreneurship.

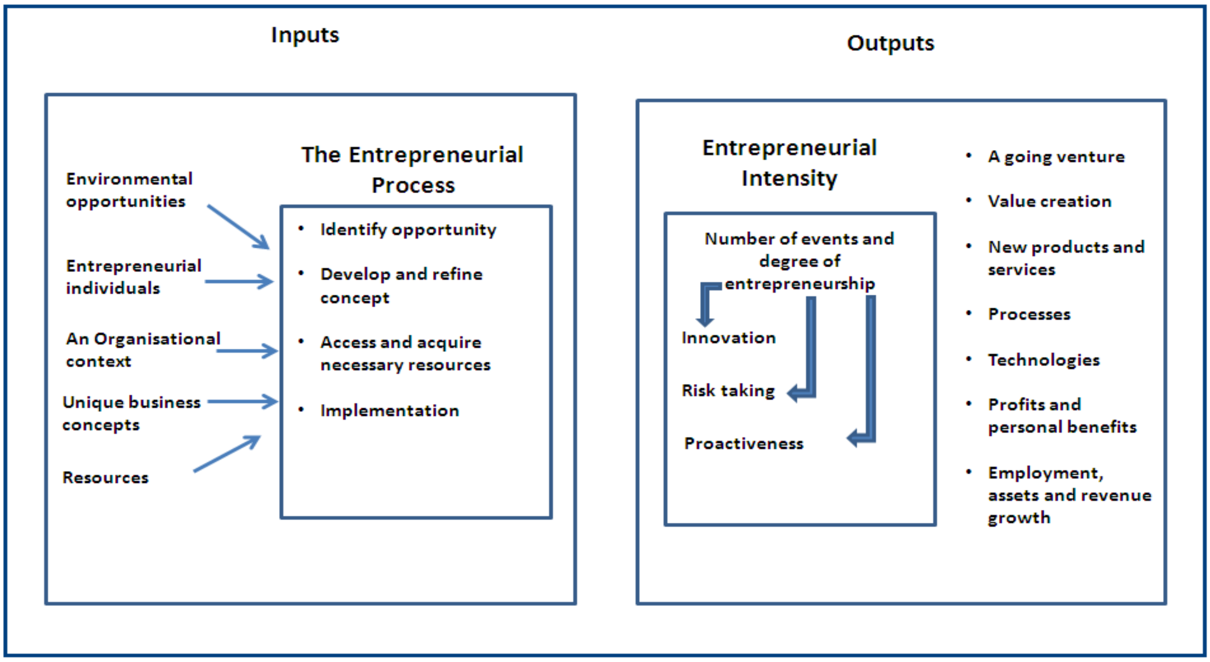
Authors and Year	Published definitions
Kuratko (2002)	Entrepreneurship includes acts of creation, renewal, or innovation that occur within or outside an organisation.
Mokaya, Namusonge and Sikalieh (2012)	Entrepreneurship is an activity that is action-oriented. It is a world of immense creativity and innovation inhabited by entrepreneurs, the individuals who innovate, take risk and create value in form of new products and services.

The latter definition fits the popular conception of what an entrepreneur does. It highlights the importance of the entire entrepreneurial process and elucidates the fact that entrepreneurs act in response to opportunities and inspire the process of innovation. For these reasons, it is deemed appropriate as it reflects the purposes of this study. Section 3.3.2 presents a discussion of the entrepreneurial process.

3.2.2 The entrepreneurial process

Morris and Kuratko (2002) theorise that the entrepreneurial process is represented by a five element model. In this model, identified as Figure 3.3 inputs such as entrepreneurial opportunities, entrepreneurial individuals, organisational context, unique business concepts and resources are evident. The output shows the level of entrepreneurship being achieved. The elements termed entrepreneurial intensity can result in various entrepreneurial events and degrees of entrepreneurship. This in turn leads to final outcomes which include value creation processes, new technologies, jobs and profits.

Figure 3.3: Model of the entrepreneurial inputs and outputs.



Source: Morris and Kuratko, 2002: 5.

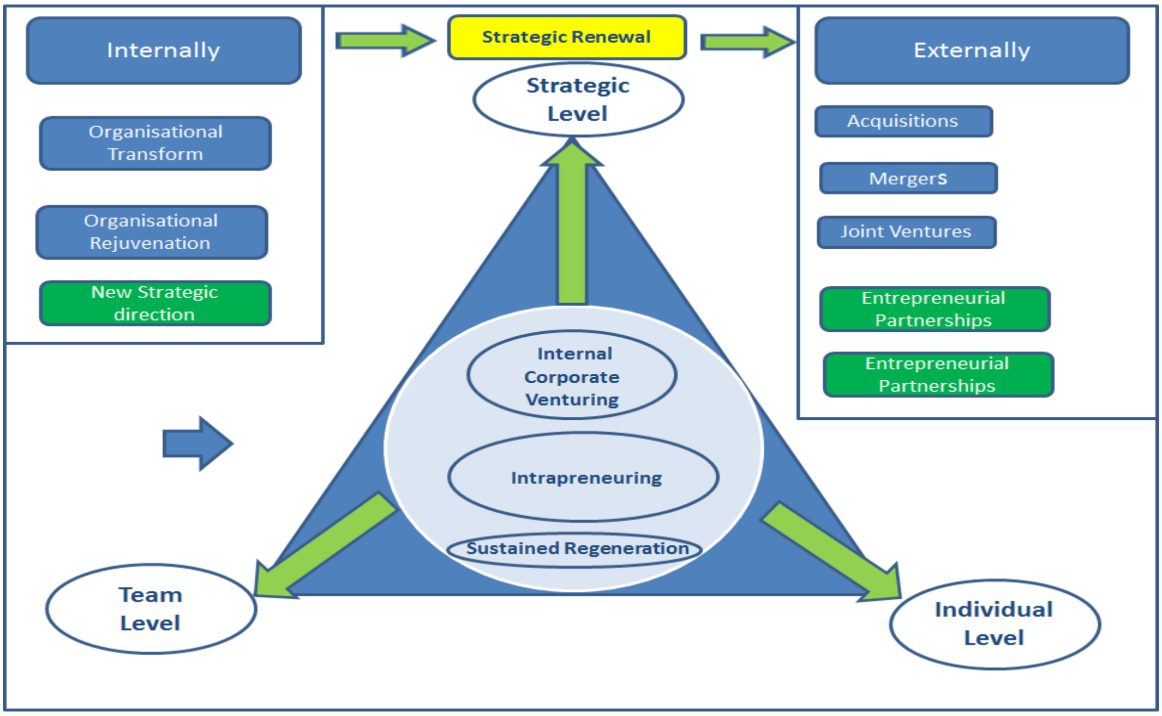
The definitions provided in the previous section 3.2.1 as well as entrepreneurship and the entrepreneurial output and input model, capture a central term in entrepreneurship as it is based on the shift in emphasis from the individual to the organisation. The term, Corporate Entrepreneurship (CE), does not refer to business start-ups from the field of entrepreneurship research, but involves entrepreneurship inside existing organisations (Antoncic and Hisrich, 2001). This entrepreneurship leads to innovations such as the renewal of operations, the creation of new services and processes and ultimately to improving the organisation's performance and competitive position (Pearce and Robinson, 2009; Kollmann and Stockmann, 2008). Corporate entrepreneurship, its importance and contribution to business innovation is discussed in Sub-Section 3.2.3.

3.2.3 Corporate Entrepreneurship (CE)

The recognition of the importance of entrepreneurial dynamics in the corporate context is increasingly acknowledged in both entrepreneurship and strategic management literature, as organisations today face a reality in which innovation is an important element for survival (Heidemann and Lassen, 2007). Entrepreneurship is a multi-faceted phenomenon, which entails both the start-up of new companies (start-up entrepreneurship) as well as the carrying out of new strategic initiatives within existing businesses (corporate entrepreneurship) (Sciascia and De Vita, 2004). CE is the process by which employees discover, foster, launch and manage new business ideas inside the organisation that leverages an organisation's assets, market knowledge, position, capabilities and expertise. Successful CE facilitates these corporate efforts to exploit opportunities for value-creating innovation, while improving competitive positioning and transforming corporations, their markets and industries (Kuratko, et al., 2005).

Christensen (2001) put forward that the pursuit of CE requires established and existing organisations to strike a fragile balance between engaging in activities that make use of existing knowledge, while simultaneously challenging them to embark upon new adventures, seeking new knowledge and opportunities to rejuvenate themselves. Ramachandran, Devarajan and Ray (2006) contend that within the realm of existing organisations, CE encompasses three types of phenomena which include the birth of new businesses within an existing organisation; transforming existing organisations by new or reshaped ideas and finally through innovation. CE is portrayed as the overall entrepreneurial orientation of a company in Figure 3.4 (Sambrook and Roberts, 2005). The holistic approach is directed at a more strategic view of how an organisation can increase its innovativeness, adaptability, risk-taking, pro-activeness, agility and identification of opportunities that can be created or exploited because of changes in the external environment. This view is not limited to the organisation's benefit. It also means that CE contributes to wealth and employment generation through the exploitation and improvement of existing business activities (Sambrook and Roberts, 2005).

Figure 3.4: Types and levels of CE.



Source: Sambrook and Roberts, 2005: 55.

In Figure 3.4 above, Sambrook and Roberts (2005) view the types and levels of CE, according to whether activity occurs at the strategic, team or individual level. At the strategic level, both internal and external factors have to be considered. Internal factors such as organisational transformation and rejuvenation along with new strategic direction and external factors including acquisitions, mergers, joint ventures and entrepreneurial partnerships need to be considered.

The function of CE as a renewal strategy within the electricity industry is essential. As the industry operates as monopolistic organisations in most countries, there is a need to embrace entrepreneurship as a form of innovative opportunity. In the electricity industry the world over, entrepreneurial partnerships such as IPPs are a key external consideration for CE. Researchers have used a variety of labels to describe CE as depicted in the definitions in Table 3.2.

Table 3.2: Definitions of Corporate entrepreneurship.

Authors and Year	Published definitions
Kuratko and Hodgetts (2007)	CE is a process whereby an individual or a group of individuals, in association with an existing organisation, creates a new organisation or instigates the renewal or innovation within the organisation.
McFadzean, O'Loughlin and Shaw (2005)	CE is the effort of promoting innovation from an internal organisational perspective, through the assessment of potential new opportunities, alignment of resources, exploitation and commercialisation of said opportunities.

To facilitate this study, the definition as proposed by Kuratko and Hodgetts (2007) is applicable as it aptly describes the potential for entrepreneurial activity within a sector or organisation as mechanism for renewal.

CE encompasses the birth of new business within existing businesses and the transformation (or rebirth) of businesses through a renewal of their key ideas (Kuratko and Hodgetts, 2007). CE, in the narrow sense, represents formal and informal activities whose aim is the creation of new ventures within existing organisations. Just as CE relates to new business ventures as a vehicle that drives collaboration between entrepreneurial behaviour and organisational renewal, ecopreneurship emphasises new business opportunities and how entrepreneurs, as self-interested individuals who recognise, exploit and create future markets for goods and services, can simultaneously foster economic and ecological benefits for society (Kuratko and Hodgetts, 2007). The adoption of greener business practices which provide ecological benefits is usually a major stimulus for innovation within an organisation, giving rise to improvements in processes, production, materials usage and marketing (Schaper, 2005). It is evident, therefore, that the degree of entrepreneurial and ecopreneurical behaviour as a critical-enterprise capability creates value for an organisation's management and those serviced by it.

3.2.4 Defining and conceptualising Ecopreneurship

Ecopreneurship has developed as a new field of research primarily within management and business studies. This places emphasis on the key role of individuals and organisations in engendering a shift towards more sustainable practices. The argument is that, far from being antithetical to environmentalism, entrepreneurial activity, by sustaining the environment, may be increasingly central to market success.

Gibbs (2009) advocates that the world may be on the edge of a new wave of creative destruction with the potential to fundamentally change the competitive dynamics in many markets and industries. Thus, increasing evidence of substantial environmental degradation and recent market developments in RE, fuel cells, green building, natural foods, carbon emissions and other factors suggests an increasing importance for ecopreneurship (Dean and McMullen, 2007). Central questions addressed in the literature, such as “When does it pay to be green?” and “Does environmental responsibility hinder or hamper competitive advantage?” are largely concerned with how to incentivise organisations to reduce their own negative environmental externalities (Lenox and York, 2011).

Entrepreneurship researchers have begun to ask a different set of questions. The nascent field of ecopreneurship asks whether and how entrepreneurs, as self-interested individuals, who recognise, exploit and create future markets for goods and services, can simultaneously foster economic and ecological benefits for society regardless even if they themselves contributed to environmental degradation (Lenox and York, 2011). Traditional theory from environmental economics largely concludes that the market failures, inherent in the economic system, prevent entrepreneurial action from addressing environmental problems. They also suggest that such failures indeed motivate entrepreneurial behaviours which degrade the environment (Dean and McMullen, 2007). The role of entrepreneurship in resolving environmental challenges is emerging as subject of debate. In the case of South Africa, high carbon emissions, depleting coal quality for electricity generation and the ever-increasing electricity demand in the country, require innovative practices to maintain a sustainable electricity industry.

Lindhult and Guziana (2009) assert that ecopreneurs do not need to be like champions and heroes, but can be any person starting up a green business. The value in contributing to a sustainable society is still there, even if the organisation is small. Ecopreneurship is therefore distinguished from other forms of corporate environmental development by a participating company's passionate commitment to environmental progress and its strong desire for business growth (Schaltegger, 2002). Ecopreneurs are social activists who aspire to transform a sector of the economy towards sustainability by proactively starting up a business through ecologically oriented business strategies (Isaak, 2005). In turn, Schaltegger (2002) advises that ecopreneurs destroy existing conventional production methods, products, market structures and consumption patterns and replace them with superior environmental products and services while they are creating the market dynamics of environmental progress. Entrepreneurs become ecopreneurs when they take their desire for innovation and problem-solving and apply it to meaningful purpose such as devising clean, RE sources and building healthy and safe homes. Defining the ecopreneur in terms of this study therefore becomes all-important. In Table 3.3 below, a selection of definitions of the term ecopreneurship is presented.

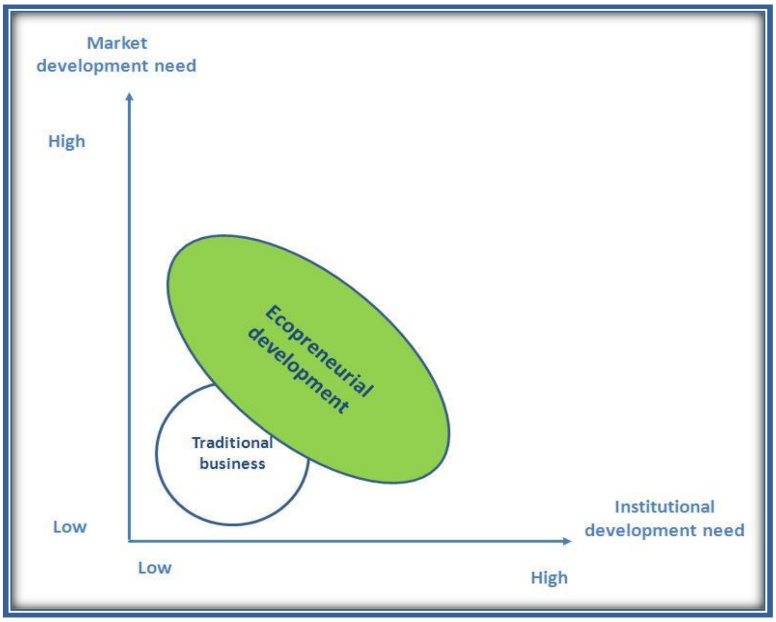
Table 3.3: Key definitions of ecopreneurship.

Authors and Year	Published definitions
Dean and McMullen (2007)	Ecopreneurs are defined as those entrepreneurs who combine environmental awareness with their business activities in a drive to shift the basis of economic development towards a more environmentally friendly basis whereas entrepreneurs only focus on business activities.
Dean and McMullen, (2007)	Environmental entrepreneurship or ecopreneurship is defined to be: the process of discovering, evaluating and exploiting economic opportunities that are present in environmentally relevant market failures.

The former definitions aptly capture the bold spirit of the ecopreneur, similar to entrepreneurship. Both embrace failure and are idea driven, innovative, creative risk tolerant, flexible, adaptable and independent. As with entrepreneurship, the definitions highlight the importance of the entire entrepreneurial process and make explicit the fact that ecopreneurs take action in response to opportunities. They are focused on restoring the ecological and cultural wonders of the planet and offer prevention-oriented alternatives to harmful practices. Environmental challenges therefore become opportunities towards success and innovation (Neuman, 2008). The definition of Dean and McMullen (2007) applies to this study.

The phenomenon of ecopreneurship is depicted in Figure 3.5. It indicates that as market conditions and regulatory policy factors change, ecopreneurial development increases. It is argued that individuals seeking to combine environmental awareness with entrepreneurial action represent the paradigm of ecological modernisation in action. The development of new business, in which a new generation of ecopreneurs is seeking to combine environmental awareness with business success and conventional entrepreneurial activity, is proving to be pivotal to the ecopreneurial process (Gibbs, 2009).

Figure 3.5: Ecopreneurial development.



Source: Lindhult and Guziana, 2009: 10.

Ecopreneurship is not only important because it provides new opportunities for the nimble first movers who identify and exploit such opportunities but also because it has the potential to be a major force in the overall transition towards a more environmentally sustainable business paradigm (Schaper, 2002). In the electricity industry in South Africa, this is important as entrepreneurial activity is sought after not only to boost the economy, but to accelerate the quest towards cleaner electricity production and a diverse electricity supply.

Schaper (2005) confirms that ecopreneurship is an existential form of business behaviour committed to sustainability. Ecopreneurs are counter-cultural or social entrepreneurs who want to make a social statement, not just money. They benefit not only from free advertising, given their advocacy of public good, but from a strong sense of individual and team motivation since their objective taps into social and political as well as economic needs (Schaper, 2005). Thus, the creation of enabling changing conditions, in which ecopreneurs can flourish, becomes all important. The next section explores entrepreneurship and ecopreneurship in the electricity industry.

3.3 ENTREPRENEURSHIP AND ECOPRENEURSHIP IN THE ELECTRICITY INDUSTRY

As in any industry, entrepreneurship in the electricity industry stems from the actions of individuals and organisations seeking new business opportunities. National investments into education and research transfer into growth businesses only when there are sufficient incentives to gather complementary assets for business development (Juha-Pekka and Hokkanen, 2009). The current pressure on power utilities to lower carbon emissions of conventional electricity production and produce cleaner electricity in the form RE creates an opportunity for both entrepreneurs and ecopreneurs to exploit (Gibbs, 2009). The IPP plays a key role as ecopreneur of this industry. These ecopreneurs who are able to spot latent opportunities, commercialise them and direct the growth of new industry are well-positioned to capture very large economic gains for their organisations and for society (Valliere and Hrelja, 2011).

Whilst established corporations are realising the importance of being environmentally friendly, it is believed that they are executing push strategies, whereby governments, regulatory agencies, stakeholders and lobby-groups impel policy and guiding principles to act in an environmentally conscious manner (Thompson and Scott, 2010). Indeed, ecopreneurship could be conceptualised as being formed from a push-pull relationship between technology and ecology. There are legislative and market drivers too. Technology makes new environmental initiatives possible; by providing opportunities. At the same time, the desire to 'improve the world' (whether that desire is held by inventors or environmentalists) provides motivation and thus opportunities for inventors/technologists (Thompson and Scott, 2010).

Ecopreneurship has the potential to solve two main problems: the potential to drive innovation and to stimulate a sustainable environment that changes the harmful “business as usual” practices of the past. Where other people might see problems and crises, innovative green business leaders see opportunity (Green for All, 2009). These opportunities extend to large power utilities the world over where ecopreneurship is largely explored.

3.3.1 IPPs as electricity industry entrepreneurs

The combined opportunity for private power generation from IPPs, the recognition of the possible cost competitiveness, and environmental and economic benefits of RE and energy efficiency, suggests the viability of a new form of energy supply enterprise, the IPP (Woodhouse, 2005a). The IPP concept is an extension of the market-driven bidding processes that have provided alternatives to traditional ways of meeting the demand for energy services. IPPs therefore focus on private generation in state-dominated power markets.

In the 1990s, a rising tide of private investment in power infrastructure flooded into developing countries, much of it focused on power generators known as IPPs. These IPPs would sell bulk electricity into the state-dominated power system under a longer term purchase agreement compared to that of other generators in the country’s experience (Woodhouse, 2005b). IPPs were originally conceived as re-sellers of co-generated electricity and other small-scale power resources. A report for the National Association of Regulatory Utility Commissioners in the USA, specifically addressed conservation and load management programmes and allowed RE developers to bid as IPPs. As experience was acquired, the possibility of financing and building large, central-generating facilities using non-utility private companies gained credence. The absolute level of investment peaked in 1996 and then ebbed rapidly by the end of the decade (Woodhouse, 2005b).

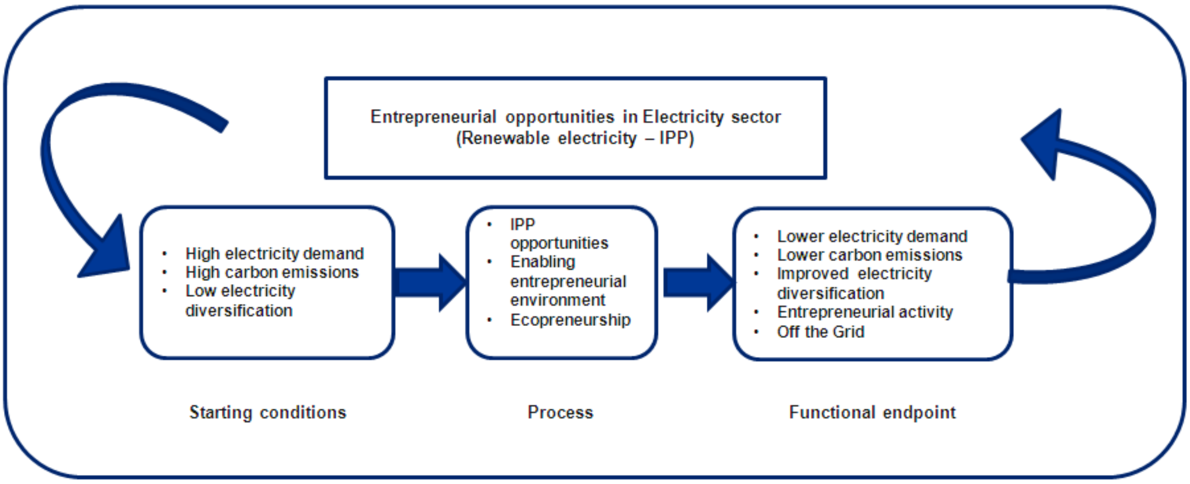
IPPs are the vehicle for entrepreneurship in the electricity industry by ensuring that a government attains its goals; attracts private capital to meet demand growth in power generation, encourages the introduction of new technology and catalyses a more efficient, better managed and more competitive electricity market (Woo, 2005). To date, the thrust of the reforms in the electricity industry worldwide was to increase private sector participation in order to reap the benefits from increased competition and efficiency in power generation and the value of retail supply points (Woo, 2005).

Incorporating IPPs in the electricity industry depends on a series of interlocking changes elsewhere in government that are essential to imposing market discipline on the industry. For example, state budget reforms have been essential for imposing hard budget constraints on State Owned Enterprises (SOEs). The imposition of independent corporate governance has been essential in creating truly competitive and accountable new private enterprises (Woodhouse, 2005b).

Sine, et al. (2005) suggest that the electricity industry utilities were regional monopolies. Non-utility generators (IPPs) could not sell directly to consumers and utilities had no incentive to give non-utility generators access to their distribution networks. With the exception of large hydroelectric plants, utilities relied almost exclusively on production technologies that burned fossil fuels. Although innovators explored alternative electricity-generating technologies, the utilities' monopolistic position allowed them to lock would-be innovators of electric power out of the market (Sine, et al., 2005).

Figure 3.6 illustrates the process of interpretation of entrepreneurship via IPPs in the electricity industry.

Figure 3.6: A process Interpretation of Entrepreneurship in the RE sector.



Source: Own construction, 2014.

The IPP experience varies widely internationally, depending on the approach taken by different countries and regions. Table 3.4, prepared by Globaleq (2010), a UK-based IPP, demonstrates the differing outcomes between six developing countries in Latin America, a region which has generally followed a pro-IPP approach. This approach is in line with the standard model and that of Africa, which has generally followed a more cautious approach congruent with the hybrid model (Pickering, 2010).

Table 3.4: Comparison of developing countries (Latin American and African IPPs).

Country	*Private %*	*No of IPPs*	*Country*	*Private %*	*No of IPPs*
Guatemala	76%	12	Ghana	11%	1
Costa Rica	25%	32	Tanzania	28%	2
Nicaragua	59%	12	Kenya	27%	5
Panama	88%	23	Cote d'Ivoire	41%	2
El Salvador	61%	14	Senegal	18%	2
Honduras	69%	20	Uganda	45%	1
Average	**63%**	**19**	**Average**	**28%**	**2**

Source: Globaleq, 2010: 3.

The data indicates very different outcomes in each of the two regions. Pickering (2010) attributes this outcome to the degree to which each region has successfully addressed factors such as the implementation of power tariffs which adequately reflect both costs and risks and achieve financially healthy utilities; the establishment of clear rules and policy for IPP entrants and commitment to the entry of private power. There are some fifty IPPs operating across Africa, the majority of which are successful, stable and contribute to economic and social development (Eberhard and Gratwick, 2005).

In a study of IPPs across Africa, many developing countries have chosen not to implement the full standard model (Pickering, 2010). Amidst the electricity demand and lowering emissions in South Africa, barriers to entry remain high and the introduction of IPPs remains a challenge. Currently, power utility Eskom (South Africa) is in the initial stages of the approval of IPPs. Significant gains for RE, in South Africa have been achieved up until now (Yelland, 2010). The South African Government has repeatedly made positive policy statements about its intent to open the power system to IPPs (Pickering, 2010). The South African economy is growing and demand for electricity is increasing at a high rate. Thus access to modern electricity service has become a priority and a social right that must be addressed at national government level (IEA, 2010). Entrepreneurial opportunity through IPP utilisation in the RE industry is gaining momentum as government is focussing specifically on RE targets.

3.3.2 Entrepreneurial opportunities in South Africa

South Africa remains one of the more poorly performing countries with regard to entrepreneurial activity, despite the fact that the country exhibits the factors which are conducive to an enabling entrepreneurial environment, including government policies and programmes aimed at stimulating entrepreneurship (Herrington, Kew, Simrie and Turton 2011). In order for South Africa to grow economically and socially, entrepreneurship may significantly contribute to sustaining a green economy and ultimately take heed of its mandate of creating jobs. It is crucial that the private sector plays a role in addressing the future electricity needs of the country. This will reduce the funding burden on Government, relieve the borrowing requirements of Eskom and introduce electricity generation technologies that Eskom may not consider part of its core function but which may play a vital role in the future electricity supply options. These are in particular, Off-Grid, distributed generation, co-generation and small-scale renewable projects. Maas and Herrington (2011) concur that, through this innovative practice, in South Africa entrepreneurs will be able to create new, competitive markets and businesses which lead to job creation and have a multiplying effect on the economy.

An economy's capacity for entrepreneurship is determined by an individual's ability and motivation to start businesses. This may be enhanced by society's positive perceptions and attitudes with regard to entrepreneurial development (Herrington, et al., 2011). The contribution which entrepreneurship makes to the economy can be further increased if participation by different groups is encouraged and the environment is conducive to developing high-growth enterprises (Herrington, et al., 2011).

Over the past decade, the concept and practice of entrepreneurship has received increasing emphasis internationally (Gibb, 2009) and in South Africa in particular. Herrington, Kew and Kew. 2008) posit that the Global Entrepreneurship Monitor (GEM) has used the Total Early-stage Entrepreneurial Activity (TEA) index as the principal measure of entrepreneurial activity in participating countries. The TEA index provides a benchmark for comparisons between different countries, as well as longitudinal in-country comparisons. It measures the participation of individuals in early-stage entrepreneurial activity and conveys the percentage of the adult population between the ages of 18 and 64 years that is in the process of starting a business or has recently done so (Simrie, et al., 2012).

South Africa's TEA in 2008 stood at 7.8%, which is greater than it was in 2006 (5%) but still lower than India-Brazil (11.5% – 12%), Colombia (24.5%), Mexico (13.1%) and even the United States 1 (10.8%). According to the GEM (2011a) in 2009, following the economic crisis, the level of early-stage entrepreneurial activity in South Africa dropped again to just over 5%. Recent statistics reveal that total early-stage entrepreneurial activity (TEA) shows that South Africa's rate in 2011 (9.1%) has remained constant (8.9% in 2010). However, South Africa's TEA rate is, again, far below the average of comparable economies around the world. This therefore remains a challenge but equally presents an entrepreneurial opportunity. Key performance areas of entrepreneurial activity in South Africa are depicted in Table 3.5.

Table 3.5: Entrepreneurial activity in South Africa.

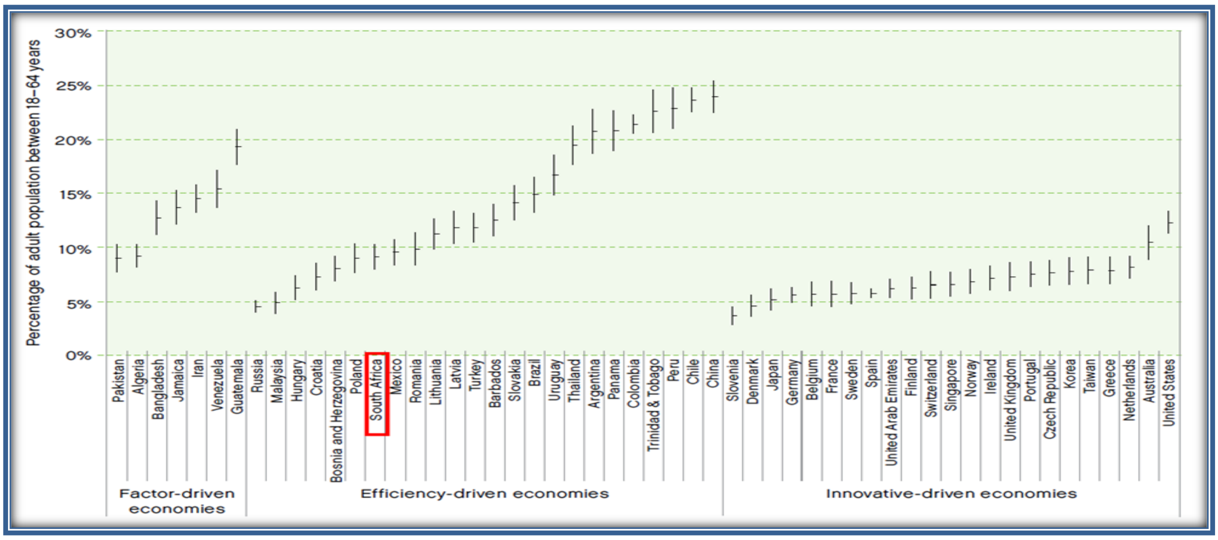
		2002	2008
Number of countries participating		102	133
Institutions:	• Business cost of crime and violence	96	133
	• Public trust of politicians	35	65
	• Reliability of police services	86	106
	• Diversion of public funds	47	56
	• Property rights	31	20
Health:	• Business impact of HIV/Aids	100	133
Finance:	• Ease of access to loans	34	31
Infrastructure:	• Telephone lines	65	91
	• Quality of electricity supply	24	100

Source: GEM Adult Population Survey, 2009: 5.

As is evident from the table above, a number of key areas, in South Africa's performance in terms of entrepreneurial activity, have weakened considerably since 2002. The decrease in ranking with respect to crime, the reliability of police services and the diversion of public funds is of particular concern. These elements impact on the impression that overseas funders have of the country and do not improve chances of increasing the share of foreign direct investment. The decrease in ranking with respect to infrastructure and particularly the supply of electricity is also of concern. The loss of income and business confidence, as well as the number of small businesses that were unable to survive the protracted electricity supply outages in 2008/9, seriously dented South Africa's international appeal (Herrington, Kew and Kew, 2008).

Figure 3.7 depicts the GEM multi-year international study about entrepreneurial activity. Reynolds, Schultz and Hekman (2006) confirm that South Africa has repeatedly filed reports concerning the low entrepreneurial activity over the years. The country ranked as the 20th among the countries surveyed in 2003 (29th / 54 in 2011) and was categorised in the below average group. The central measure in this study is the Total Entrepreneurial Activity (TEA), which indicates how much of the adult population is active in starting a new business. South Africa's TEA in 2002 was 6.3% and reflected as 9.1% in 2011 (Herrington, et al., 2011).

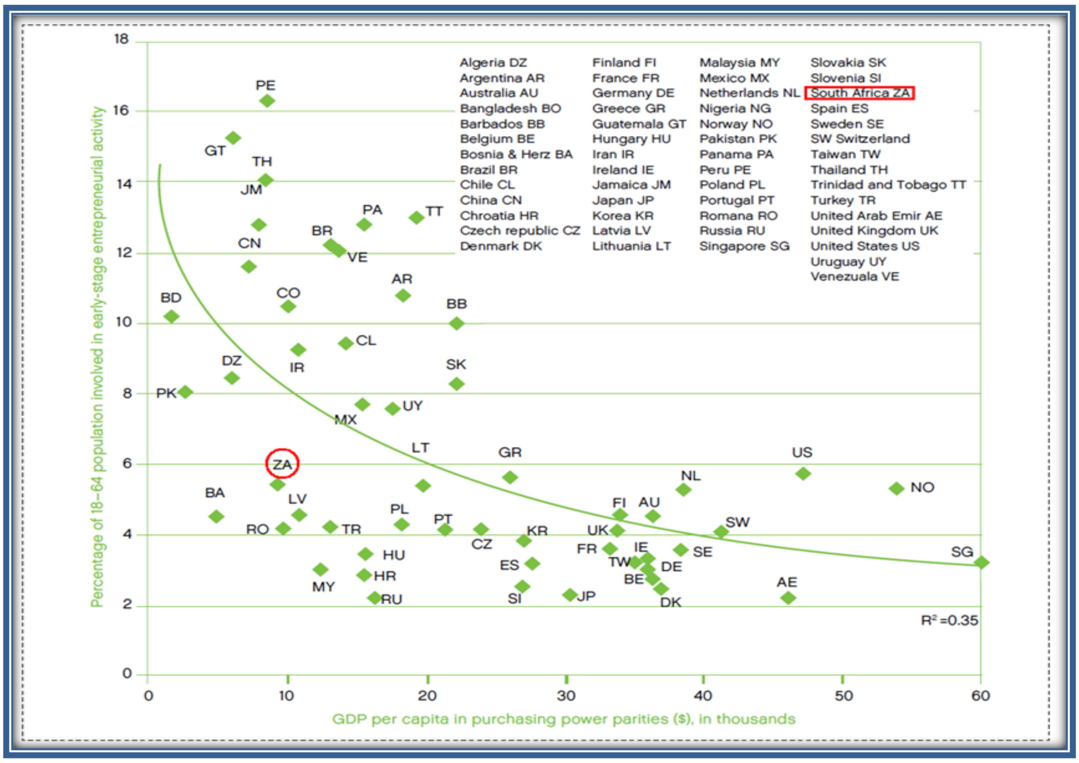
Figure 3.7: TEA rates for participating countries in 2011.



Source: GEM, 2009: 17.

Figure 3.7 plots the TEA rates of the 54 countries against their GDP per capita levels. South Africa clearly falls below the line of best fit – reinforcing the fact that the country's TEA rate is lower than expected, given its GDP per capita. Previous GEM research has shown that TEA rates in general, tend to decline with increasing levels of GDP per capita. The decline can be ascribed to the increasing availability of job opportunities as economies grow. This is indicative of South Africa as demonstrated by the past hosting of the FIFA Soccer World Cup in 2010. The South African economy received a boost, both in terms of the financial returns it gained, as well as the increase in entrepreneurial energy that surged as many new small businesses emerged. Entrepreneurial aspirations flourished in anticipation of the opportunities that this major international event signalled (Herrington, et al., 2011). South Africa's TEA rate increased by 62% to 8.9% from 2009 to 2010 and remained fairly constant in 2011.

Figure 3.8: Total Entrepreneurial Activity.



Source: Herrington, Kew, Simrie and Turton, 2011: 17.

According to Bosma, Wennekers and Amorós (2012), the relationship between TEA and GDP per capita is less evident for economies in the innovation-driven stage. The South African economy is characterised by a lower TEA rate compared to its GDP and therefore still in the innovation-driven stage.

The electricity industry provides an example in both its history and current state. Prior to the Public Utility Regulatory Policy Act of 1978, small-scale producers of electricity encountered substantial resistance from monopolistic providers who controlled the distribution of power. The act required large utilities to purchase power from small-scale electricity producers and enabled entrepreneurs to develop hydro-electric and other RE projects (GEM, 2011).

It is argued that the inertial properties of large organisations in the industry combined with regulatory systems that set rates based on costs and prevented the development and implementation of ecopreneurship. Ecopreneurs who overcome the market barriers in this industry may therefore have a substantial opportunity to profit from the implementation of RE and distributed generation technologies while reducing environmental impacts

(Martinot, 2004). Hence, environmental entrepreneurs who can overcome market power have the opportunity to profit from the implementation of environmentally superior business methods (Lenox and York, 2011).

What is required, therefore, is a national, integrated and co-ordinated support system that caters to the specific needs of ecopreneurs. Education and training efforts should focus on inculcating an entrepreneurial mindset. They should provide the ecopreneurs with the right knowledge and skills to start environmentally driven businesses, and good skills to overcome initial barriers in this sector. Schaltegger (2002) concurs that ecopreneurship is therefore instrumental in efforts to solve the problem of the environment yet achieve business success. In the case of South Africa, GEM (2011) concurs that the promotion of ecopreneurship should be a key focus towards green initiatives in the economy.

In the next Sub-Section, the relevance of entrepreneurship in South Africa is discussed.

3.3.3 Relevance of entrepreneurship in South Africa

The promotion of Small, Medium and Micro Enterprises (SMMEs) is the focus of considerable interest in South Africa and in many other countries (Department of Trade and Industry, 2013). In the White Paper on National Strategy for the Development and Promotion of Small Business in South Africa, the Government explicitly identified the promotion of SMMEs as a policy imperative for addressing the challenges of unemployment and poverty. SMMEs are an important source of jobs. They contribute significantly to the economic growth of any country and in advancing national and individual prosperity (World Bank, 2007).

The transition from poverty to wealth in most nations has mainly been through private actors, farmers, investors or by small and larger businesses. If countries, particularly those in Africa, are to emerge from poverty and unemployment and create a more prosperous future, they will need more SMMEs and bigger businesses involved in entrepreneurial activity (Moss, 2007). However, if this is to be achieved, entrepreneurs need an environment that is more conducive to starting up, operating and expanding their businesses (Mahadea, 2003).

South Africans may have high levels of untapped potential within organisations which need to be explored and developed (Herrington, et al., 2010). In order to foster entrepreneurial employee activity, it will require a shift in management mindsets, a recognition and appreciation of employees exhibiting entrepreneurial tendencies as well as the development of a corporate culture which intentionally stimulates and supports entrepreneurial employee activities. The alternative is that South African companies, by not recognising the potential which already exists within the business, may lose valuable, cost-effective opportunities to innovate through increased productivity and competitiveness (Herrington, et al., 2011).

South Africa obtained an Entrepreneurial Employee Activity (EEA) rate of 0.3% which is significantly lower than the average of 1.8% for efficiency-driven economies. These figures suggest that the formal South African employment environment exhibits very low levels of entrepreneurship (GEM, 2011). EEA is most prevalent in the innovation-driven economies. It is interesting to note that the innovation-driven economies with the highest levels of EEA are among those with the lowest TEA rates. This is further indication that entrepreneurship in organisations replaces, to some extent, independent entrepreneurship as an alternative means of pursuing entrepreneurial opportunities (GEM, 2011).

The GEM (2011a) states that, compared with other employees, people who are involved in EEA are significantly more likely to recognise entrepreneurial opportunities and believe that they have the ability to start a business. In fact, these perceptions are remarkably similar to those of early-stage entrepreneurs. Entrepreneurial employees are also far more likely than other employees to be actively involved in setting up new independent businesses that they will own and manage. Entrepreneurial employee activity and early-stage entrepreneurship thus appear lucrative in the early stages of operations.

The South African Government has repeatedly made positive progress in respect of entrepreneurship particularly regarding its intent to open the electricity industry to IPPs, starting with the Energy White Paper of 2003 (Department of Minerals and Energy, 2003). In this regard, the power utility Eskom plays an integral part of IPP participation in electricity generation. The first contracts between government and IPPs to add 1 400 megawatts of RE to the national grid were signed in Pretoria. Energy Minister Dipuo

Peters said the contract signing, with 28 approved bidders, was not limited to the energy sector (Moneyweb, 2013) but presented various benefits for the South African economy.

Power utilities play a fundamental role in advancing economies and create wealth in both the developed and developing worlds. Affordable and reliable electricity is integral to household productivity and the development of most industries including agriculture, finance, health care and communications (Sutton, 2007). Thus, the creation of a good platform for reliable electricity provision through essential entrepreneurial components can only enhance an operative entrepreneurial environment.

3.4 COMPONENTS OF AN ENABLING ENTREPRENEURIAL ENVIRONMENT

General components for an entrepreneurial environment have been classified differently by various researchers (Lundström, Almerud and Stevenson, 2010). However, a gap in the literature remains which highlights entrepreneurial components for the RE sector. This section therefore firstly presents the general components and then addresses the proposed components required for an enabling entrepreneurial environment in the RE sector. Many features are essential for enabling an entrepreneurial environment (EU-Africa Business Forum, 2007). Ensuring simplified regulatory processes, improving delivery time, eliminating corruption, meeting information needs and improving corporate governance norms for entrepreneurial start-ups, amongst others are some of the overall enablers that exist to create a better business and regulatory environment (Goswami, Dalmia and Pradhan, 2008).

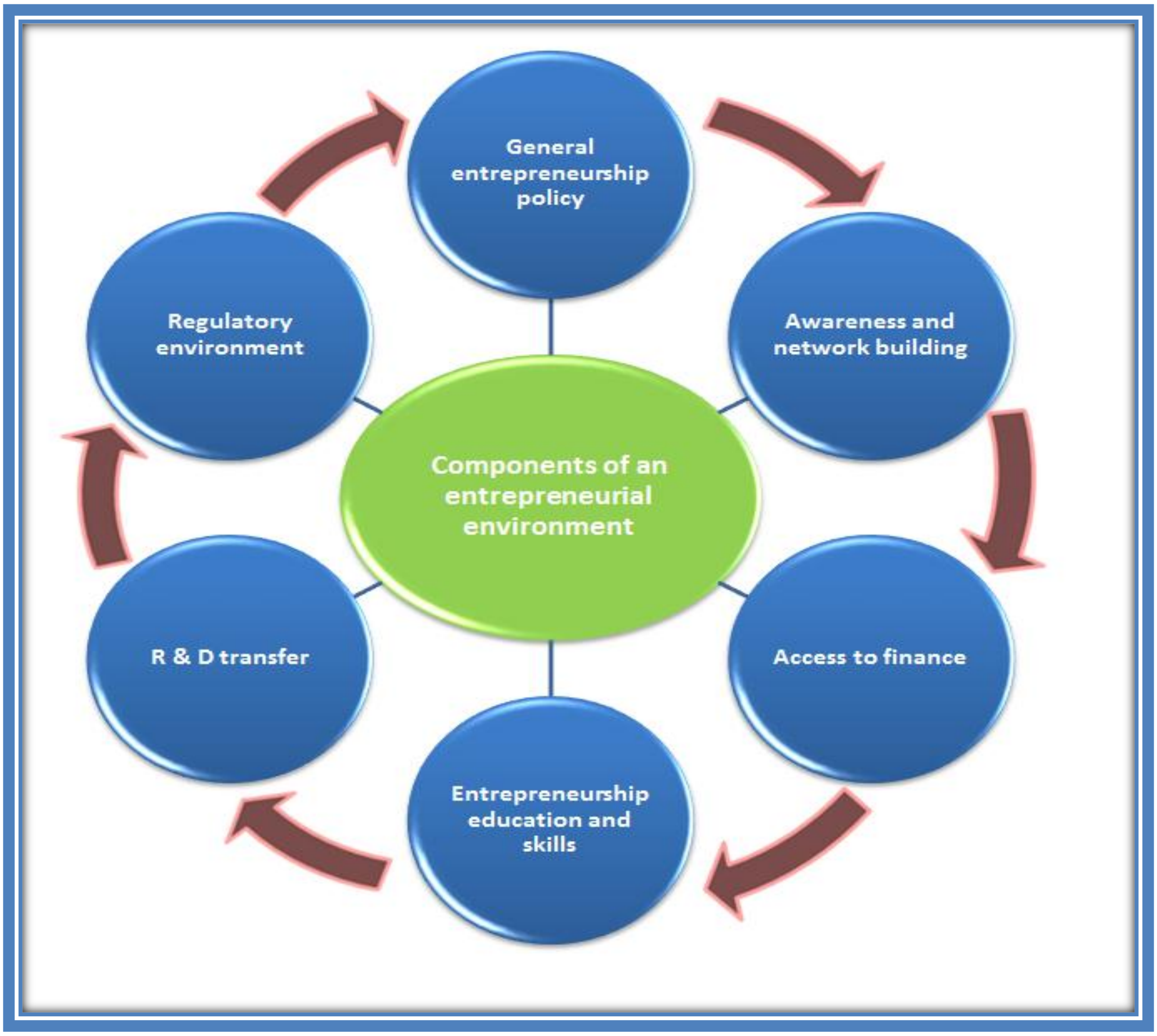
Lundström, et al. (2010) contend that components of an enabling environment are a collection of guidelines that set out the overall goals, objectives and principles, as well as the means and specific measures designed to achieve them. Clemensson and Christensen (2010) describe the term as including four elements, such the norms and values in a country with regards to entrepreneurship; the policy and legal regulatory framework in which enterprises operate; the administrative arrangements used to implement and enforce this framework; and lastly the organisations that promote, regulate and represent enterprises and their workers. For the purpose of this study, components of an enabling entrepreneurial environment are defined as modules aimed at the pre-start, start-up and early post-start-up phases of the entrepreneurial process. The components are designed to address the areas of encouraging entrepreneurial activity in the electricity industry. Thus the focus would be for the industry to consider entrepreneurship as an option; to move into the nascent stage of taking actions to start a business; and to proceed into the entry and early stages of the business through creating an enabling entrepreneurial environment (Lundström, et al., 2010).

The key components of an enabling entrepreneurial environment identified by EU-Africa Business Forum (2007) include the smooth flow of information; ease of starting a business and obtaining various clearances and permits; ease of filing taxes; an efficient legal system; enabling legislations and regulations; absence of corruption and world-class infrastructure facilities. For economic developers, such an enabling environment creates stimulation for economic development and therefore ensures a flourishing business climate. Thus, creating an enabling entrepreneurial environment is essential, as it acts as an important catalyst for entrepreneurs who seek organisational sustainability (Parrish and Foxon, 2009). Partnership with municipalities, private businesses, their state governments and other organisations, ensures that there is a sound and appropriate infrastructure necessary for businesses generally and for entrepreneurs in particular. Therefore, governments can become core partners in providing support and encouraging entrepreneurship with a vision of creating a stronger local or regional economy (Markley and Dabson, 2006).

In order for a country to grant the necessary support, the components of an enabling entrepreneurial environment need to be defined. The promotion of an enabling environment inspires and enables entrepreneurs to start and successfully grow their businesses in an effective and sustainable system (United Nations Conference on Trade and Development, 2009).

The components cited by the United Nations Conference of Trade and Development, (2009) for such an environment is discussed in Sections 3.4.1 to 3.4.6. For the purposes of this study, these components appear appropriate. These components include entrepreneurship policy, network building, access to finance, education and skills in entrepreneurship, research and development and a regulatory environment. Figure 3.9 depicts the components of an enabling entrepreneurial environment typically needed for good entrepreneurial practice.

Figure 3.9: General components of an enabling entrepreneurial environment.



Source: Lundström, Almerud and Stevenson, 2008: 42.

A discussion of each of the identified components for an enabling entrepreneurial environment follows.

3.4.1 Entrepreneurship policy

Lundström, et al. (2010) argue that entrepreneurship policy proves to be critical in an entrepreneurial environment. General entrepreneurship policy provides an enabling environment for entrepreneurship as it includes the existence of a national policy and institutional arrangements for implementing policies and monitoring mechanisms. A strong, regulatory environment driven by proactive policy measures seeks to reduce the administrative burdens related to company formation and failure. Laws regulating labour, taxation, international trade and investment, public procurement and commercial laws, also, should provide fair and transparent enforcement of competition, health, safety and environment regulations (Lundström, et al., 2008).

The entrepreneurship policy framework addresses six areas that have a direct impact on entrepreneurial activity namely: general entrepreneurship policy; awareness and network building; entrepreneurship education and skills; research and development R & D transfer and the regulatory framework (Lundström, et al., 2008).

The relevance of entrepreneurial components in the electricity industry is detailed by Haw and Hughes (2007). The authors state that although some of the local side effects of burning fossil fuels, such as thick smoke and respiratory problems, have been a global problem for some time, it was not until the end of the last century that attention was drawn to the fact that by burning fossil fuels and emitting greenhouse gases (GHGs), countries are contributing to a change in the planet's atmosphere and a resultant change in climate. This environment will thus provide the platform for network building, entrepreneurial activity and awareness as governments strive towards employing RE as an alternative form of electricity provision in the quest to lower carbon emissions (Haw and Hughes, 2007).

3.4.2 Network building

Globally, an awareness and network building process is necessary to support an entrepreneurial environment. Entrepreneurship is a process driven by entrepreneurial individuals and teams (GEM, 2011). Therefore the key to catalysing entrepreneurship is in people and networks. Too often, policy measures focus more on institutional arrangements and infrastructure, rather than on people and social networks. In order to facilitate entrepreneurial networks, it is important to identify local entrepreneurs and to help to connect them with others in the entrepreneurial ecosystem, widen the social base of capital, including access to entrepreneurial finance and to new entrepreneurs from communities not traditionally associated with business, especially from marginalised groups (Goswami, et al., 2008). Consideration of the provision of finance is a logical consequence of creating such opportunities.

3.4.3 Access to finance

Ready access to early-stage finance is often perceived as one of the biggest impediments for young and start-up entrepreneurs. Mason (2008) regards access to finance as the seed to start-up and nurture the early stage of the entrepreneurial process in which financing remains a major challenge for many entrepreneurs. It is a key factor in deciding whether to become an entrepreneur as well as in deciding the nature of the enterprise to promote (Goswami, et al., 2008). The market for RE technologies is quite young and its lack of maturity leads to higher volatility and thus to greater risk. Financial institutions will factor all these risks into their credit conditions, which will raise the cost of lending (Pegels, 2010c). In addition, a lack of competition among financial institutions may have led to reluctance to explore new fields of lending activity in the past. As there is consistently a lack of experience in RE projects, it is difficult for project developers to obtain funding on the private capital market (Pegels, 2010c).

The United Nations Development Programme (2004) states that innovative schemes are also needed to transform financial flows into long-term productive investment for entrepreneurs. The availability of affordable finance remains a barrier for RE investments, especially in developing countries such as South Africa. RE projects focus on understanding the nature of financial barriers so that effective barrier-removal efforts can be targeted (Barbut, 2009). Access to finance is more often than not the main barrier to the start-up and growth of a business for many SME's in all kinds of sectors. Obtaining the appropriate education and skills to allow an understanding of the sources of finance and how to overcome barriers to entry, such as accessing finance, need to be taken into account (Barbut, 2009). In some countries, IPPs have difficulty obtaining bank financing because of uncertainty as to whether utilities will continue to honour long-term Power Purchase Agreements (PPA) to buy the power. This proves of vital importance to the sustainability of entrepreneurs, to uphold the continuity of electricity supply which is an imperative in the electricity industry.

3.4.4 Entrepreneurship education and skills

The importance of education for social progress and economic development is undisputed. Adopting an approach in which the integration of entrepreneurship training at all levels (primary, secondary and tertiary) into the education system is encouraged, is desirable. The skills base is poor among entrepreneurs and those with lower literacy levels and income in remote rural areas (Department of Trade and Industry, 2013). Providing skills to entrepreneurs where innovation, cross-disciplinary approaches and interactive teaching methods are embedded, all require new models, frameworks and paradigms. Skill-building activities could range from programmes for top public and private leadership to training micro-entrepreneurs, to joint efforts with public authorities and unions to improve workforce skills (The United Nations Development Programme, 2004). Therefore the nature and role of education in catalysing entrepreneurship, including research and development, especially in the highly skilled and knowledge-driven sectors, is a topic requiring special attention (Goswami, et al., 2008).

Generating a critical mass of entrepreneurs who are oriented to high levels of growth depends on the quality of education provided and the presence of an environment that encourages innovation. Education is indispensable for skills development and is fundamental to entrepreneurship and innovation. The ability to innovate and generate commercially valuable new products and processes can only take place in environments that encourage experimentation and value addition (Goswami, et al., 2008). Critical entrepreneurial development and research enables entrepreneurs to stay abreast of growth in the electricity industry and in so doing, enables them to consistently improve their practice.

3.4.5 Research and development

By taking into account research and development transfer, entrepreneurship policies in this area seek not only to promote science and technology development, but also to promote their use and their transfer and diffusion into society and should be regarded as an integral part of broader policies. Policies can include: public investment in research and development and technology transfer; provision of incentives for private investment in research and development; technology acquisition and intellectual property protection. Haw and Hughes (2007) suggest that in a large, capital-intensive industry such as the energy industry, the government plays a vital role in planning and providing investment for power stations, transmission systems and research and development with specific focus on conventional and RE.

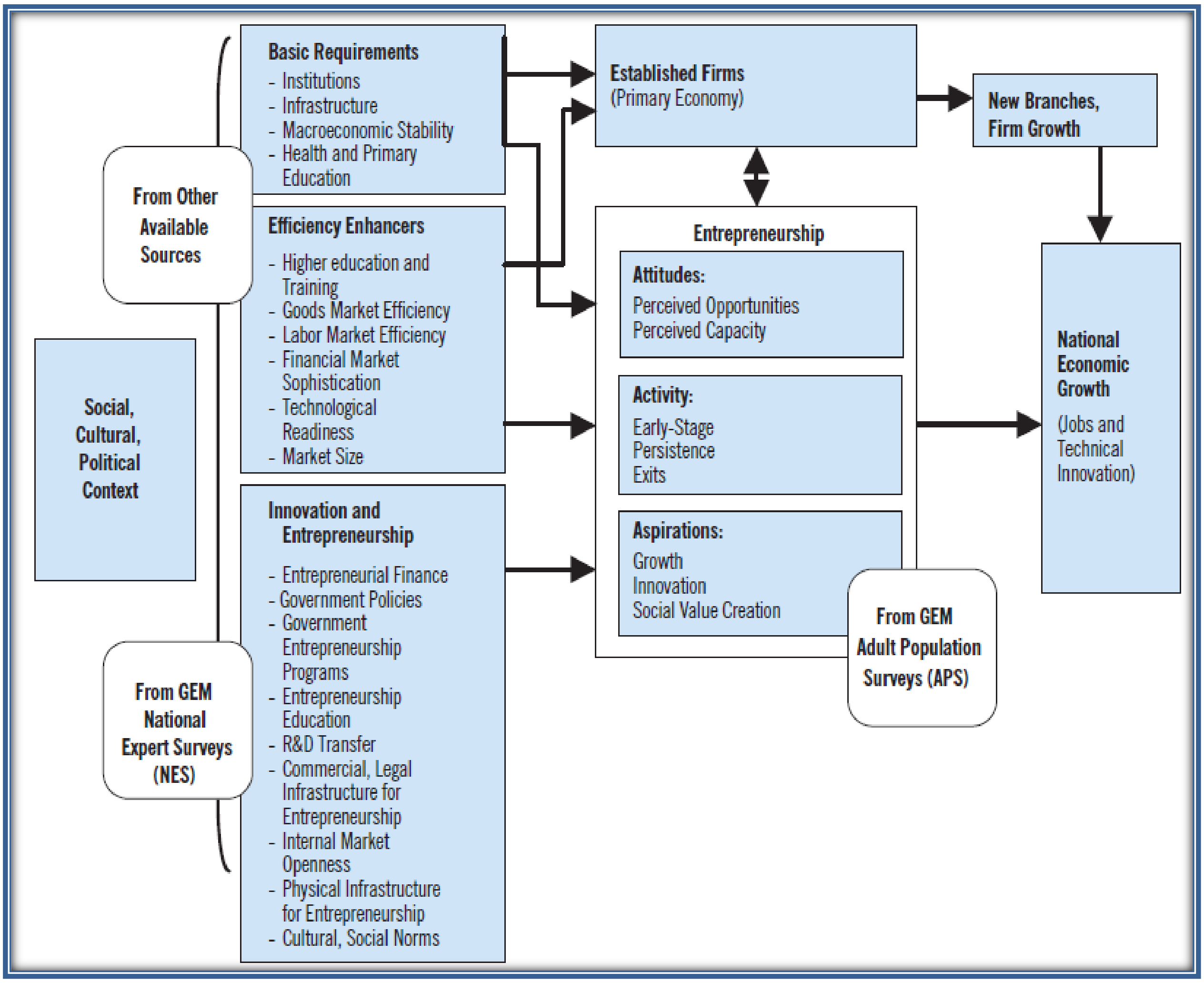
Dean and McMullen (2007) postulate that prior the legislation regulating utilities, small-scale producers of electricity encountered substantial resistance from monopolistic providers who controlled the distribution of power. The Public Utility Regulatory Policy Act of 1978 requires large utilities to purchase power from small-scale electricity producers and enables entrepreneurs to develop RE projects. However, it is argued that the inertial properties of large organisations in the industry, combined with regulatory systems that set rates based on costs, inhibit the development and implementation of an enabling environment for RE (Dean and McMullen, 2007). Enabling environmental reforms such as research and development are thus necessary to unleash the efforts of current and emerging entrepreneurs (Clemensson and Christensen, 2010).

Securing an enabling entrepreneurial environment is key to ensuring that entrepreneurship thrives. Beck and Martinot (2004) mention that available loan terms may be too short relative to the lifetime of equipment or investment.

The GEM model set out in Figure 3.10 below, documents how entrepreneurship is affected by national conditions. It also shows that GEM considers three major components of entrepreneurship as important: attitudes, activity and aspirations. This is done on the basis of the promotion of an environment that inspires and enables individuals to start and successfully grow their businesses and build an effective national system of innovation. GEM monitors entrepreneurial framework conditions in each country through harmonised surveys of experts in the field of entrepreneurship (GEM, 2011).

For the electricity industry, the innovation and entrepreneurship indicator proves appropriate for elements such as entrepreneurship programmes and entrepreneurship education. Pickering (2010) states that the designation of Eskom Power Utility as the single buyer of power from IPPs by the South African Government, is perhaps the only firm sign of Government's intentions pertaining to entrepreneurship programmes and its commitment to entrepreneurial education in the industry.

Figure 3.10: The GEM model.



Source: GEM, 2009: 41.

Beck and Martinot (2004) argue that for many countries, the electricity industry's power utilities still control a monopoly of electricity production and distribution. South Africa has imposed some restrictions on power in these circumstances, as with the current absence of a legal framework, IPPs may not be able to invest in RE facilities and sell power to the utility or to third parties under so-called PPA's (Beck and Martinot, 2004). Permission to legally connect a RE source to a grid depends on local government rules, regulations and policies. These policies both allow connection and determine how physical connection is to be achieved. In the U.S., the legal right to connect to the grid is provided for in federal laws such as the Public Utilities Regulatory Policies Act (PURPA) of 1978 and by state net metering statutes (Beck and Martinot, 2004).

The GEM (2009) states that there are components aimed at stimulating and supporting entrepreneurship activity. While these can be addressed at any stage of development, it must be emphasised that they function best with an underlying foundation of basic requirements and efficiency enhancers. For example, government entrepreneurship programmes will not be effective if inadequate health care and primary education weigh heavily on the populace. Innovation-driven economies that have built relatively sophisticated, basic requirements and efficiency enhancers, however, can direct their attention toward enabling these entrepreneurship programmes (GEM, 2009).

3.5 PROPOSED COMPONENTS OF AN ENABLING ENTREPRENEURIAL ENVIRONMENT IN THE RE SECTOR

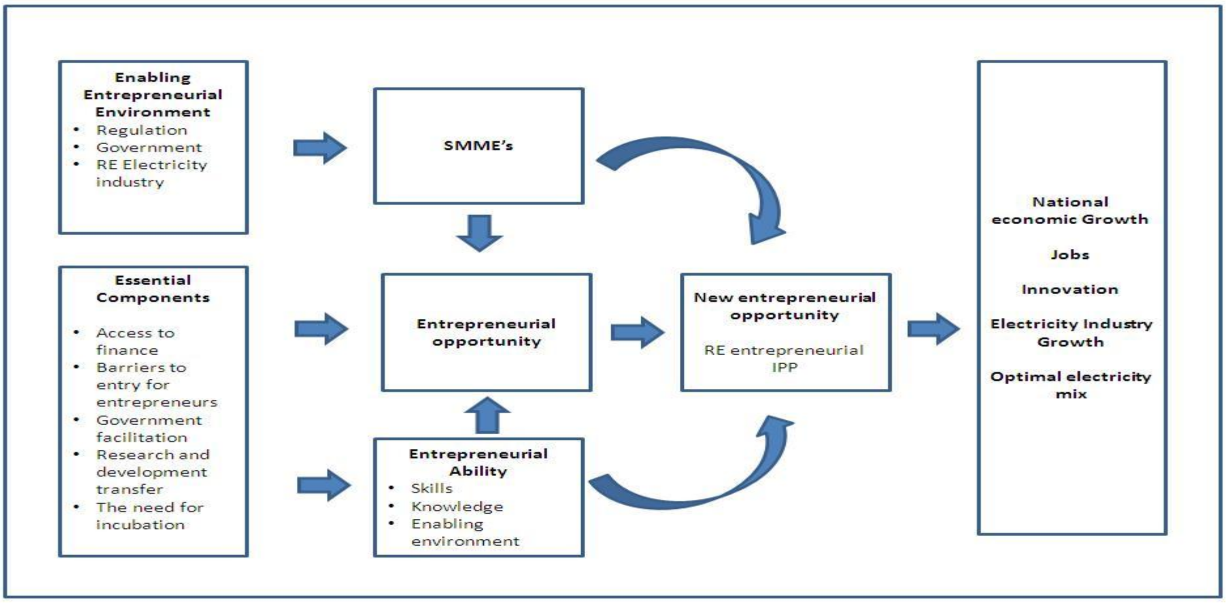
The entrepreneurship arena is dynamic and its changing nature has intensified the need to ensure that an enabling environment is established for entrepreneurs. This enabling entrepreneurial environment is fashioned by providing essential components needed to seize opportunities and advance the economy in a country. Developed countries have supported developing countries and economies in transition by relaxing their regulations to RE generation (Barbut, 2009). IPPs have facilitated RE generation through the process of entrepreneurship.

The creation of an enabling environment that is conducive to entrepreneurship is thus a far more complex undertaking than just providing the basic market institutions (United Nations Industrial Development Organization, 2008). This has been proven by the failure of orthodox, structural entrepreneurial programmes. It is therefore doubtful whether reform envisaged in the electricity industry, with despite great market optimism, can solve the structural problems of private sector development. The question remains, in creating an enabling environment for IPPs, would entrepreneurial activity in the RE sector of the electricity industry flourish?

Dean and McMullen (2007) state that the key to achieving an enabling entrepreneurial environment lies in overcoming barriers to the efficient functioning of markets for environmental resources. However, the unique characteristics of many environmental resources do not tend to be easily amenable to market allocation. Environmental entrepreneurs create and improve markets for such resources through entrepreneurial action that results in the development of property rights and economic institutions, the reduction of transaction costs, the dissemination of information and the motivation of government action (Dean and McMullen, 2007). As a consequence of the resulting development of markets, entrepreneurs can profit from the economic value created while reducing environmental degradation and enhancing ecological sustainability.

The process will thus provide entrepreneurs with an enabling environment at the start-up stage of the development of an organisation, to help reduce the cost of launching the enterprise, increase the capacity of the entrepreneur and link the entrepreneur to the resources required to start a competitive enterprise (Khalil and Olafsen, 2009). The proposed components of an enabling environment provided in Figure 3.11 are relevant to the RE sector and are discussed in Sections 3.5.1 to 3.5.5.

Figure 3.11: Proposed components needed for an enabling entrepreneurial environment in the RE sector.



Source: Own construction, 2014.

3.5.1 Access to finance

Ready access to early-stage finance, especially seed capital, serves as a key factor toward creating a favourable entrepreneurial ecosystem. Financial consideration is indispensable in deciding whether to become an entrepreneur as well as in deciding the nature of the enterprise to promote (Goswami, et al., 2008). In terms of access for younger generation entrepreneurs and IPPs, Lamb (2006) theorises that the concerns of IPPs most often cited by government are relatively high construction costs which make initial entry into the industry difficult.

Lamb (2006) believes that to improve the entrepreneurial process, access to financial assistance needs to be prioritised. Financial and regulatory institutions should create a more favourable environment that supports entrepreneurs financially.

3.5.2 Barriers to entry for entrepreneurs

The need for enacting policies to support RE is often attributed to a variety of barriers or conditions that prevent investments from occurring. Often the result of barriers is to put RE at an economic, regulatory, or institutional disadvantage relative to other forms of energy and ultimately to the electricity supply. Barriers include subsidies for conventional forms of electricity, high initial capital costs coupled with lack of fuel-price risk assessment, imperfect capital markets, lack of skills or information, poor market acceptance, technology prejudice, financing risks and uncertainties, high of transactions and a variety of regulatory and institutional factors (Dean and McMullen, 2007).

Ideally, it appears that investors in IPPs, whether national or international, would like to have the ability to enter or exit new or existing projects with a minimum of transaction costs. Business organisations have also argued that excessive regulation of entry and exit forms a key barrier to private investment (Lamb, 2006). Many of these barriers could be considered market distortions that unfairly discriminate against RE, while others have the effect of increasing the costs of RE relative to the alternatives. Barriers are often quite situation-specific in any given region or country (Beck and Martinot, 2004).

3.5.3 Government facilitation of entrepreneurship

Providing start-up resources to entrepreneurs may be regarded as imperative in facilitating entrepreneurship. Government facilitation implies assessing the process of ease of starting a business and monitoring the impact of new IPP agreements in the RE sector. Some entrepreneurs believe that while the government has some very significant policies to help entrepreneurs, the implementation of these policies is extremely poor (Goswami, et al., 2008).

General entrepreneurship policy provides the enabling environment for entrepreneurship. It includes the existence of a national policy and of institutional arrangements for implementing policies and monitoring mechanisms. Policymakers need to be clear about the type of entrepreneurship they would like to encourage and segment policies appropriately (United Nations Conference on Trade and Development, 2009). Policies should have clear objectives and specific targets for facilitating entrepreneurship. Therefore, the ideal would be the introduction of environmental protection measures for RE initiatives and the incorporation of IPPs into the sector.

According to the GEM (2011b), in South Africa, national experts are of the opinion that although some government policies (e.g. the new Companies Act, BBBEE Act 53 of 2003) are contributing to creating a supportive environment for entrepreneurial activity, the country still faces its challenges with facilitation. Furthermore, the area of government policy emerged as the second-highest ranked factor facilitating entrepreneurship – second to education. For entrepreneurs the rule of law provides the foundation for a predictable regulatory framework and capacity to govern transactions between private parties (Krutzinna, Nenshi, Risz and Sobhani, 2004).

According to Dean and McMullen (2007), entrepreneurs must overcome the legal restrictions to entry into statutory monopolies (those resulting from government restriction of competition). In the case of natural monopolies (those resulting from large economies of scale relative to total demand or anti-competitive behaviours) entrepreneurs must develop efficient, small-scale production technologies or overcome other market barriers. The authors refer to entrepreneurs who break the monopoly positions of existing organisations as market -appropriating entrepreneurs because they appropriate part of the market from the incumbent organisations (Dean and McMullen, 2007).

The electricity industry provided a similar example in both its history and current state. Prior to the Public Utility Regulatory Policy Act, small-scale producers of electricity encountered substantial resistance from monopolistic providers who controlled the distribution of power. The act required large utilities to purchase power from small-scale electricity producers and enabled entrepreneurs to develop hydroelectric and other RE projects (Dean and McMullen, 2007).

3.5.4 Research and development transfer

Dean and McMullen (2007) recognise different forms of sustainable entrepreneurship as responses to different types of market failures. Market development is important, but sustainable development requires interplay between market and institutional developments.

Policy measures in this area should seek to reduce the administrative burdens related to company formation and failure. At the same time, it relates to labour, taxation, international trade and investment, public procurement and commercial laws. Research and development should thus provide fair and transparent enforcement of competition, health, safety and environment regulations (United Nations Conference on Trade and Development, 2009). In addition, developing countries often need technological catch-up (or to 'leap frog', where the opportunities present themselves) and upgrading, as opposed to commercialisation of new technologies.

3.5.5 The need for business incubation

At the start-up stage, the entrepreneur is beset with significant challenges of marketability and resources (financial and otherwise), which successful incubation can help to address. In order to meet these new challenges of widening scope and scale of business and rapidly changing technology, it is expected that Business Incubation for Entrepreneurship (BIE) will further develop the entrepreneur in this regard (Goswami, et al., 2008). BIE is a key contributor to developing an enabling entrepreneurial environment. Historically, 87% of incubates stay in business (Lewis, Harper-Anderson and Molnar, 2011). This provides high credibility to incubation as a key entrepreneurial enabler in start-up businesses.

The process of BIE is a critical, organisational support mechanism for fledgling entrepreneurs in the initial stage. The quality and scale of BIE could become one of the most important tools to enhance the entrepreneurial ecosystem. A typical Business Incubator (BI) provides services to a budding entrepreneur such as: physical infrastructure, administrative support, management guidance, help in the formulation of a business plan, technical support, Intellectual Property (IP) advice and access to finance and networking (Goswami, et al., 2008).

According to Szirmai, Naudé and Goedhuys (2011), there is no guarantee that an incubator will succeed in fostering innovation and the creation of a sustainable innovative organisation. However, to maximise the chances of success, the authors propose the specifications of good incubator policy namely: clarity of purpose; clear entry and exit criteria; incubator management skills; monitoring and evaluation of participating organisations; strategic selection of services; minimisation of start-up costs; promotion of networking and finally financial sustainability. Incubators should eventually become financially self-sustaining (Szirmai, et al., 2011). Incubators should advance into graduate entrepreneurs becoming self-sufficient in the market.

In South Africa, an attempt is being made to address business incubation as the country is credited with the best regional performance in the following areas: the cost of starting a business, dealing with construction permits, getting credit and protecting investors (GEM, 2011). The report also notes the following salient findings with regard to starting a business in South Africa: It takes approximately six procedures and 19 days to start a business. The process of starting a business has been made easier with the implementation of a new company law, which removed the requirement to reserve a company name and simplified the incorporation documents (GEM, 2011).

The global electricity industry is under threat as more pressure is exerted on power utilities because of a spiralling supply and the demand for cleaner, more environmentally friendly generation. Although the means establishing of IPPs is still in its infancy stage, the electricity industry is yet to provide an enabling environment for entrepreneurs to flourish in. By providing an environment whereby essential components are set ingredients for the success of such entrepreneurs, a good base towards sustainable entrepreneurship should be ensured. These essential components not only provide guidance to entrepreneurs, but clearly, businesses alone cannot bring about sustainability without key components that assist entrepreneurs in creating an enabling environment.

3.6 SUMMARY

The problem experienced by entrepreneurs globally and especially in South Africa is that they are not in the position to sustain their businesses within the first two years. As a result, young entrepreneurs find their businesses struggling within the first two years of operations (Dean and McMullen, 2007). This proves no different for the electricity industry, with fewer opportunities and having to arm-wrestle with the big utility Eskom where continuity and quality of supply remain key imperatives.

In Chapter 3 the components of enabling entrepreneurial environment supporting IPPs in the electricity industry were outlined. Particularly, Section 3.2 conceptualises and defines entrepreneurship while, Section 3.3 concentrated on entrepreneurship and ecopreneurship in the electricity industry. Section 3.4 outlined components for an entrepreneurial environment and Section 3.5 focussed on the proposed components of an enabling entrepreneurial environment in the RE sector.

Studies indicate that there are general components aimed at stimulating and supporting entrepreneurship activity (GEM Global Report, 2010). The researcher identified these components in Section 3.4 as:

- Entrepreneurship policy;
- Network building;
- Access to finance,
- Entrepreneurship education; and
- Skills and research and development.

In a detailed diagram (Figure 3.9), the chapter indicated the proposed components needed for entrepreneurs in the electricity industry as: access to finance; removal of barriers to entry to IPPs entrepreneurs; government facilitation of entrepreneurs, research and development transfer and business incubation to create the enabling entrepreneurial environment necessary in the RE sector.

Typical challenges of a lack of an entrepreneurial culture in many countries include: unfavourable legal, policy and regulatory frameworks; the lack of entrepreneurship education across formal and informal educational systems; the lack of access to affordable financing in the form of start-up; and little knowledge about and access to relevant business development services and support schemes in the RE industry. These are components needing to be prioritised in the quest towards and enabling an entrepreneurial environment.

An enabling entrepreneurial environment will aid entrepreneurs known as IPPs in the electricity industry to uphold the key imperative of innovation thus contributing to South Africa's RE targets and a better energy mix with growing electricity demand (Lamb, 2006).

The research question addressed in this chapter is*: RQ_2. What are the components of an enabling entrepreneurial environment?* The International and National power Grid models were addressed in Chapter 2. In the following chapter the RE resources available will be discussed. The chapter will further focus on the challenges experienced in the electricity industry pertaining to electricity sources and explore the feasibility of alternative electricity sources.

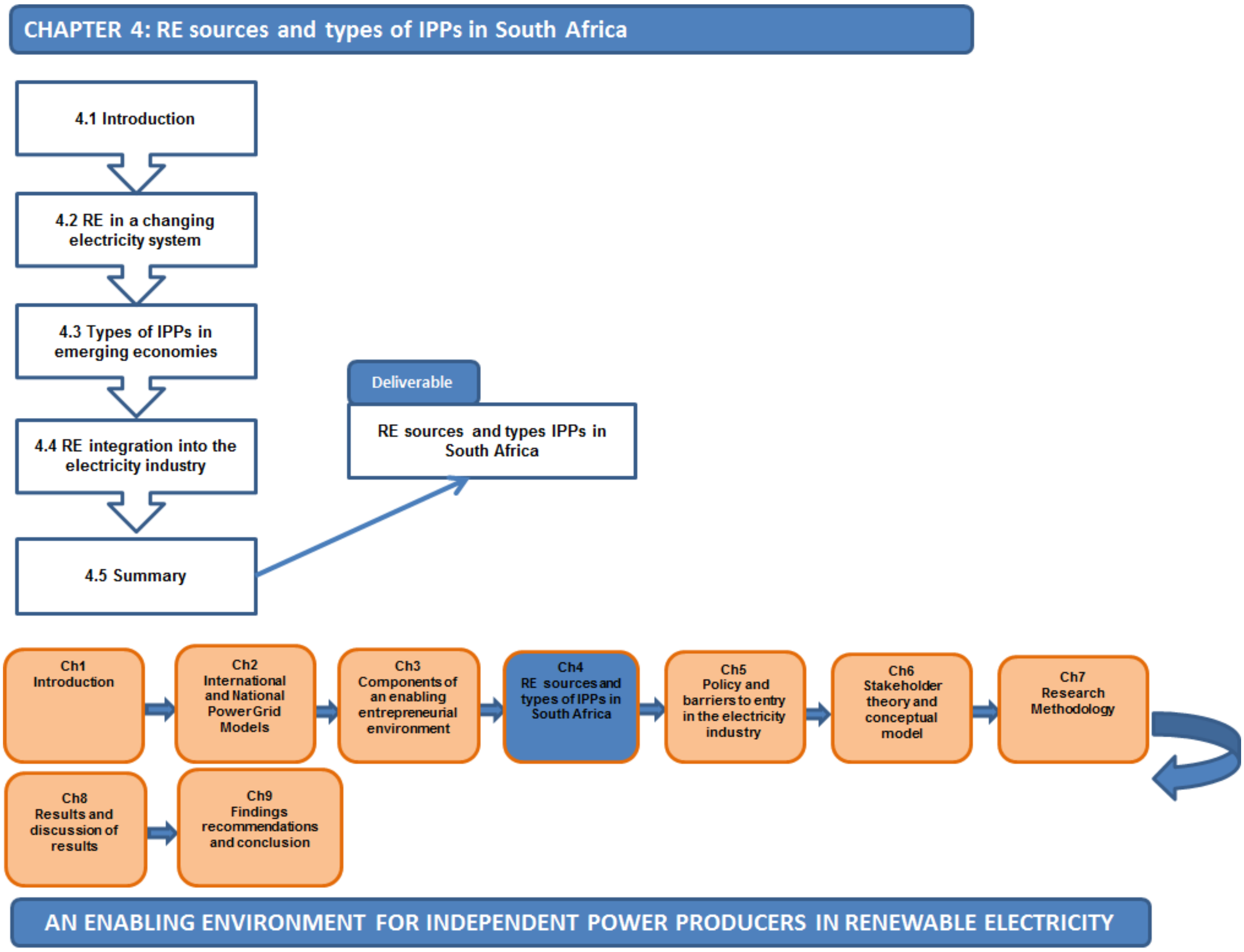


Figure 4.1: Outline of the chapter.

CHAPTER 4
RE SOURCES AND TYPES OF IPPS IN SOUTH AFRICA

"Even disregarding the real and imminent threat of climate change we find compelling reasons to be looking at a shift from fossil fuel based energy to alternative, renewable energy, together with better management of our energy usage" (Saliem Fakir, 2009)

4.1 INTRODUCTION

In Chapter 3 the concepts and nature of entrepreneurship and ecopreneurship in the RE sector were investigated. In particular, IPPs as electricity industry entrepreneurs, entrepreneurial opportunities in SA and the proposed components of an Enabling Entrepreneurial Environment in the RE sector were highlighted.

The development of the electricity industry, throughout more than twelve decades of its existence, has traditionally been accorded a high priority by most countries in the world (Rabbitte, 2012). This importance is likely to grow in the years to come as the world becomes more reliant on electricity daily. Growing concerns about electricity security and climate change have heightened interest in harnessing RE sources as a response to these critical concerns. Consequently, the successful integration of RE generation into large power utilities has become fundamental to addressing climate change and concerns about the security of the electricity supply (Outhred, 2007a).

A variety of technology options are on the table to mitigate emissions from the electricity system in the coming decades. Amongst the most discussed sources are nuclear and an increase in variety of RE sources such as wind, solar (solar thermal and photovoltaic (PV)) and hydro power (Battaglini, Lilliestam and Haas, 2008). Increased focus is on the potential contribution of RE and the path to achieve a more sustainable energy mix for large power utilities and lower carbon emissions (Banks and Schäffler, 2006). Both low-carbon electricity production and the expansion of electricity services and mix can be achieved by the increasing the use of RE sources and in so doing, address climate change concerns (Schwan, 2011).

The objective of this chapter is to identify sources of RE and the types of IPPs complementing the relevant sources. A mix of solar, hydro and wind alternatives needs to be added to the grid as new RE technology unfolds. Larsen and Russo (2010) further contend that the optimal mix of RE and conventional electricity is of vital importance to the electricity grid. Since the grid is made up of everything from power lines to generators to the meters in homes and still runs on century-old technology, alternative forms of electricity generation become a focus point. Existing electricity technology wastes too much energy; it costs too much money and is susceptible to outages and blackouts (Larsen and Russo, 2010). Securing the electricity supply through the optimal electricity mix relates most obviously to RE as a sustained move towards greater diversity but the move requires more than a single technology option or energy source (Winkler, 2005).

Notably, in South Africa, the electricity industry has been given high priority by the country's policymakers and planners (Department of Minerals and Energy, 2013). As the government is committed to the introduction of greater levels of competition in electricity markets, it is a given that the promotion of RE will contribute significantly towards a more sustainable and secure electricity mix. In doing so, the ideal is for government to create an enabling entrepreneurial environment to facilitate the introduction of IPPs that generate electricity from RE sources. To complement these reforms, increased investment by the private sector in RE, specifically IPPs, the commercialisation and local manufacturing of RE technologies should be encouraged (Department of Minerals and Energy, 2013).

At present, RE contributes relatively little to primary generation and even less to the consumption of commercial electricity, however, it could significantly contribute to small power users (Winkler, 2005). The theoretical potential for RE in countries such as South Africa is significant, therefore exploring renewable forms of electricity sources is of the utmost importance in making a contribution to the welfare of the environment. Thus, investment in RE and energy efficiency becomes critical to reduce the negative economic, social and environmental impacts of electricity production and consumption (Nathwani and Chen, 2012).

Woodhouse (2005b) states that emerging countries such as South Africa rely heavily on coal to meet their energy needs. It is a relatively low-cost means of supplying electricity to many residential, commercial and institutional consumers. However, because the concerns about the use of fossil fuels and global warming are being raised, the need to utilise RE sources more has been recognised. An Integrated Energy Plan (IEP) to develop the RE sources, while taking safety, health and the environment into consideration has been initiated in South Africa (Glazewski, 2004). This chapter is therefore addressing the third and fourth research questions and research objectives (RQ_3, RQ_4; RO_3, RO_4).

The research questions addressed in this chapter are:

- *RQ_3 – What RE sources are available that IPP entrepreneurs can utilise in the RE sector?*
- *RQ_4 – What type of IPPs are required in the South African electricity sector?*

The research objectives addressed in this chapter are:

- *RO_3 - To identify RE sources applicable to increased IPP entrepreneurial activity.*
- *RO_4 - To determine and describe the type of IPPs in the South African electricity sector.*

The purpose of this chapter is to identify sources of RE and the types of IPPs complementing the relevant sources. This chapter discusses prime RE sources in South Africa and outlines the type of IPPs that are required in the South African electricity industry.

Figure 4.1 outlines the chapter as follows: Section 4.2 introduces a discussion on RE sources in a changing electricity system and in Section 4.3 the types of IPPs in emerging economies are presented with specific emphasis on opportunities, access to the sector and accessibility to the industry. Current opportunities in the electricity industry and needs will be examined and a guide towards RE integration into the electricity industry provided (Section 4.4). Figure 4.1 outlines the chapter with the sections above. A summary of this chapter is provided in Section 4.5.

4.2 RE IN A CHANGING ELECTRICITY INDUSTRY

Electricity is and will be a growing industry as energy usage continues to be used more in the heating, cooling and transport sectors (Rabbitte, 2012). Growing apprehensions about climate change have intensified interest in harnessing RE resources as a response to this fundamental challenge. RE can contribute to the reductions in air pollution, with co-benefits of reducing greenhouse emissions which can contribute to climate change (Winkler, 2005). RE will therefore be a critical and growing component of the global energy supply to 2020 and beyond. Winkler (2005) posits that investment in RE and energy efficiency is important to reduce the negative economic, social and environmental impacts of electricity production and consumption.

Most of the world's electricity grids were built when energy sources were relatively inexpensive. While minor upgrades have been made to meet increasing demand, the grid still operates the way it did almost 100 years ago. Electricity flows over the grid from central power plants to consumers and reliability is ensured by maintaining excess capacity (Frye, 2008). Methods of producing and using electricity have environmental and health effects that increasingly endanger welfare and the key challenge is to move to a cleaner electricity supply and more efficient use of electricity, while continuing to extend affordable access to modern electricity services (Winkler, 2005).

Brussels (2008) theorises that in order to achieve the energy policy goals of sustainability, security of supply and improved competitiveness, while caring for the environment, the production of RE should be promoted. The fundamental reason for using RE is that it is, precisely, renewable (Winkler, 2005). For this reason, there is a need for more efficient and effective regional power markets, which not only provide predictability and stability for participants, but also create a level playing field for renewables entering the market (Schellekens and Finlay, 2010). Large scale penetration of intermittent renewables into the market is expected to have profound implications on many aspects of planning, operation and control, as well as on the corresponding regulation of power systems. Countries with substantial volumes of these technologies are already experiencing noticeable impacts on the operation and economics of their power systems (Pérez-Arriaga and Batlle, 2012).

The expansion of RE towards power generation stems from the persistence of supportive policy and market frameworks as well as from increased economic attractiveness for renewable technologies in an increasing range of countries and circumstances. Moreover, technology cost developments, grid and system integration issues and the cost and availability of financing will also weigh in as key variables (IEA, 2012). Ottinger (2005) contends that RE sources need priority because:

- The overwhelming scientific evidence that emissions of greenhouse gases from carbon combustion threaten catastrophic results arising from rapid climate change;
- The severe health and environmental consequences being experienced in every major city of developing countries from the combustion of fossil fuel
- The high cost, environmental damage and security threats of other alternatives such as nuclear power; and
- The continuity of supply challenges the electricity industry is facing.

Socolow (2012) cites that coal power is the most carbon-intensive form of power production. Existing electricity systems are heavily based on fossil energy sources, coal being the most dominant. Given the strong demand for energy in emerging markets, it stands to reason that current energy systems need to change (Battaglini, et al., 2008). Current statistics as recorded by the World Coal Association (2011) show that coal is still the most used source for electricity production in most countries as shown in Table 4.1 with South Africa being one of the leading countries.

Table 4.1: Percentage coal utilisation for electricity production.

South Africa	93%	Kazakhstan	70%	Morocco	55%
Poland	90%	India	69%	Greece	55%
China	79%	Israel	63%	USA	45%
Australia	76%	Czech Rep	56%	Germany	44%

Source: World Coal Association, 2011: 5.

Because of the above factors, ensuring the continuity of the electricity industry depends on reform. The IEA (2012) states that more than ever, the need for a fundamental shift to a cleaner and more reliable electricity supply system is clear. Countries need to adopt technological solutions and policy measures, such as targets to stabilise and reduce greenhouse emissions. Global temperature would otherwise continue to increase, having severe impacts on the environment (Nathwani and Chen, 2012). The question remains: What technologies can make that reform happen?

4.2.1 Continuity and reform for the electricity industry

Winkler (2006) contends that a sustained move towards reform in the electricity industry requires greater diversity of energy sources and more than single technology options. Reform in the electricity industry through the integration of RE resources cannot be solved in isolation from the other challenges facing modern electricity industries. A co-ordinated effort is needed in the electricity industry to ensure that concepts are complementary and must co-exist in order to guarantee a transition to a cleaner electricity industry (Battaglini, et al., 2008). Therefore, countries are undertaking processes to restructure the electricity industry which involves dismantling of formerly vertically integrated monopoly supply utilities and the introduction of competition and enhanced end user participation (Outhred, 2007a).

Frye (2008) states that governments and regulators, utility companies and technology organisations are rethinking how the electricity grid should look. Already, utility companies and governments around the world are launching efforts to:

- Increase distributed RE power generation to increase the electricity supply without additional greenhouse gas emissions;
- Use plug-in hybrid electric vehicles (PHEVs) to generate and consume electric power intelligently;
- Scrub and store the carbon from coal plant emissions;
- Use demand management to improve energy efficiency and reduce overall electricity consumption; and
- Monitor and control the energy grid in near-real time to improve reliability and utilisation, reduce blackouts and postpone costly new upgrades.

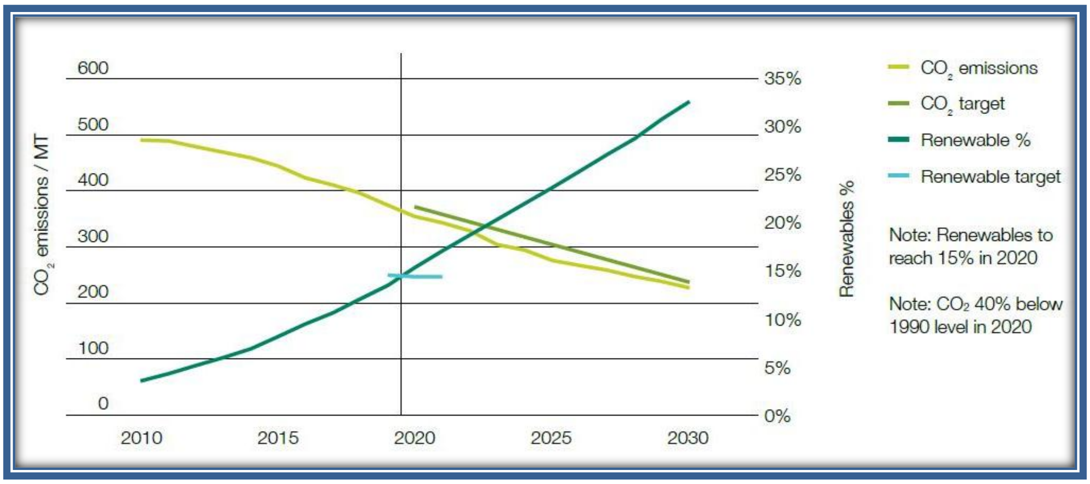
Achieving a reduction in the dependence on coal and imported oil will require that energy planning be considered in a similar light to national security (Worthington and Tyrer). Reduction of the dependence on conventional energy is inevitable over the long-term, but will be at far greater cost and with little prospect of a just distribution of costs and benefits, If countries do not plan for it opportunities and resources may not be within reach to reform the electricity industry in the future (Banks and Schäffler, 2006).

While RE remains generally more expensive than conventional sources, economic incentives play a large role in leading technologies to become increasingly attractive in the electricity industry (IEA, 2012). Worthington and Tyrer state that growth in electricity demand is not the only reason to consider alternative supply options. The current electricity supply world-wide is primarily coal-based and although these sources will last for more than a century if used at current rates, large power plants will need to be replaced over the next thirty years.

Worthington and Tyrer (2010) further argue that coal has many other uses and the need to conserve this resource for future use is imperative as these fossil fuels, including oil, produce carbon dioxide when burned to produce energy. It is now widely accepted that climate change, partially caused by human-generated carbon dioxide, represents an extremely serious environmental threat to the world as a whole. With the global average temperature increasing by 2C° per industrial level, this is an increase widely considered enough to avoid (Battaglini, et al., 2008).

Becker and Fischer (2012) posit that reform in the electricity industry through greening of emerging economies is particularly important and challenging. First, economic growth is strongly correlated to electricity demand, which entails the danger of greater fossil fuel dependence, but also gives the chance to introduce the deployment of RE. Second, emerging countries have limited capacities to respond to major external shocks. RE sources can play a major role in managing energy-related environmental impacts such as local environmental issues, thus securing the electricity supply through a more diverse energy source mix, a goal that perhaps relates most obviously to RE (Battaglini, et al., 2008).

Figure 4.2: CO_2 emissions and percentage of RE.



Source: Smith, 2011: 15.

Figure 4.2 illustrates the potential of RE and the effect a diverse energy mix will have on the reduction of CO_2 emissions. As RE production and use increases, CO_2 emissions decline. Countries that are being contracted to RE targets would further necessitate the need for a more diverse energy mix in electricity generation. It stands to reason that a considerable number of conventional power plants will have to be replaced over the next years. This change provides an opportunity to develop a sustainable electricity supply through the systematic phasing out of conventional electricity sources such as coal (German Advisory Council on the Environment, 2012).

4.2.2 Phasing out conventional electricity sources

With most economies founded upon and maintained by conventional electricity sources by the burning of fossil fuels, the world faces critical choices around future power generation (Worthington and Tyrer, 2010). Fossil-fuel based electricity production is one of the largest industrial sources of carbon dioxide, a primary greenhouse gas linked to climate change. It is also a major source of pollutants including nitrous oxide, sulphur dioxide, mercury and particulate matter. Most of the world’s electricity is provided by coal-fired power stations, the highest energy-producing polluters in the world (Worthington and Tyrer, 2010).

An integrated energy policy should synchronise the phasing-out of conventional electricity sources with the expansion of renewables. It will be helpful that the further expansion of renewables and a regime of more stringent global regulation of emissions driven by trading will result in a decreasing economic attractiveness of new coal-fired power plants (German Advisory Council on the Environment, 2012).

Over the past decade, however, close to 50% of new global electricity demand was met by coal (as depicted in Table 4.2). The need for this trend to be quickly reversed remains in order to successfully reduce industry carbon emissions and have any chance of meeting the RE objectives. Coal remains the largest source of global power generation and supplies the largest share of additional electricity demand worldwide over the past decade (IEA, 2012).

Table 4.2: World primary energy demand by fuel.

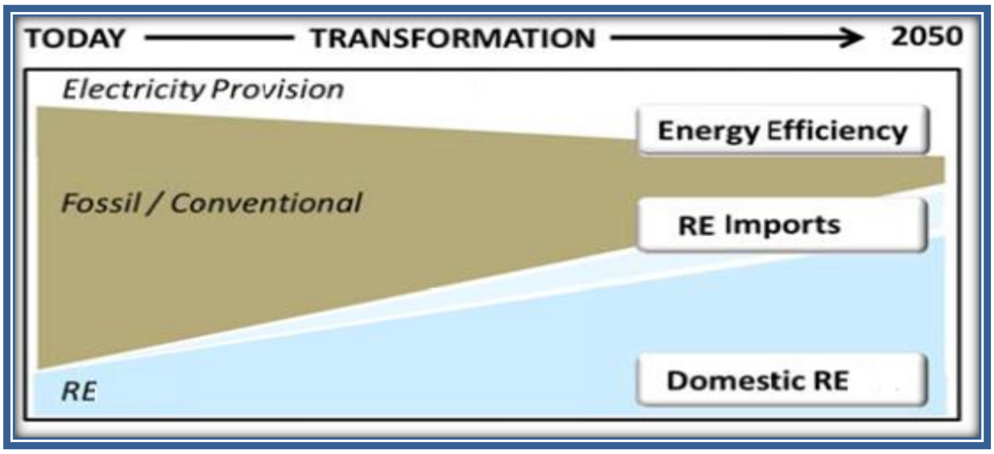
	1980	2008	2015	2020	2030	2035	2008-2035*
Coal	1 792	3 315	3 892	3 966	3 984	3 934	0.6%
Oil	3 107	4 059	4 252	4 346	4 550	4 662	0.5%
Gas	1 234	2 596	2 919	3 132	3 550	3 748	1.4%
Nuclear	186	712	818	968	1 178	1 273	2.2%
Hydro	148	276	331	376	450	476	2.0%
Biomass and waste**	749	1 225	1 385	1 501	1 780	1 957	1.7%
Other renewables	12	89	178	268	521	699	7.9%
Total	7 229	12 271	13 776	14 556	16 014	16 748	1.2%

Source: IEA, 2010: 23.

The electricity industry is expected to contribute more than one-third of the reduction of potential CO_2 emissions worldwide by 2020 and almost 40% emissions savings by 2050 (IEA, 2012). Figure 4.3 depicts that enhanced power generation efficiency, a switch to lower-carbon fossil fuels, nuclear power and the increased use of renewables are all required to achieve this objective. The German Advisory Council on the Environment (2012) argues that special measures to accelerate the shutting-down of old power plants will not be needed since, due to the priority feed-in of renewables, the latter are expected to cover the residual load, to an increasing extent. Owing to the long transition periods, there is a considerable scope for planning an environmentally acceptable structural change of electricity supply.

It is believed that during the period of transition to renewable sources, there is no need to extend the service life of nuclear power plants. The expansion of renewables and the flexible reserves of the existing, conventional power plants will suffice to meet the electricity demand, i.e. there is no reason to fear that a gap in electricity supply might arise (German Advisory Council on the Environment, 2012). RE will support existing electricity generation rather than replacing conventional electricity generation in the form of coal and nuclear energy.

Figure 4.3: Transformation of the electricity industry.



Source: Schmid, Pahlea and Knopfa, 2011: 21.

Similarly, South Africa is at a crossroads with regard to energy sources utilised for electricity generation. With an economy founded upon and maintained by the burning of fossil fuels, in particular coal, South Africa faces critical choices around future power and specifically electricity generation (Worthington and Tyrer, 2010). The need for increased electricity capacity to meet electricity demand coincides with growing awareness of the short- and long-term implications these decisions will have on the South African economy, society and the environment at large. The introduction of extensive RE technologies and the use of RE and conventional electricity generation, termed the 'power mix', offers great opportunities for local job creation and for making the best use of the available natural resources (Worthington and Tyrer, 2010).

Pegels (2009) indicates that the South African electricity industry forms a vital part of the economy and at the same time contributes most to the problem of emission. Transforming this industry is therefore urgently needed, but it will be difficult. The first steps have been taken to promote the efficiency of electricity use and promote RE. Challenges however exist, for large-scale change to take effect. Renewables are the fastest-growing source of world energy, with consumption increasing by 2.8% per year (Sein, 2010). Relatively high projected oil prices, as well as concern about the environmental impacts of fossil fuel use and strong government incentives for increasing the use of renewables, improve the prospects for the use of RE sources worldwide in the future (IEA, 2011).

4.2.3 RE sources for electricity generation

Energy-related activities are the major source of carbon emissions and for this reason, the provision of electricity from renewable sources requires priority through the extension of energy sources. According to Schwan (2011), the development mechanisms that remove barriers to RE programmes and promote low-carbon development are needed. The integration of RE sources thus cannot be solved in isolation from the other challenges facing modern electricity industries (Bull and Kelly, 2007). Moreover, many countries are undertaking the restructuring of the electricity industry, which involves disaggregation of former, vertically integrated monopoly supply utilities and the introduction of competition and increasing end user participation in the form of IPPs (Bull and Kelly, 2007). In the next section the types of RE sources will be outlined. The most important electricity sources for the RE sector are solar and wind (Outhred, 2007a).

4.2.3.1 Solar

Apt, Lave and Pattanariyankool (2008) claim that the most popular RE source with electricity users is solar power and this is either PV or solar thermal power. According to Timilsina, Kurdgelashvili and Narbel (2011a), solar energy has experienced an impressive technological shift. While early solar technologies consisted of small-scale PV cells, recent technologies are represented by concentrated solar power and also by large-scale PV systems that feed into electricity grids. The rapid expansion of the solar energy market can be attributed to a number of supportive policy instruments, the increased volatility of fossil fuel prices and the threats to the environment which of fossil fuels present, particularly greenhouse gas emissions (Timilsina, et al., 2011).

Solar is virtually a limitless resource. It is free of greenhouse gas emissions, widely thought to contribute to global climate change (Gandhi and Middendorf, 2009). In developed countries where air conditioners are used, solar generates more electricity needed during times of peak electricity usage (e.g. running air conditioners more during the hottest, sunniest days of the time). Once installed, solar systems can function for 25 or more years with little maintenance or oversight (Gandhi and Middendorf, 2008).

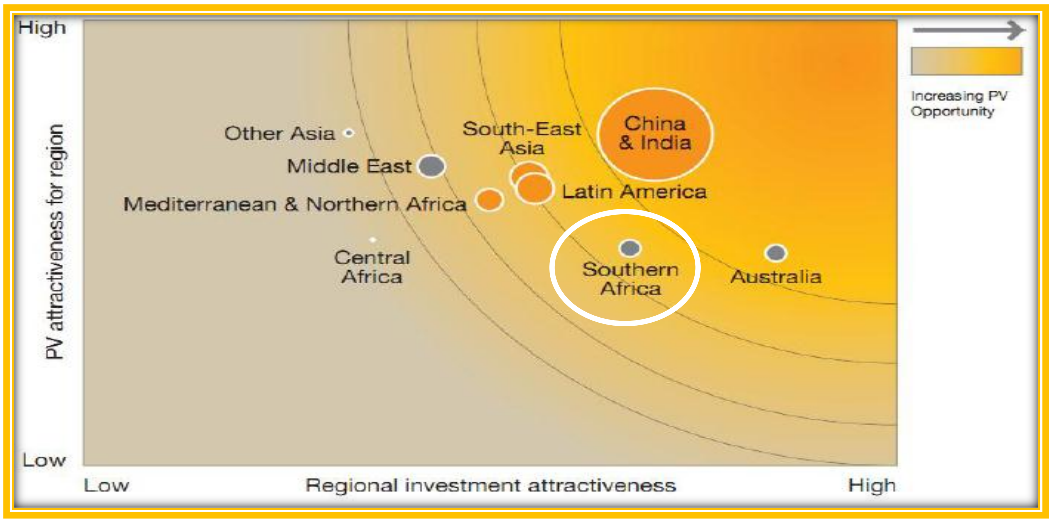
In leading countries such as the United States of America, no significant constraints exist to the technical potential of renewable resources. The potential of solar resources in the electricity industry is significant. In theory, solar panels covering less than 10% of Colorado, for example, could provide enough electricity to power the entire United States of America (Komor, 2009).

Electricity generation from RE sources, such as solar PV and by concentrating solar power is costly, as power plants are significantly more expensive. These solar technologies will not achieve significant market penetration unless costs drop significantly or unless there is a policy either to subsidise or mandate the use of these technologies. Some cost reductions in solar power will occur with economies of scale in production and the effects of the learning curve; however, breakthroughs are needed in PV cell production methods in order to allow for high-volume, low-cost PV manufacturing. Reasonably priced solar electricity could revolutionise the electricity system. However, since there is the enormous resource of wind, there are other options for renewable energy. There is well-documented technical and economic potential for gains in end-use efficiency. Countries such as the United States could reach high levels of renewable penetration even without deployment of significant solar energy (Rugolo and Aziz, 2010). Intermittent renewables cause a difficult transmission problem because of low capacity. If enough transmission is built to transmit the peak power capacity of an intermittent power source, on average the utilised fraction of the transmission capacity is the production capacity factor, which ranges from 10 to 20% for solar PV (Rugolo and Aziz, 2010).

According to Timilsina, et al. (2011), two types of PV systems exist in the markets: grid connected or centralised systems and Off-Grid or decentralised systems. The recent trend is strong growth in centralised PV development with installations that are over 200 kW, operating as centralised power plants. The leading markets for these applications include

Germany, Italy, Spain and the United States. While grid-connected systems dominate in the OECD countries, developing country markets, led by India and China, presently favour Off-Grid systems. This trend could be because they have large rural populations and developing countries are adopting an approach to solar PV that emphasises PV to fulfil basic demands for electricity that are not met by the conventional grid (Timilsina, et al., 2011).

Figure 4.4: Opportunity mapping in emerging economies.



Source: Horacek, 2011: 16.

In Figure 4.4, the results from China, India, Southern Africa and Latin America mark them as the most promising candidates for solar generation. Since solar PV constitutes a modular, low-risk and low-maintenance technology that is frequently installed in small-scale, it is perfectly accessible to the small investor. Private persons and farmers owned as much as 51% of total RES-E capacities in 2010 (Horacek, 2011). Thus, PV systems are declining in cost, improving in efficiency and increasing rapidly in sales. The cost of electricity produced from PV systems is still higher than from most other competing technologies, at about 30 cents per kWh, but these costs are expected to continue to decline steadily. These potential reductions in cost, combined with the simplicity, versatility, reliability and low environmental impact of PV systems, should help them to become increasingly important sources of economical premium-quality power over the next 20 to 30 years (Herzog, Lipman and Kammen, 2010). On the contrary, wind off-shore constitutes a centralised, high-risk and high-maintenance technology that is only worthwhile installing on a large scale. A decisive growth in wind off-shore capacities thus requires tapping the capital resources of industry and institutional investors, or pooling private investments (Schmid, et al., 2011).

4.2.3.2 Wind

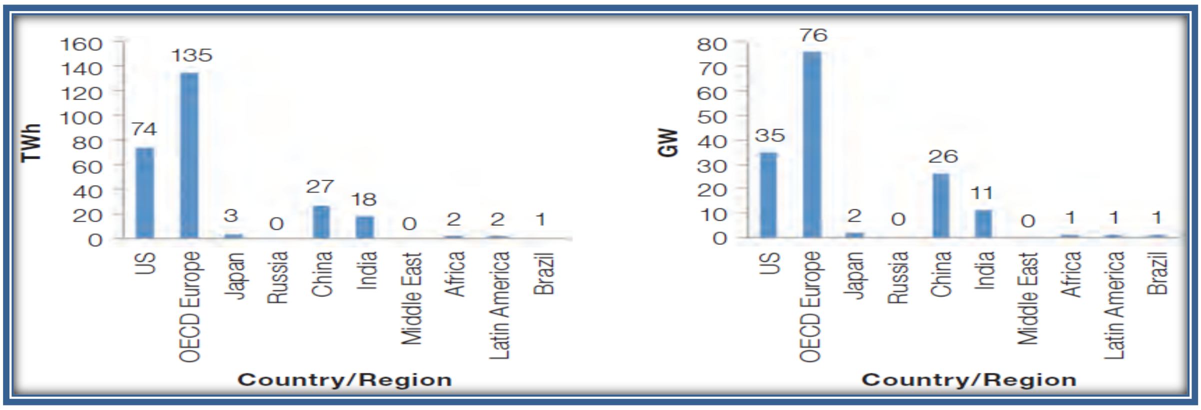
Wind has considerable potential as a global clean energy source, being both widely available and producing no pollution during power generation. Wind energy has been one of humanity's primary energy sources for transporting goods, milling grain and pumping water for several millennia (Herzog, Lipman and Kammen, 2009). The wholesale cost of wind power appears to be competitive in some locations but there are three principal problems with wind. The first is that good wind sites are generally located far from load centres. Transmitting the electricity 1 000 miles from a wind site to a city would double the delivered cost. The second is that the wind generally does not blow when electricity demand is high. In developing countries RE grid connection often is economically prohibitive and it is a potential scenario in the far-distanced future (Herzog, et al., 2009).

The third problem is that wind is variable. Wind turbines do not produce a steady stream of power. Electricity from a wind turbine fluctuates continually. If wind produced much of the power required by an RPS, transmission, backup generation and storage to control variability would increase the cost considerably (Apt, et al., 2008). To illustrate the potential of wind, Komor (2009) posits that by one estimate, countries such as the United States have more than 8 000 giga-watts (GW) of available on-shore wind power potential resource, compared to a current total U.S. electricity generating capacity of about 1 000 GW.

Although wind energy is a clean and renewable source of electric power, many challenges must be addressed. Wind turbines are complex machines with large flexible structures working under turbulent and unpredictable environmental conditions and are connected to a constantly varying electrical grid with changing voltages, frequency, power flow and the like. Wind turbines have to adapt to these variations, so their efficiency and reliability depend heavily on the control strategy applied. As wind energy penetration in the grid increases, additional challenges such as: response to grid disturbances, active power control and frequency regulation, reactive power control and voltage regulation, restoration of grid services after power outages and wind prediction, are being revealed (Camacho, Samad, Garcia-Sanz and Hiskens, 2011).

The intermittency of RE sources such as wind and solar presents a major obstacle to their extensive penetration into the grid. The developed world has become accustomed to reliable, on-demand electricity. Most of the modern population simply would not accept access to electricity only when the wind is blowing or the sun is shining (Rugolo and Aziz, 2010). Figure 4.5 below indicates the current energy generation by country indicating the untapped potential of wind energy within the electricity industry.

Figure 4.5: Wind energy generation and capacity by country.



Source: IEA, 2012: 45.

Komor (2009) suggests that wind power plants must be located where the wind resource is sufficient, which may be far from existing transmission lines or population centres. Significant increases in new wind electricity generation will require new transmission lines. Transmission lines are expensive to build (2 to 4 million dollars per mile), difficult to site and require approvals from multiple levels of government. Promising attempts to address these problems include innovative financing approaches that clarify who pays and how much. Non-wire options are being considered, such as distributed storage that can reduce the need for transmission. Federal and state roles in transmission planning and siting authority are being clarified. Wind power plants, unlike coal and natural gas power plants, cannot be scheduled to deliver specified amounts of power at specified times. Instead, wind power plants generate electricity when the energy resources, the wind and sun are available (Komor, 2009).

In recent years wind electricity has seen a phenomenal boom. In 2008 alone, 8.5 GW of wind power were installed in the United States, representing a 50% increase in U.S. wind capacity (Herzog, et al., 2009). After many years in which the technical and environmental promise of wind clearly exceeded the commercial reality, wind has turned the corner and is now a commercially proven, reliable and cost-competitive option for producing utility-scale electricity. Herzog, et al. (2009) believe that wind energy is currently one of the most cost-competitive RE technologies.

In studies done to assess willingness to pay for various methods of CO_2 emissions control, the most favoured technologies were solar, hydro-electric and wind (Apt, et al., 2008). Renewables currently play a small but growing role in the electricity system. However, with legislation under consideration in various countries it could lead to a significantly larger role for RE in the industry. Wind and solar could play a larger role as wind and solar resources are plentiful and wind technologies are commercially available. The principal barriers to greater use are the costs of the technologies, the need for new transmission lines and the challenge of integrating variable power sources (that is, power plants whose generation is dependent on fluctuating resources) into the electricity system (Komor, 2009).

4.2.3.3 Challenges for wind generation

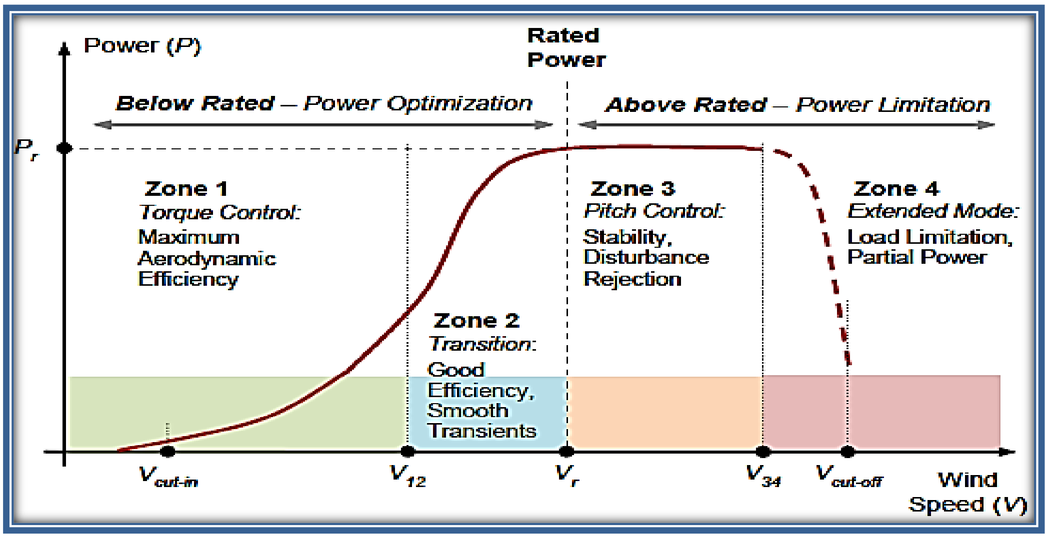
Wind technology does not have fuel requirements as do coal, gas and petroleum generating technologies. However, both the equipment costs and the costs of accommodating special characteristics such as intermittence, resource variability, competing demands for land use and transmission and distribution availability can add substantially to the costs of generating electricity from wind. For wind resources to be useful for electricity generation, the site must have:

- Sufficiently powerful winds;
- Be located near existing transmission networks; and
- Be economically competitive with respect to alternative energy sources.

While the technical potential of wind energy to fulfil the need for energy services is substantial, the economic potential of wind energy remains dependent on the cost of wind turbine systems and the economics of alternative options (Herzog, et al., 2010). The low capacity of intermittent renewables causes a difficult transmission problem. If enough transmission is built to transmit the peak power capacity of an intermittent power source, on average, the utilised fraction of the transmission capacity is the production capacity factor, which ranges from 20 to 50% for wind (Rugolo and Aziz, 2010).

A generic qualitative power curve for a variable-speed pitch-controlled wind turbine is shown in Figure. 4.6. Four zones and two areas are indicated in the figure. The rated power (Pr) of the wind turbine that is, the actual power supplied to the grid at wind speed greater than (Vr) separates the graph into two main areas.

Figure 4.6: Power curve of a wind turbine and control zones.



Source: Camacho, et al., 2011: 7.

Below rated power, the wind turbine produces only a fraction of its total design power and therefore an optimisation control strategy needs to be performed. Conversely, for the above-rated power, a limitation control strategy is required (Camacho, et al., 2011). The accuracy of forecasts for wind speed is getting better and better but still uncertainties remain. The transmission grid has to deal with large, unscheduled variability in power generation (Buhler, 2010).

Dorji (2007) states that the need for a comprehensive strategy and action plan became more obvious in view of RE development and the future plans for electrification in emerging countries. Government will promote public and private sector participation in the form of IPPs, to achieve equitable distribution of electricity and maximise socio-economic and environmental benefits that will promote the extension of grid and Off-Grid electrification. It can further promote green and clean electricity systems in the country's energy mix and thus reduce the rate of greenhouse emissions (Ojha, 2009). Further, government can prescribe levies for IPPs to recover the cost of delivering electricity to rural and remote customers. The objective of generation objective is to develop electrification projects mainly for export, but only after meeting domestic needs and the supply of electricity to remote communities through decentralised projects (Dorji, 2007). As countries seek diversification of electricity sources, the option of hydro-power thus becomes a consideration especially in countries that are well endowed with water resources (Tamrat, 2007).

4.2.3.4 Hydro

All over the world, water scarcity concerns are often used to dismiss out-of-hand the potential for hydro-power. Hydro-power is one of the most widely known forms of RE (Yermoli and Krishnan, 2010). In reality, energy derived from extracting the potential energy of elevated water during its descent has an important role to play. This is especially important when one considers the vast volumes of water that are moved around the country to balance the supply and demand for water and the fact that the energy content of this water is seldom considered (Banks and Schäffler, 2006). Hydro-power provides about 96% of the RE in countries such as the United States. Whiriskey and McCarthy (2006) postulate that by investing in a small hydro-power system, it is possible to reduce exposure to future fuel shortages and price increases and help reduce air pollution. Improvements in small turbines and generator technology mean that micro technology (under 100 kW) hydro schemes are an attractive means of producing electricity.

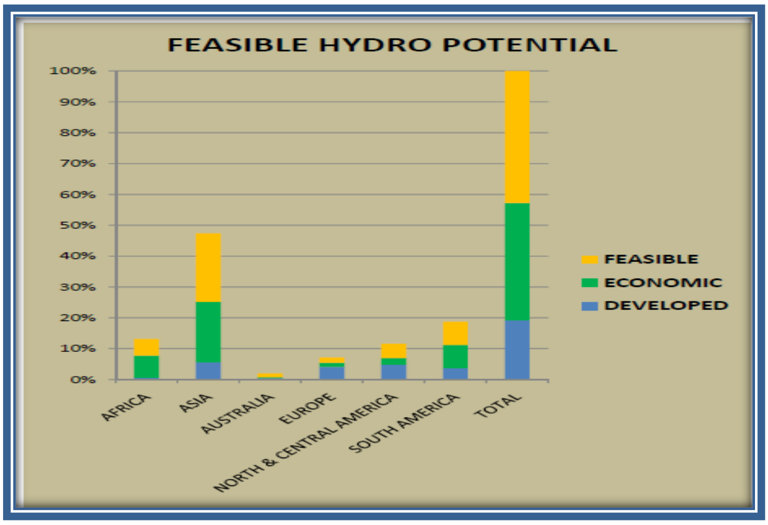
Generally, hydro-power plants with a reservoir are most flexible, followed by gas-fired power plants, then coal-fired power plants and then nuclear power plants, but it is difficult to measure flexibility to allow use of the measurements in generation planning (IEC, 2012). Hydro-power plants with reservoirs are very flexible in operation. They can be easily and quickly started up or shut down with little impact on equipment health or service life. Yermoli and Krishnan (2010) posit that most hydro-electric projects have a dependable capacity, suggesting that they can be used with confidence to meet peak demand for a specified time period.

Plants can start from off-duty status and ramp to full-loading status in several minutes and change their capacity by 50% in fractions of a minute. Their minimum output can be very low, which means a regulation range of near 100% capacity. However, output and hence the flexibility contribution of hydro-power plants can be influenced by seasonal factors (drought and flooding seasons) as well as by non-electricity-sector requirements such as flood and drought control or environmental and navigational considerations (IEC, 2012).

Yermoli and Krishnan (2011) suggest that unlike micro-hydro, small hydro-plants may be connected to the grid. There is little to differentiate a small hydro connected to the grid from a larger hydro-plant, other than the scale of operation. Electrical protection and control systems to connect small hydro to the grid may be relatively more expensive (as a percentage of development cost) than for larger plants and small plants offer less in the way of frequency stabilisation. While larger hydro-plants are ideal sources of spinning reserve (the margin between the load and the full capacity of each generating unit) for system operators, a dispatcher may decide not to bother to keep that margin and just run flat out. Therefore, in systems that pay for spinning reserve (bundled in a category of compensation called 'ancillary services'), small hydro may not qualify for that payment. A small hydro operator might not even be required to notify the dispatcher before synchronising its turbines to the grid (Yermoli and Krishnan, 2011).

Hydro-power's ability to provide peaking power, load following and frequency control helps protect against system failures that could lead to the damage of equipment and even brown- or blackouts. Hydro-power, besides being emissions free and renewable, has the above operating benefits that provide enhanced value to the network in the form of efficiency, security and most important, reliability. The electricity benefits provided by hydro-electric resources are of vital importance to the success of our national experiment to deregulate the electric industry (Yermoli and Krishnan, 2011). Figure 4.7 illustrates the potential of hydro generation in countries compared to Africa and South Africa in particular.

Figure 4.7: Hydro potential.



Source: Yermoli and Krishnan, 2010: 13.

Most hydro-electric projects have some dependability, in the sense that they can be counted on to supply power at times of peak demand. Storage hydro has greater dependability than run-of-river hydro because the stored water can be used when it is most needed. Dependability is the main reason why hydro-electric power is preferred as RE source (Yermoli and Krishnan, 2011).

4.2.3.5 Pumped storage hydro

Pumped storage plants do not produce net energy but they actually consume it because it takes approximately 25-30% more energy to pump water than the plant later generates with the same water. However, if the price differential between peak and off-peak power is more than 30%, pumped storage plants can become attractive. Very often the benefit comes primarily from the role pumped storage plants can play in maintaining stability of electrical frequency in large interconnected networks. When a large pumped storage plant is operating in pump mode it can reduce demand rapidly by stopping the pumps and immediately add generation by reversing the flow. This can make a difference of several thousand megawatts within a few minutes. For this reason pumped storage projects are in accounting terms, more often considered to be assets of the transmission system than of the generation system (Yermoli and Krishnan, 2010).

In terms of rural electrification, other small, mini and micro hydro plants (usually defined as plants less than 10 MW, 2 MW and 100 kW, respectively) also play a key role in many countries. An estimated 300 million people in China, for example, depend on small hydro (Herzog, et al., 2009). There is vast unexploited potential worldwide for new hydro plants, particularly in emerging countries and the generation of electricity via a hydro source can be a significant contributor towards a more sustainable electricity industry. It is therefore the view of researchers that IPPs concentrating on these sources can play an integral part in the RE sector of emerging economies through good integration and partnering.

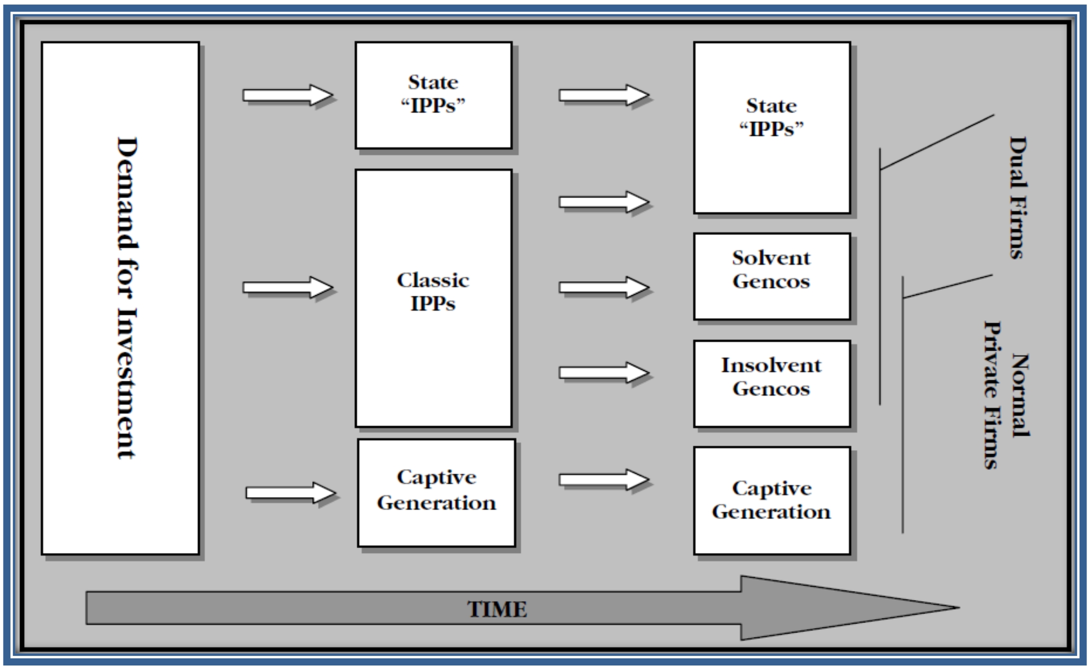
4.3 TYPES OF IPPS IN EMERGING ECONOMIES

The present pattern of economic growth has led to severe degradation of environmental quality and rapid depletion of natural resources. Hence, there is a need for urgent solutions in sustaining the electricity industry (Ojha, 2009). An IPP is a power-generating company set up under the principles of social market economy to meet the electricity demand and at the same time diversify the current electricity mix (Ojha, 2009). IPPs are typically considered non-public utility power-generating organisations, which are privately owned and owned by a number of investors. Given their global presence and increasing influence, they have become a sector that serves the general public and their portfolio of facilities and has a direct and significant impact on mitigating climate change (Nathwani and Chen, 2012).

Private sector participation in the electricity industry (in the form of IPPs) can contribute to expanded access, provided there is concession within the industry (Clark, Davis, Eberhard, Gratwick and Wamukonya, 2005). RE is particularly challenging for grid operators, since it is generally not a dispatchable form of generation and it tends to be located in areas of the country which are not presently well served by the grid (Pickering, 2010). The challenge still exists for emerging economies where new RE sites are located far from the existing grid, demanding substantial investment in transmission lines to deliver their power to consumers (De Oliveira, Woodhouse, Losekann and Araujo, 2005).

Woodhouse (2005b) states that the need for new power capacity along with a halting reform of the power sector has produced three types of enterprises that are often referred to as IPPs. Figure 4.8 summarises the situation diagrammatically. At the top are state-dominated organisations that masquerade as private organisations and increasingly compete with their fully private brethren. These enterprises attract the name ‘IPP’ for various reasons, including the fact that some plants receive favourable treatment when they are viewed as IPPs. Often these plants are managed by the dual organisations that emerged from a country’s restructuring process and the desire to embrace something called an IPP is partly evidence of these organisations’ savvy in seizing the latest management concepts in the electricity industry. All five of the state-owned generation companies created in China’s most recent reform of the power sector are formally called ‘IPPs’ although each organisation is actually state-owned and state-controlled (Woodhouse, 2005b).

Figure 4.8: Types of IPPs.



Source: Woodhouse, 2005b: 54.

Figure 4.8 depicts the middle as ‘classic IPPs’, which is the target. These plants sell electricity under a long-term contract. In each of these cases, the key off-taker for the power is a state-owned (or state-regulated) electric utility, although in some cases, additional revenue is earned by sales to private distributors or large private users. Classic IPPs are usually financed on a project basis, with a special purpose vehicle established to own and manage the IPP. The company draws equity from a number of foreign and domestic investors and secures its debt with a syndicate of banks on the basis of expected revenues. Most projects are highly leveraged, with debt accounting for as large a share of project finance as the bank syndicate will tolerate. Developers and lenders entering these IPP arrangements knew that their ventures would be risky (Woodhouse, 2005a). To the greatest extent possible, developers and lenders sought to shift risk to the host government by relying on long-term power purchase agreements (‘PPAs’) and a host of other arrangements that they believed would insulate projects from the vagaries of government decision making and unexpected changes in circumstance (Nathwani and Chen, 2012). Economic models showed that the plants would be profitable so long as these minimum terms were met.

Núñez-Luna (2005: 14) argues that a strong need exists to authorise private participation in certain sectors of the industry that “do not constitute public service”, but which ultimately means that private projects cannot sell electricity directly to end-users. On that basis, the private sector can participate in the following subsectors: self-generation, co-generation, independent production and import-export of electricity liberally. Each of these sub-sectors can be utilised as key initiatives in the RE sector as driving forces behind green initiatives (Nathwani and Chen, 2012). Ojha (2009) states that it is equally so in the case of emerging countries where IPP generation receives key focus. Initiatives can contribute greatly to:

- Significant reduction on carbon emissions;
- Increased accessibility to electricity services;
- Promote energy diversity thus securing an optimal energy mix; and
- Innovative ways dealing with climate change.

4.3.1 Types of IPPs relevant to the South African RE sector

This section presents an extension of the RE sources mentioned in Section 4.2 and explores IPPs as manifested in these sources.

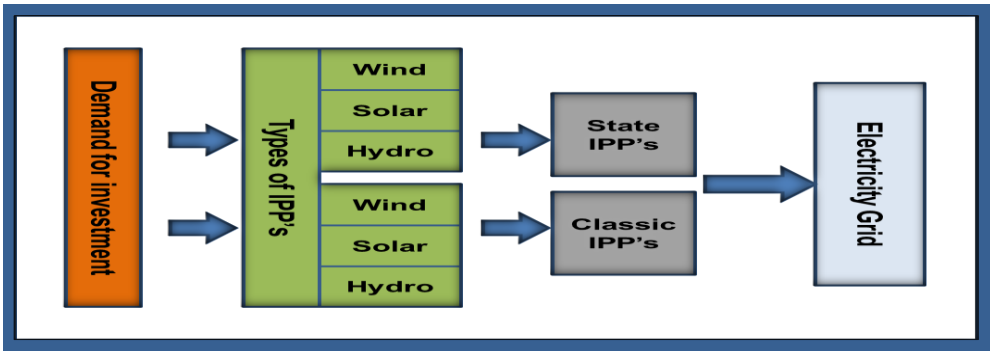
Rogers (2004) states that the characteristics of RE sources, in particular, wind and solar, which are often suggested alternatives to conventional coal electricity generation, need to be recognised. Solar and wind have two inherent weaknesses for large-scale electricity production: low intensity and intermittency. The low intensity requires large areas to collect the energy and intermittency means that the energy is not always available when needed.

The intermittency drawback can be overcome to some extent by making provision for energy storage when it is feasible, but this provision may increase the area requirements for collection of energy even further. For example, an analysis has shown the land area required for a solar-thermal electricity plant to replace the Pickering Nuclear Power Plant near Toronto in providing base-load service (Rogers, 2004). The following IPPs are seen as strongly rooted within the electricity industry as viable electricity generation options:

- Solar IPPs;
- Wind IPPs; and
- Hydro IPPs.

Types of IPP generation are depicted in Figure 4.9 indicating the extent to which they can impact the electricity grid. Solar, wind and hydro are seen to be key role players in both State and Classic IPPs.

Figure 4.9: Types of IPP generation in South Africa.



Source: Own construction, 2014.

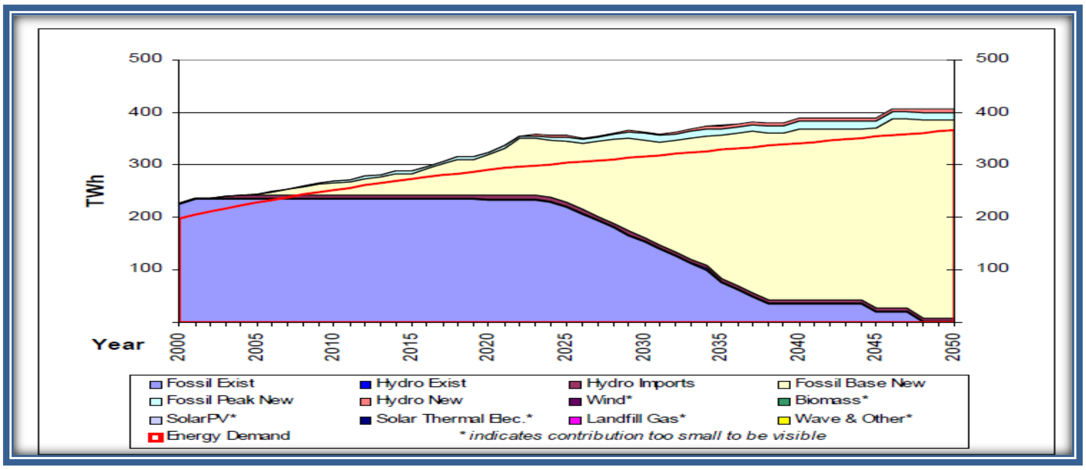
Winkler (2005) posits that providing affordable, adequate and reliable modern energy supplies to most South Africans remains a major challenge since current demand outstrips supply during peak demand periods. Access to electricity has increased from one-third to two-thirds of the population since 1994. Banks and Schäffler (2006) state that several renewable sources have the potential to contribute significantly to South African energy supplies by offering alternative electricity-generating sources aiding current high demand. Studies have shown that because climate change has become an important cross-border environmental issue, IPPs are under gradually increasing pressure from regulators and the public to demonstrate their commitment to limiting further greenhouse gas emissions

(Nathwani and Chen, 2012). In addition, studies are showing the contribution RE can make to current electricity demand in particular:

- Solar thermal (for heating), electricity generation through IPPs and solar PV electricity generation. South Africa has an excellent solar resource and great IPP generation potential. Being one on the sunniest countries on the continent, South Africa boast with great PV potential;
- Wind electricity generation through IPPs is yet another untapped area in the RE sector. South Africa has fair to reasonable wind resources by international standards;
- Biomass (heating, cooking, electricity and, in particular, liquid fuels for transport and cleaner cook stoves);
- IPPs utilising biomass already contribute between 9% and 14% to the total energy requirement, but it could be utilised more efficiently and current use is not always sustainable; and
- IPPs utilising hydro-power. South Africa is not particularly well endowed with hydro-power potential, but there is potential to import hydro-power and to develop locally significant micro-hydro potential.

The potential for RE generation through IPPs is emphasised further as Figure 4.10 assumes slow progress from decision makers for RE generation technology in South Africa. The figure clearly illustrates the huge increase in capacity of fossil plants that would be needed between 2022 and 2038. This raises major warning flags about the environment and the economy. These warnings centre around the projected impact of fossil plants on climate change, the environment and the estimated cost to the economy if action is not taken (Battaglini, et al., 2008). They also highlight the opportunity that South Africa has to prepare for the capacity crunch and to have alternative solutions in place for implementation on a large scale. The renewable energy contribution in this scenario reaches a maximum of 4%.

Figure 4.10: Energy demand matching RE.

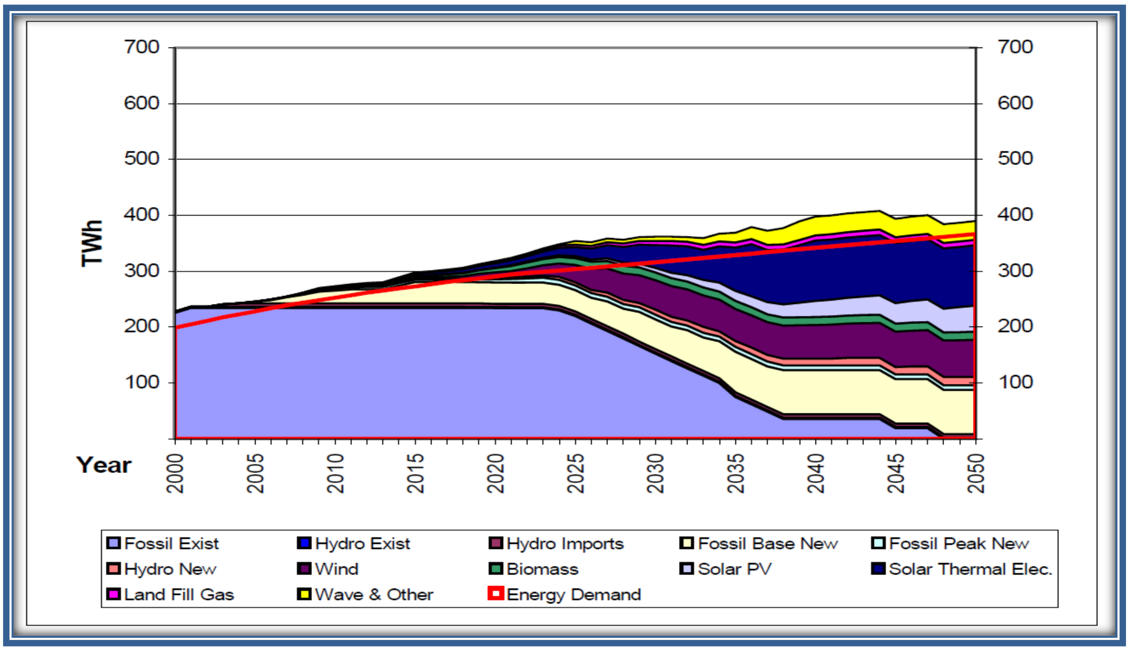


Source: Banks and Schäffler, 2006: 5.

The above scenario illustrates how short time really is, particularly in the light of the required growth rates of IPPs in emerging industries such as solar PV, wind and solar thermal electricity. Effective large-scale IPP industries will take time to develop and even at a 20% annual growth rate, it will take several years before they can start to add energy capacity to the grid on the scale required.

Figure 4.11 illustrates a progressive renewable future in which RE plays a moderate role in electricity generation by 2020 (about 13.3% contribution and contributes about 70% by 2050). The pre-2020 installations would place the country in a strong position to expand capacity rapidly from 2022 onwards, as coal plants are decommissioned. Such preparatory work would be important for local capacity development and job creation via IPPs. However, it may also be critical to secure the potentially realisable cost reductions in RE technology allowing better access for IPPs in an enabling entrepreneurial environment (Banks and Schäffler, 2006).

Figure 4.11: Energy demand matching RE.



Source: Banks and Schäffler, 2006: 21.

According to the (IEA, 2010), most of South Africa's energy supply comes from coal. South Africa ranks fourth in the world in the production of hard coal and is the fifth-largest exporter of hard coal in the world (IEA, 2008b). In 2007, South Africa's electricity generation reached 266 Twh (IEA, 2009. South Africa has an installed capacity of 43 650 MW which represents close to 34.5% of the African continent's total installed capacity. Electricity is produced mainly from coal (94%). Eskom – the national power utility – generates 97% of the electricity. Around 55% of the distribution is managed by Eskom and 45% by the municipalities (NERSA, 2009). Since 1994 no new generation capacity has been built. Due to strong economic growth, rapid industrialisation and a massive electrification programme, Eskom's surplus capacity has been reduced to below safe production levels. In January 2008, massive power outages occurred nationwide. South Africa has since embarked on aggressive demand-side management (DSM), energy efficiency, as well as planning new generating capacity programmes supporting IPPs and claims to have the lowest electricity tariffs in the world.

South Africa's state-owned entity utility Eskom, is licensed to generate, transmit and distribute electricity. It is the sole transmitter of electricity via the country's high-voltage transmission grid, generates 96% of national electricity and is responsible for 60% of distribution directly to customers. Eskom has 27 power plants in South Africa that make up

40.7 GW of the country's 43.9 GW capacity. Of this, 34.7 GW comes from 13 coal-fired power plants in the northeast, many immediately adjacent to privately owned coal mines in this area. The remaining generation comes from pumped storage and imported hydro-electricity, the Koeberg nuclear power station, four gas fuelled turbine stations and one wind energy power station. Eskom is Africa's largest and the world's fourth largest energy utility (Daniel and Lutchman, 2006). It stands to reason that the potential for RE in South Africa is considerably high and the high demand for electricity and the impact on the environment could be eased though the successful utilisation of RE IPP generation on, and off the grid.

4.3.2 The South African electricity situation

The South African electricity industry has been and continues to be, at the centre of the country's development (Davidson and Winkler, 2003). The origins of the electricity supply industry in the first years of the twentieth century, for example, were driven by the needs of the booming mining industry. Later, the development of a local nuclear capacity reflected concerns for power supply security. In the 1950s the apartheid government decided to develop Sasol, a synthetic petroleum industry as a response to threats to crude oil imports. Today, the present government's focus is on widening household access to electricity, to make modern energy services more equitable and also affordable for the poor. It also hopes to increase the empowerment of the disadvantaged. The electricity industry sector remains at the heart of structural developments in the economy (Davidson and Winkler, 2003).

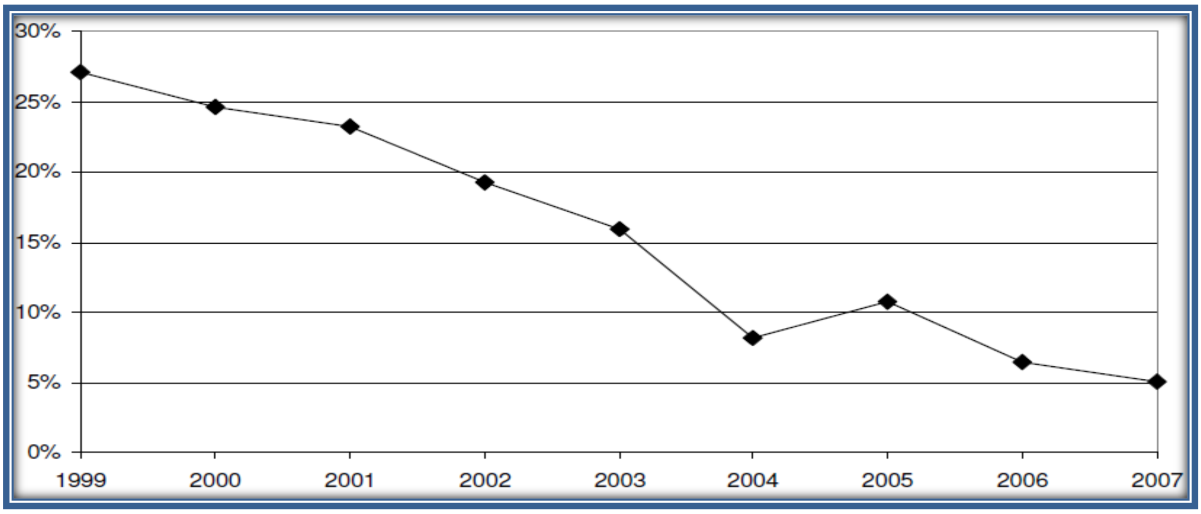
Stein, Levetan, Christie and Frittelli (2010) state that over 70% of South Africa's energy is derived from imported fuels and coal-powered energy generation. Electricity produced at power stations is transmitted by sending the power over high-voltage power lines to the various sub-stations distributed across the country. All the high-voltage lines plus the big transformers and related equipment from the transmission system are known as the National Grid. Distribution of electricity from the sub-stations to end consumers is managed by Eskom and the relevant local governments.

The role of the electricity industry in climate change mitigation in the country is key as emissions to 2050 are anticipated to continue to be dominated by energy sources which are increasing at a far more rapid rate than emissions from the non-electricity industry (Tyler, 2009). The country has also recently undertaken a climate change mitigation scenario process of a 'peak, plateau and decline' emissions trajectory. This follows an aspirational electricity industry target of between 30-40% emissions reduction off a 2003 baseline by 2050 that has been adopted by Cabinet (Tyler, 2009). However, there is currently no institutional or policy infrastructure in place to consider how this target will be met, nor the roles of various sectors (Tyler, 2009). South Africa has in recent years undergone an electricity supply crisis and a potential liquid fuels crisis is looming, which have prompted urgent reassessment of many aspects of the electricity industry, including energy institutions, regulation and policy. The policy regarding the environment is changing quickly, with a focus on energy security.

This widespread and persistent load shedding in the first quarter of 2008 fundamentally shook public and investor confidence in South Africa's power utility Eskom. In January 2008, there was almost daily load shedding for two weeks leading to a government declaration of a national power emergency in January 2008. This had a severe impact on production levels in all sectors of the economy and compromised the image of Eskom and South Africa (Chettiar, Lakmeeharan and Koch, 2009).

Figure 4.12 illustrates a declining coal reserve margin leading up to 2007. The declining reserve margin meant that the existing generation plant had to run harder, leading to a rise in the load factor of large coal-fired stations from their design level of around 60% to a stressful 74%. As a result plant availability began to decline, as witnessed by the steady drop in the Energy Availability Factor (EAF) from the management target of 90%+ down to 87.5% (Pickering, 2010).

Figure 4.12: South African reserve margin leading up to load shedding.



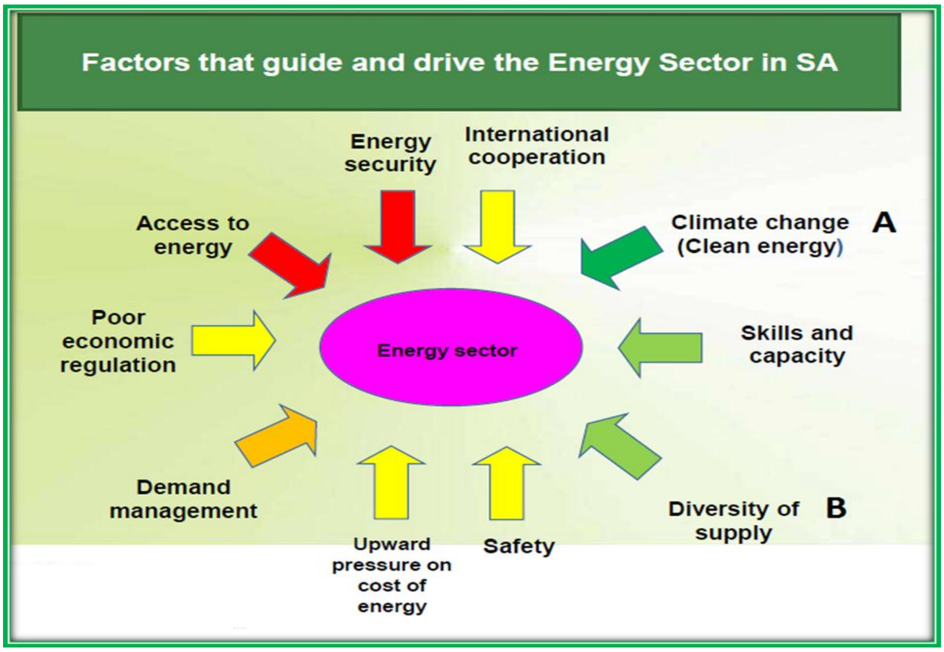
Source: Lakmeeharan, 2010: 32.

In order to address the electricity and environmental challenges, Pickering (2010) posits that although both Government and Eskom continue to make positive statements about the need for IPPs to enter the sector, through RE power projects, progress has been painfully slow. Without clear signals as to the nature of the future power market, private developers are understandably reluctant to invest significant resources in the expensive business of project development .This limits the access of IPPs into the RE sector drastically. The electricity crisis in South Africa accentuated the need for electricity generation alternatives. RE expansion and integration into the electricity industry through improved IPP activity are considered as a potential solution to the electricity challenge experienced in South Africa (Pickering, 2010). A currently slow and cumbersome administration policy on IPP especially in the RE sector requires immediate attention to support the government's RE integration programme of allowing Eskom to contract with IPPs (Pickering, 2010).

Figure 4.13 below depicts the factors that drive the electricity industry in South Africa. Specific focus is given to A, climate change and B diversity of supply. These two factors are the priority areas that drive the electricity industry in South Africa with specific focus on RE. Winkler (2005) states that RE generation in SA can have tangible benefits to the environment given that current electricity generation is predominantly coal. RE can contribute to reduction in local air pollution, with co-benefits of reducing emissions of greenhouse gases which contribute to climate change. Given that electricity generation is mainly based on coal, diversity of supply is a key focus.

RE generation can make a significant contribution to the electricity industry through wind, solar and hydro sources. RE sources are another major option for increasing diversity (Magubane, 2011). South Africa is richly endowed in terms of wind and solar sources. There are also opportunities for the country to develop a competitive advantage in solar thermal technologies and establish the South African industry and technicians as front runners in the rapidly expanding, international RE sector. Investing in these areas has a significant benefit to the country.

Figure 4.13: Factors that guide and drive the electricity industry in SA.



Source: Magubane, 2011: 6.

4.4 RE INTEGRATION INTO THE ELECTRICITY INDUSTRY

Economic, environmental and security concerns associated with conventional fuel supplies have strengthened support for clean energy technologies among governments and the private sector on a global scale; however, questions about how to effectively integrate large amounts of variable RE generation persist (Cochran, Bird, Heeter and Arent, 2012). The integration of RE resources cannot be solved in isolation from the other challenges facing modern electricity industries (Outhred, 2007a). According to the IEA (2011b), RE sources currently provide 14% of the world's energy supply and are projected to remain minimal, despite a projected 60% increase in global energy consumption by 2030 as shown in Figure 4.10. Figure 4.11 in turn indicates that RE sources are often transformed into electrical energy for transfer to end-user premises (direct biomass combustion is an exception and hydrogen may in future provide an alternative energy pathway). Thus it is important to consider the question of integration of renewable energy resources into the electricity industry.

Reducing the reliance of remote communities on fossil fuels is driving the development of technologies designed to integrate, manage and control renewable generation in power networks. This technology would potentially increase the production and integration of RE into isolated power generation systems that once relied on fossil fuels alone (ABB, 2012). Bull and Kelly (2007) contend that the successful integration of RE generation into large power systems has become fundamental to successfully addressing climate change and energy security concerns.

According to the ABB (2012), one of the biggest challenges of integrating renewable generation in any power grid is intermittent generation, which can be caused, for example, by gusting wind or clouds on a sunny day. This simple occurrence can destabilise the grid and cause an unwelcome generator response known as hunting, even when wind flow is low, which leads to unnecessarily high consumption of backup fossil fuels, engine damage and expensive blackouts. While many countries implemented attractive incentives for developing renewables projects, the power produced needs to be effectively integrated into the grid, along with assurances that energy will be purchased. This can be achieved through policy tools, such as priority dispatch and renewable off-take agreements (IEA, 2012).

In emerging countries, challenges exist for initiatives such as rural electrification as grid connection often is economically prohibitive or only a potential scenario in the distant future (Schwan, 2011). European Commission (2004) believes the administrative and grid access barriers to the use of RE sources need to be removed at national and local levels. ABB (2012) argues that poor integration design can inflict damage on a power generating station.

A promising alternative has evolved with the maturation of small-scale stand-alone systems (Schwan, 2011). Micro-energy systems generate electricity locally and facilitate decentralised electricity generation (Schwan, 2011). In the rural transition from traditional to modern energy sources, RE-based micro systems, such as solar PV systems, biogas digesters, small wind or micro hydro Mini-Grids, play a key role as they offer cost-efficient alternatives to grid extension (Schwan, 2011). The technology predominantly used for Off-Grid electrification is solar PV in the form of small, home systems, which are also the focus of the case study presented in this study. In most developing countries sunlight is an abundant resource making small, home systems an attractive and viable option.

The major difference in producing clean energy is that it requires lots of smaller generators, some with variable amounts of power output. A big advantage is that they can be located inside the grid, close to where power is used. Small generators include wind turbines, solar panels, micro turbines, fuel cells and co-generation (combined heat and power) (Greenpeace, 2011).

Table 4.3 shows how a competitive electricity industry decision-making framework can be structured in terms of governance, commercial, technical and security regimes (Outhred, 2007b). One task of the governance regime is to specify and implement the other regimes and the interfaces between them that manage boundary issues. Since its nature is largely separable, the technical regime can be developed within a self-regulatory environment so long as overarching objectives are specified at the governance level, for example, with respect to compliance with international standards. For a particular electricity industry, countries should now review the ability of these various regimes to function effectively in the presence of high levels of renewable energy penetration. This is that because, non-storable renewable energy fluxes, implies new sources of uncertainty in the flow of energy through an electricity industry (Bull and Kelly, 2007).

Table 4.3: Governance, commercial, technical and security regimes for an integrated electricity industry.

Governance Regime	The set of formal institutions, legislation and policies that underpin the decision-making framework in which a competitive electricity industry operates. The governance regime includes the formal regulatory arrangements for electricity industry participants, supplemented by the broader social context that influences the industry. The scope of an electricity industry is defined by the physical extent of the underlying transmission and distribution networks and may involve one or more national jurisdictions.
Security Regime	The task, assigned to one or more system operators, of maintaining the integrity of a local or industry-wide core of an electricity industry in the face of threats posed by plausible large disturbances. The security regime typically has authority to restrict and, if necessary, override the commercial regime in defined circumstances and to a specified future horizon. For example, the security regime may have the power to direct participants to operate their components at specified levels and, under defined circumstances, to disconnect components. This is an example of the prioritisation of industry goals.
Commercial Regime	The commercial arrangements for the competitive electricity industry may include spot markets for electrical energy and ancillary service as well as associated derivative or capacity markets and commercial interfaces between competitive industry participants, such as generators and end users and regulated industry participants, such as network service providers.
Technical Regime	The integrated rules for component and system design and system operation that allow the various components of an electricity industry, when connected together, to function effectively as a single machine. These rules are necessary for the industry to deliver a continuous flow of electrical energy of appropriate availability and quality from generation equipment to end-use equipment, tracking decision-maker targets, rejecting disturbances and degrading gracefully if equipment faults occur.

Source: Outhred, 2007b: 15.

In the analogy of the electricity industry as a single machine, RE generators become new component types for that machine. Compatibility will be considered in governance and commercial, security and technical dimensions. This is perhaps particularly important if South Africa is to follow the hybrid model for an extended period. Access to transmission will be a critical factor in the growth and development of the IPP industry, whether these investments are based on traditional fossil fuels or renewable energy sources (Pickering, 2010). Even if responsibility for long-term grid planning is shifted out of the power utility Eskom, there may still be opportunities for Eskom to favour grid investments which suit its own generation plans and slow down investments which are primarily in the interests of IPPs (Pickering, 2010).

Developing renewable resources, presents a set of technological challenges not previously faced by the grid. Examples of challenges are the location of renewable resources far from population centres and the variability of renewable generation (Larsen and Russo, 2010). Optimisation within the RE sector includes increasing legislative stability and reducing investment risk, reducing administrative barriers, addressing grid issues and encouraging technological diversity (Brussels, 2008). Transmitting electricity from sources to distant population centres strains the physical, ownership and regulatory structure of the grid (Larsen and Russo, 2010).

Horacek (2011) states that with a quick risk analysis of the situation in 2009, after the financial crisis had struck countries, solar projects were abandoned and cancelled, the supply chain from China to other countries fell apart, leaving many of the small-scale Chinese PV manufacturers bankrupt or closed down. This has paradoxically helped the progressive Chinese PV manufacturing market, as only the strong large-scale manufacturers survived and the producers realised that a balance must be achieved by setting up a strong, reliable domestic PV market to diversify the demand and ensure that economy fluctuations of the West have less impact on Chinese PV production. This is where the project of a stand-alone PV electrification of rural China comes strong, as long-term indices show 95% of Chinese PV is being installed Off-Grid.

To date, wind and solar are the two sources to have received considerably more investment than other renewable energy sources. Thus focus on wind and solar energy and the three principal issues associated with integrating wind and solar resources with the grid are key imperatives. These are: variability of generation addressed by forecasting; energy storage and transmission; remote location of wind and solar resources rectified by transmission and how the business values key resources such as storage (Larsen and Russo, 2010). RE power system will require electricity policies to incorporate a longer-term perspective and a broader geographical scope (Schellekens and Finlay, 2011).

4.5 SUMMARY

RE sources play an integral part in the modern electricity industry. The South African electricity industry proves no different. With problem, key areas such as carbon emissions and diversity of supply having high priority, a vehicle in the form of IPPs is needed to sustain this industry.

Schellekens and Finlay (2010) suggest that RE is well-positioned to play an significant role in the future to address both energy security and climate change concerns. RE resource options such as solar and wind seems to be a particularly promising options worldwide and particularly in South Africa both for domestic and commercial use as well as for alternative electricity generation. Haw and Hughes (2007) state that globally, this technology appears to be the renewable source of choice. As a generation technology, it allows storage and therefore can be used to meet peak demand a key determinant for countries having problems with electricity supply capacity.

The generation of electricity from RE sources thus includes technologies such as hydro power, wind power, solar power, tidal and wave power, geothermal power and power from renewable biomass. First, they are among the renewable generation types. Wind and solar are subject to natural variability in their energy sources. This variability creates distinct challenges for integration into the larger power system, namely non-dispatchability, however they are posed to be to be well suited in rural electrification projects. Secondly, wind and solar are relatively mature for use in large capacities and in wide areas and so have a significant impact on the electricity grid. This is likely to increase over time and is the primary reason why wind and solar remain feasible options for the RE sector (International Electro-technical Commission, 2012).

Fear exists that pressing the introduction of renewables too aggressively would result in high cost, unreliable electricity, leading to a public backlash against these policies. Less aggressive policies favouring renewables have brought down the costs of these technologies over recent years in the rest of the world (Apt, et al., 2008). Currently, a major risk to investment is the short-sightedness of electricity policy and the short-term changes of many national support schemes. This is the result of a general lack of a longer-term policy view. An essential aspect of government is that it recognises the long-term value of moving towards 100% RE rather than being focused on shorter-term routes that head off in different directions (Schellekens and Finlay, 2011). This can only be achieved if an enabling entrepreneurial environment together with the appropriate vehicle for delivery of RE in the electricity namely IPPs are utilised.

The research questions addressed in this chapter are:

- *RQ_3 - What RE sources are available that IPP entrepreneurs can utilise in the RE sector?*
- *RQ_4 - What type of IPPs are required in the South African electricity sector?*

The research objectives addressed in this chapter are:

- *RO_3 - To identify RE sources applicable for increased IPP entrepreneurial activity.*
- *RO_4 - To determine and describe the type of IPPs in the South African electricity sector.*

The deliverable of this chapter was RE sources and types of IPPs in the RE sector of the electricity industry.

(The priority place in the world for private investment in power generation is in countries Woodhouse, 2005b). Experience to date suggests that only a few investors have gained from their investment and had returns from within the electricity industry amidst the urgent need for new or alternative power generation in South Africa. In this study the researcher evaluated the types of IPPs specifically for South Africa and it was outlined that the following IPPs are strongly rooted within the electricity industry:

- Solar IPPs;
- Wind IPPs; and
- Hydro IPPs as immediate focus areas.

Whether IPPs have met reasonable expectations of key stakeholders up until now remains a key challenge for both Government and power utility Eskom. The following chapter will discuss Policy and Best Practice in the electricity industry.

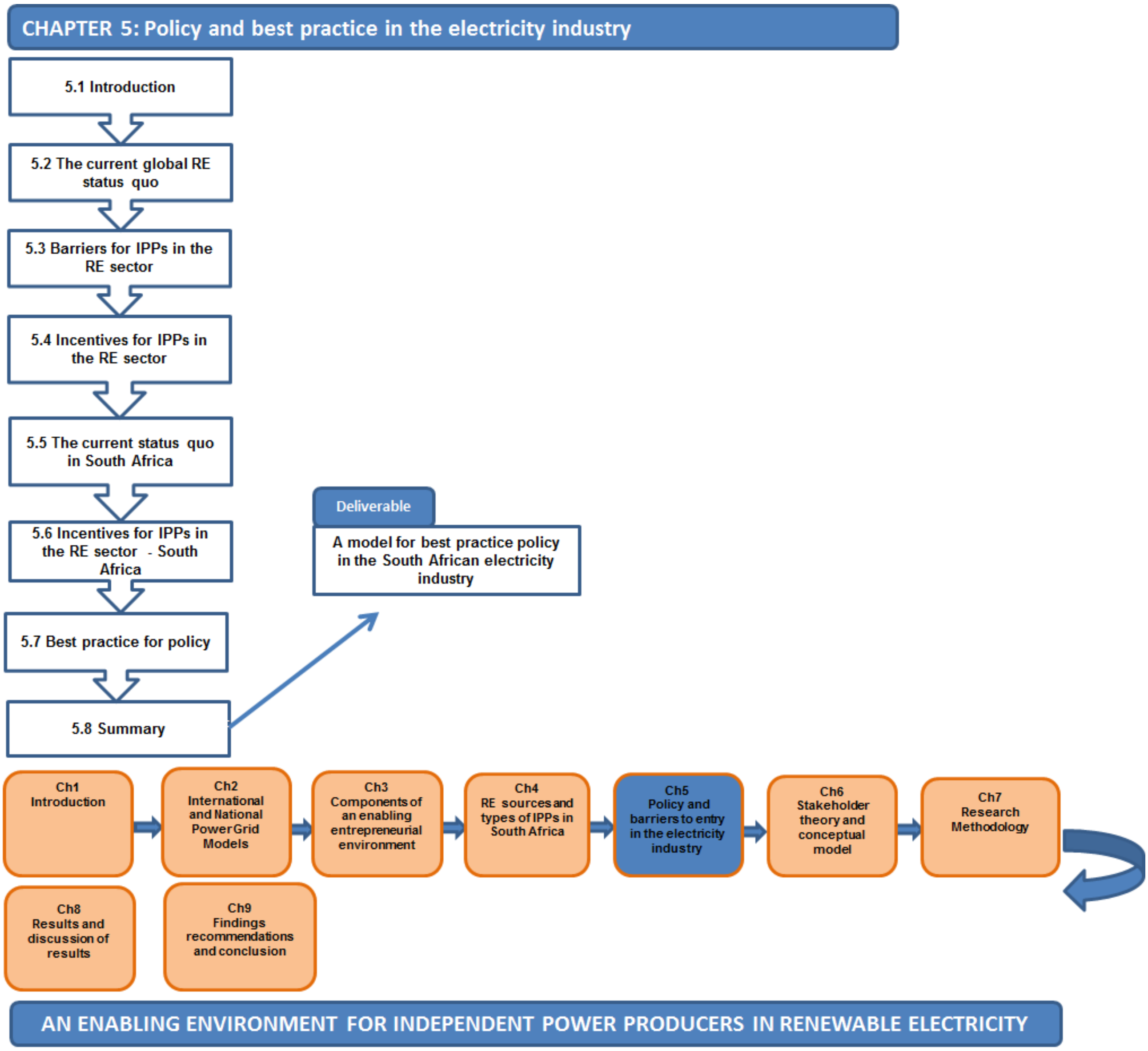


Figure 5.1: Outline of chapter.

CHAPTER 5

POLICY AND BEST PRACTICE IN THE ELECTRICITY INDUSTRY

Best practice in policymaking and institution-building for the deployment of grid-connected renewable energy can be found scattered throughout reports and policy papers of major international actors and in the discourse of policymakers and business people (Garcia, 2013: 1).

5.1 INTRODUCTION

In the previous chapter, RE sources and IPP accessibility to the electricity industry were examined. It has been demonstrated that RE can contribute towards a more sustainable electricity industry through the introduction of IPPs to the grid. Therefore, an enabling entrepreneurial environment needs to be created to reap both economic and environmental benefits for any country. Such an enabling, entrepreneurial environment will therefore necessitate meticulous regulation aided by impeccable policy particularly in South Africa where RE is still in its infancy stage (Ma, Chunbo and He, 2008).

According to REN 21 (2013), only a few countries had RE support policies in the 1980s and early 1990s but many more countries, states, provinces and cities began to adopt such policies during the period 1995–2005, especially during the period 2005–2012. The number of countries with some type of support policy related to RE more than doubled during the latter period, from an estimated 55 in early 2005 to some 120 by early 2012. At the national, state, provincial and city levels, policies have played a major role in driving RE markets, investments and industry growth. However, not all policies have been equally effective and success has often rested on detailed design and implementation. Consequently, it seems that governments continue to update and revise policies in response to design and implementation challenges and in response to advances in technologies and market changes.

These targets and support policies will continue to exert a strong influence on national markets in the years and decades ahead. It is clear, therefore that in the future, national policymakers will confront a wide range of choices and considerations in continuing, updating and retiring existing policies and creating new ones. As renewables become more integrated with existing infrastructure, policymakers will confront the need for new policies and policy cycles to achieve these various forms of integration (REN 21, 2013). Governments, academics and the professional policy organisations that form the peer networks of bureaucrats and politicians have described the policy cycle as a process that starts with a need and ends with an evaluation of the policy impact (IRENA, 2012).

Considering the electricity policy in South Africa, Baker (2011) states that it is at a definite crossroads. The author mentions that the country's historical dependence on cheap coal for approximately 90% of its electricity generation is under threat from a variety of factors (Baker, 2011). Also, despite regulatory delays and departmental tensions, power dynamics in the electricity industry are shifting with the potential introduction of private RE generation into the energy mix, where wind is set to form the largest component. Meanwhile, Eskom's Medupi coal-fired power plant deemed as essential to the country's generation expansion has been redefined as a clean coal power plant following a World Bank loan of 3 billion dollars in April 2010 (Baker, 2011). In terms of addressing the policy need, the first step in the policy cycle, it becomes critical to examine policy and best practice for the South African electricity industry as the country is gearing up to incorporate IPPs through RE initiatives in the system.

A reliable and affordable supply of electricity is essential for the competitiveness of global industrial product markets and a necessary ingredient in the daily workings of modern societies. At the same time, environmental impacts of energy usage are one of the most difficult global policy challenges (REN 21, 2011). Reliable access to affordable electricity supply with acceptable environmental effects is only achieved with comprehensive and carefully balanced policy actions to establish the necessary incentive-based framework. At least 96 countries now have some type of policy to support renewable power generation. More than half of these countries are emerging countries or those considered as emerging economies. Such policies are the most common type of renewables' policy support, although many other policy types exist to support RE (REN 21, 2011).

Best practice in policymaking and institution-building for the deployment of grid-connected RE can be found scattered throughout reports and policy papers of major international actors and in the discourse of policymakers and business people (Garcia, 2013). These global, best practices could provide both explanations for electricity industry inefficiencies and a set of solutions. At the global level, electricity industry best practices are promoted by a range of supra-state agencies and organisations (Keating, 2006).

Garcia (2013) claims that to date, there have been no attempts to describe the best practices and best practice models in relation to a broader policies-and-institutions framework. A diversity of national economic and electricity systems clearly do exist even within market economies but no one set of rules is necessarily better than another (Hall and Soskice, 2001). This implies that system -outcomes depend on complementarities between different elements of the policies and institutions of a given system.

The objective of this chapter is to identify the importance of policies for grid-connected RE best practices in the electricity industry. The research question addressed in this chapter is:

- *RQ_5 – What are best practice policies that the South African RE sector could consider?*

The research objective addressed in this chapter is:

- *RO_5 - To describe policy and best practice in the South African RE sector.*

To this end, the chapter has the following main aims: to systematically develop a best practice model regarding policies proposed by relevant international organisations to show how a model resembles a sector-specific application of the policies and to discuss institutions of liberal market economies conducive for IPP participation.

In this chapter, the researcher reflects not only on those policies and institutions that constitute a best practice model, but argues that this model is applicable to RE within the electricity industry. Making explicit the appropriateness of the best practice model for renewables is another contribution and this understanding might help engender prudence in the application of the said model in an attempt to create an enabling entrepreneurial environment for IPPs. Wisuttisak (2012) posits that possible reforms to the electricity regulation, in order to create market competition and efficiency in global electricity industry are inevitable. Thus, in order to create the enabling entrepreneurial environment, it is necessary to overcome barriers within the electricity industry that hamper IPPs implementation.

The chapter introduces policy and best practice in the electricity industry. The current status quo, both globally and in South Africa needs to be examined and a guide towards improved policies in the electricity industry will be presented. Section 5.2 provides the current global status quo in the electricity industry. Section 5.3 covers the barriers to IPPs in the RE sector. Section 5.4 expounds on incentives for IPPs. Section 5.5 details the current electricity status quo in South Africa. Section 5.6 covers incentives for IPPs, Section 5.7 covers best practice for policy and finally, Section 5.8 concludes with a summary of this chapter.

5.2 THE CURRENT GLOBAL RE STATUS QUO

In globalised and automated economies, the role of electricity is increasingly important as a driver for economic prosperity**.** While there are relatively strong provisions for access to information about environmental and social aspects of electricity decision making, there is disconnect between environmental and social objectives and power development goals (Pune, 2006). Energy security is a key driver for the prioritisation of RE in most countries, but low-quality coal which causes local air pollution and contributes to global warming is also emphasised in the same context (Pune, 2006). These provisions are enshrined in policies that are normally difficult to amend as environments change and opportunities in industries become accessible.

Policies enable essential facilities to establish rules that will give fair access to new entrants (IEA, 2011). These policies enable new market entrants to have access to the infrastructure of electricity grids and distribution and transmission lines. Providing access may imply an amendment of current policy to ensure accessibility of alternative electricity production to the network. The amendment of policies may thus include provision of, the access regime, interoperability (that different systems, products and services work together transparently), standards, the importance of market definition in defining an essential facility, single versus joint ownership of an essential facility, legitimate reasons to deny access and possible remedies (IEA, 2011).

Wisuttisak (2012) states that policy formulation for the electricity industry remains fundamental as it strives to enable market participation. Policy amendment should thus consider how to create change in the current uncompetitive market structures of the world, electricity industry. The amendment can be based on, for example, the competition assessment toolkits, which argue that there is a need for reform of regulations and laws that maintain an uncompetitive market structure (Wisuttisak, 2012). Moreover, the Global Energy Act policy should be amended to include significant rules on access to essential facilities (Al-Sunaidy and Green, 2006; Wolak, 2003).

Amendment of such global policies would also help encourage and support new market participants to compete with the existing State Owned Enterprises (SOEs) in the electricity market. The Energy Act (1998) must maintain free and fair market competition for new participants and it requires all SOEs not to abuse their market power and use anticompetitive behaviour which deters new market participants. The amendment would therefore guarantee that competition between new entrants and dominant incumbent operators occurs in a fair and free manner (Guasch, 2004). By focusing on the retail sector, the Energy Act (1998 amendment) would contribute to the creation market competition. This will then contribute to market efficiency and improvements in retail service for consumers.

Policy process is instrumental in achieving good governance, but reforms have been driven by donor organisations and have favoured industry players over the public. Provisions for transparency and accountability have not been sufficient (REN 21, 2011). In 2011, emerging countries represented more than half of the 118 countries that had established RE targets and support policies. REN 21 (2011) suggests that investments of emerging countries in RE companies, utility-scale RE generation and biofuel projects exceeded those of industrialised countries for the first time in 2010. Thus, because most of the future growth in energy demand is expected to occur in emerging economies, this trend helps to reduce the negative environmental impact of present and projected rapid economic growth of those countries.

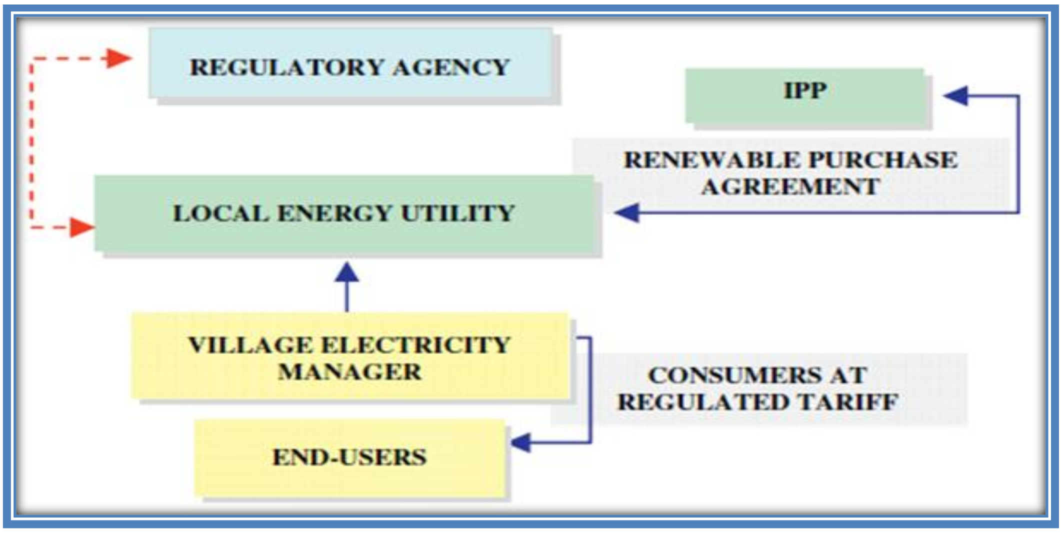
Indeed, policy is one of the main drivers in moderate and high-renewable scenarios in the electricity industry. The environmental effects of electricity generation are not addressed by normal incentives as in competitive markets. There is a need therefore for energy and electricity policies to address the need for incentives for the electricity market. Environmental benefits are classical public goods and liberalised electricity markets will not adequately account for their value or for the cost of their potential loss. Policy intervention is needed to ensure they are properly taken into account. Policies motivated by environmental and climate change concerns are already having serious impacts on liberalised electricity markets, as was intended (IEA, 2005).

REN 21 (2013) reiterates that policy and Industry experts have offered a wide range of views about the role of policy in any electricity industry. For example, some predicted a cascade of new policies for RE to match existing policies for electricity. Though the evolution of policies such as feed-in tariffs, there remains uncertainty about when such evolution would need to take place. Scenarios incorporate a wide variety of policy mechanisms, taken in various combinations over various time frames to stay abreast with changes within the industry (REN 21, 2013).

Some of these changes for emerging economies include the following notion. A suggestion is that where a wide variety of tariff modes of charging for electricity are used for IPPs, the FIT scheme should be used. A few are already using the grid-connected FIT scheme (Bristow, 2007). In the FIT scheme for grid-connected systems, the FIT values are set as being revenue neutral to the government, with the difference between cost and prices paid implicitly by all utility consumers. In the case of emerging economies, due to the lack of financial possibilities from most of the rural users, a key factor for the success of the Renewable Energy Premium Tariff (RPT) support scheme is to define the financial flows involved to compensate for the difference between electricity costs and prices paid and to identify which entity should bear the cost of incentives for the RE production (Bristow, 2007).

The local government provides a RPT scheme to IPPs including a RE purchase agreement, as depicted in Figure 5.2 (Woodhouse, 2005b). Then, the rural electrification agency, regulatory agency or an equivalent governmental institution, offers the legal and regulatory RPT frameworks for IPPs to install solar, wind, biomass, small hydro-power and geothermal power generation technologies connected to a Mini-Grid.

Figure 5.2: Independent power production regulatory framework.

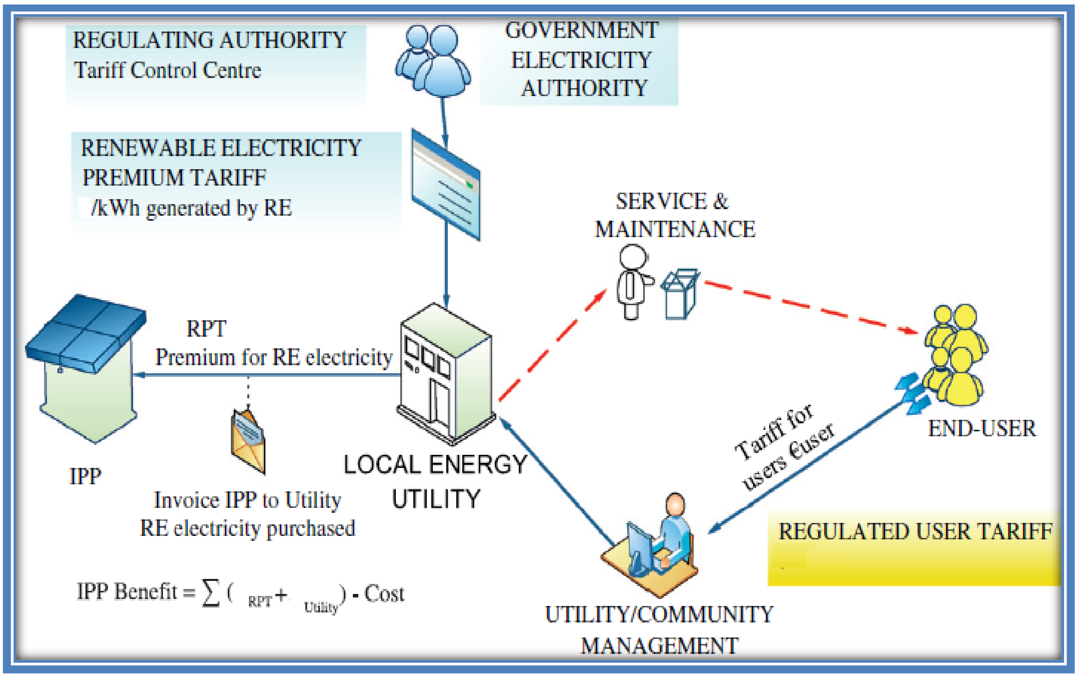


Source: Moner-Girona, 2009: 4.

Moner-Girona (2009a) confirms that under this management, when the IPP owns the RE facilities, the local energy utility owns the grid and purchases the electricity produced from the IPPs. The local energy utility operates according to various requirements by the regulator and the customers and the regulatory body creates the policy umbrella to support the RPT.

Figure 5.3 depicts that for financial flows that the rural electrification agency provides through the local energy utility, a RPT premium tariff to the IPP per kWh produced by RE sources. The IPP sells RE to the local electricity utility under the renewable purchase agreement with the fixed premium values for RE production. The rural electrification agency determines and covers the total amount of RPT generated per year through the local energy utility. The IPP has to report to the agency and then the rural electrification agency makes a technical analysis of the report and determines the amount of RPT that will be given to the IPP. Moreover, the IPP has the responsibility of installation, operation and maintenance of the connected system. In most isolated areas, the real electricity costs are not affordable for the majority of remote customers.

Figure 5.3: RPT scheme where IPPs are involved.



Source: Moner-Girona, 2009a: 5.

Moner-Girona (2009a) states that the emphasis should be on the need to create market conditions that encourage increasingly cost-effective investment in renewables through a well-grounded economic policy and an enabling environment for IPPs to operate in. According to IEA (2008c), the main goal when promoting renewables is to achieve a smooth transition towards mass-market integration of RE sources. This will also requires transforming today's situation into a future energy system in which RE competes with other energy technologies on a level playing field. Once this is achieved, no or few additional economic incentives will be needed for RE and its deployment will be accelerated by consumer demand and general market forces (IEA, 2008c). Therefore, it is evident that policy is one of the main drivers in moderate and high-renewables scenarios (REN 21, 2013). A working definition of *policy* for this study is provided in the next section.

5.2.1 Policy: A working definition

The term *policy* is defined as having a number of components, ranging from the broad policy paradigm which guides the approach to policy development in a particular area, to statements and intentions, written documents and institutional orientation and capacity (Tyler, 2009). Following from this definition it is argued that, at the level of written and stated energy policy, the intention exists to move towards a more diverse, efficient and less carbon-intensive energy sector. A number of policy instruments are being developed towards achieving this. However, the targets set are too low and all initiatives are hampered because of institutional and financing reasons (Tyler, 2009). On the other hand, however, the dominant energy policy paradigm and the orientation and capacity of the country's energy institutions are fundamentally misaligned with climate mitigation policy. In particular, conflicts between these institutions constrain policy co-ordination and hence alignment (Tyler, 2009).

At its broadest, policy is governed by the policy paradigm, defined as the system of ideas and standards that specify the goals of policy, the kinds of instruments that can be used to attain them and the very nature of the problems they are meant to solve (Marquard, 2006). For the purpose of this study, it is important to note that policy development can be contested due to conflict of interests within the policy-making community. This could result in a lack of coherence between the various components of policy (Marquard, 2006).

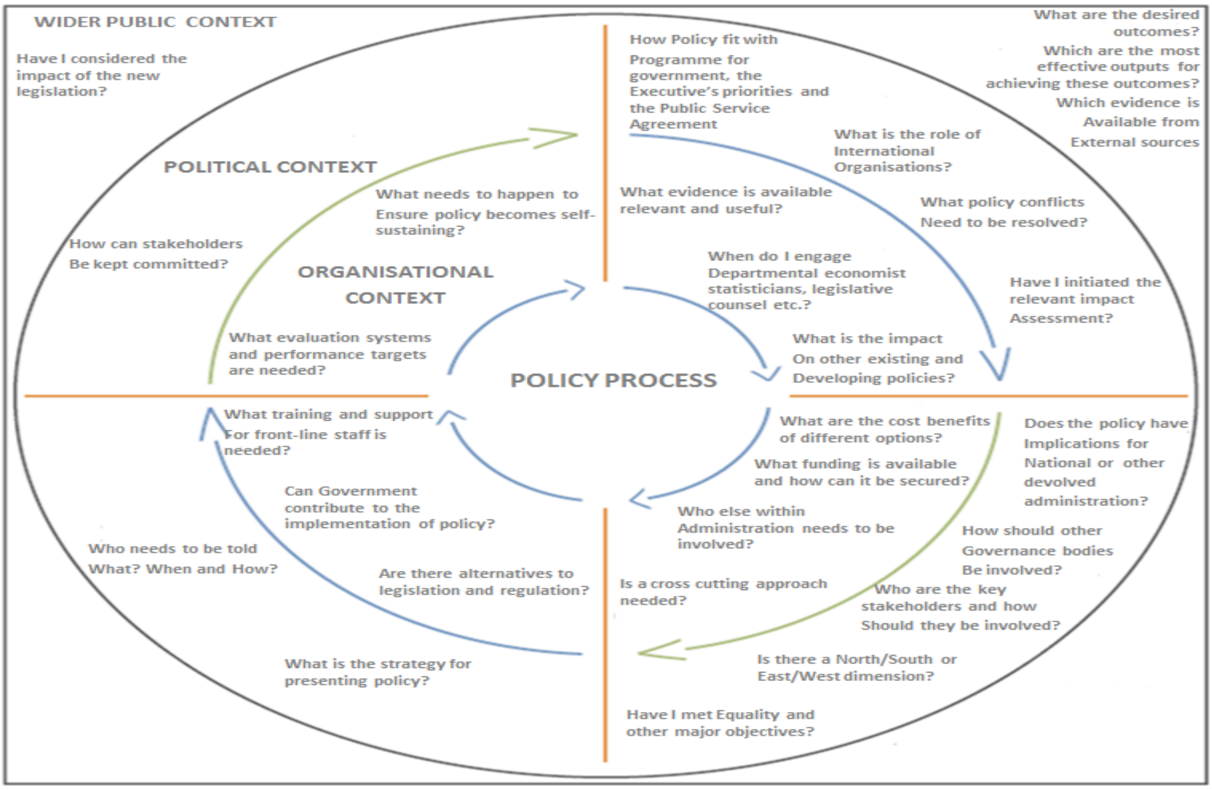
REN 21 (2013) concedes that with increasing levels of renewables, the business models and revenue streams of many existing utility and energy companies are coming under threat or stress. Some companies will lose market share, revenue and even sufficient profit to continue to exist. How existing companies (called 'incumbents') decide to respond to that stress will shape how RE develops in the future. According to REN 21 (2013), it is believed that utilities are already re-evaluating their strategies and this will certainly start to happen in the next three to five years within the industry. Overall changes in business models and market structures within the five to ten year time frame are certain. REN 21 (2013) further states that utility resistance is declining with new business models, guided by new policy frameworks and a mind-set change of established utilities, which are recognising that if change is not forthcoming, business-as-usual is not possible.

Globally, many countries have committed to RE targets and have adopted policies to promote the deployment of RE within their industries (IRENA, 2012). Nevertheless, the implementation of key RE initiatives seems to be slow and cumbersome. These initiatives do not seem to be supported by a clear policy or roadmap and financing plan to reach the RE targets. The importance of understanding electricity and energy policy-making and the implementation process is of vital importance as this shapes the industry and economic future of any country (IRENA, 2012).

Figure 5.4 depicts the policy process with the different impacting levels (organisational, political and public contexts) being noted. The process is agreed to be cyclical, a process that starts with a need and ends with an evaluation of the policy impact. It provides an overview of the policy-making cycle represented by questions that must be considered at each phase and in the appropriate context. As noted by IRENA (2012), policy does not occur in a vacuum. In reality, it takes place in a broad public, political and institutional context, in which the enabling structures are also a source of barriers to policy-making.

Figure 5.4 provides an overview to the policy-making cycle represented by questions that must be considered at each phase and in the appropriate context. How does the context of a country impact policy-making? It is assumed that emerging economies face the same types of challenges to the development and implementation of policy as any other country, advanced or developing. These challenges are exacerbated in smaller countries given their small populations, relatively small land areas and their emerging economies that are often dependent on external aid. According to IRENA (2012), the resources available for emerging economies to any particular sector of the economy or society are often limited. This applies to all resource aspects: institutional, human, fiscal and material. Limited resources are a barrier to policy-making and implementation in any context. Limited resources mean that the capacity to overcome barriers is generally diminished and together with limited opportunities for human resources development, including external competition, it becomes a challenge to retain experienced and trained staff within, amongst others, the energy and RE sectors of the government.

Figure 5.4: The Policy Process.



Source: IRENA, 2012: 7.

Tyler (2009) suggests that the overriding reason why the energy sector has underperformed on the implementation of climate mitigation aligned policies is argued to be the continuing orientation of the well-resourced energy institutions towards a centralised, fossil-based supply approach. There is limited institutional capacity to support energy efficiency, RE or planning responses to climate change mitigation and where these are attempted they are thwarted by lack of co-ordination, or more sinisterly, by well-established institutions with vested interests in maintaining the status quo.

5.2.2 Energy policy alignment with climate change policy

This study considers the alignment of existing and emerging energy and related policy areas with RE aspirations. Areas of synergy and conflict with a country's climate change mitigation objectives are explored and the researcher considers how greater policy alignment could be achieved.

Winkler, Marquard and Jooste (2010) posit that the primary causes of misalignment are argued to be, firstly, existing and entrenched institutional orientation and capacity and secondly, the lack of a single, overarching, co-ordinating energy policy institution which has sufficient power and influence to deal with the vested interests of the existing energy institutions. The authors then explore what would be required to align energy policy with a government's mitigation vision by means of thought experiments in the areas of RE and energy efficiency. The establishment of a single, overarching, co-ordinating energy policy institution is identified as a pre-requisite to any chance of alignment.

According to REN 21 (2011), policies for promoting RE exist in different shapes and combinations, depending on the national energy market conditions. Essentially, governments through effective policies try to achieve the following goals:

- Reduce market barriers for the relatively new RE technologies;
- Create energy market and infrastructure conditions in which RE products can compete with the currently dominating fossil fuels;
- Price the resource scarcity of conventional energy sources and thereby prepare for the time when their stocks are running low;
- Reduce the vulnerability to energy price volatility;
- Decrease impacts on environmental and human health;
- Explore the industrial RE market that features huge future growth prospects and employment capacities; and
- Balance the social, environmental and economic costs of conventional energies with RE (REN 21, 2011).

In trying to achieve these goals, countries find themselves facing a challenge with the introduction of RE in the industry. Challenges include access to the network, the administrative process and restrictive legislation governing RE generation in the electricity industry.

The purpose of policy should therefore be to remove or compensate for such obstacles, thus making renewable technologies competitive vis-à-vis traditional alternatives. It is proposed that state institutions should first tend toward the development of an overall regulatory framework that is conducive to market transactions (Garcia, 2013).

According to IRENA (2012), the main drivers for RE policy development identified globally include:

- Energy security: The risks involved with high dependency on fossil fuels, such as rising fuel costs and supply shortages, are further intensified by the rising energy demand. A transition to a greater share of renewables in the energy mix is part of the solution to establish greater energy security;
- Energy access: Higher electrification rates in with lower energy access would ensure better services related to health, education, communications, etc., contributing to socio-economic development;
- Abundance of RE resources: Some countries are relatively well-endowed with some RE resource(s) as in the case of South Africa where wind and solar are dominant energy sources; and
- Readily available financing and technical assistance: The availability of financing (through loans and grants) and technical assistance for projects from donor agencies and organisations facilitate RE deployment.

Policy for alignment necessitates that financial resource for IPPs be available and accessible in the industry. Thus financial resources pose a barrier to entry for most start-up IPPs. Financial resources and market barriers include:

- Budget constraints that hamper the development of energy policy and also hamper the possibility of conducting workshops to generate proposals;
- The lack of funds in particular phases of RE deployment hinders undertaking energy resource assessments or feasibility studies for RE projects;
- Limited public funds often create competition for financial resources between different sectors. This may limit the allocation of funds to the energy sector;
- The high upfront cost of RE technologies makes RE investments more difficult;
- Small market sizes are often less attractive to entrepreneurs; and
- The lack of regulatory frameworks that would encourage private participation in the energy sector (IRENA, 2012).

The RE sector is in its infancy stage in most emerging economies and though developed economies are better inclined, barriers to entry for IPPs still pose a challenge for the electricity industry.

5.3 BARRIERS FOR IPPS IN THE RE SECTOR

The elimination of market distortions in the electricity industry that put RE at a disadvantage vis-à-vis conventional electricity generation sources, remain important. Therefore, it is necessary to create a level playing field especially from a cost and benefit perspective (IEA, 2006). RE deployment requires an enabling environment with conditions that are conducive to fostering investments. Governments can help shape enabling environments by supporting the adoption of policy and regulatory frameworks whilst removing administrative barriers to RE sector. This would make RE investment more attractive (IRENA, 2012).

REN 21 (20112 posit that barriers to using RE include:

- *Costs and pricing*: Both implicit and explicit subsidies for fossil fuels distort the market conditions and investment decisions, thereby handicapping their RE competitors. The prevailing blindness of conventional markets to environmental costs encourages the subsidies and yet, because RE accounts for the environmental impacts that conventional energy sources usually externalise, they have a hard time competing with the low market price of fossil resource-based power. Additionally, RE investments require larger amounts of financing than conventional energy sources due to the high initial capital costs. Thus the hurdle rate for RE projects is higher and capital markets can demand a premium lending rate for financing these projects because more capital is being risked upfront than in conventional energy projects. Periodic fluctuations of oil and gas prices change the opportunity costs for RE projects and directly influence investment motivation;
- *Legislation:* Generally, RE producers encounter a variety of legal hurdles, due to the fact that the policy field is relatively new and often works on a trial-and-error basis. Subsequent to the newness, RE policies are subject to constant changes and investments are often held back because governments do not provide the necessary policy stability that can guarantee long-term profit. Although IPPs suffer from a lack of legal frameworks, other RE entities are impaired by planning restrictions that are too stringent to foster innovative technologies or business strategies;
- *Infrastructure:* RE producers must compete against technologies that rest on well-established infrastructure, designed to suit their special characteristics. The

difficulties in predicting the exact production quantities from RE sources make it hard to weave these technologies into a grid that is designed to calculate and deliver the exact amount of electricity that is consumed at any given point in time. Natural processes bring about these fluctuations in production capacities for RE; further research and technological advancement are needed to match conventional grid characteristics and novel RE generation;

- *Information:* The information infrastructure of RE is also lagging. The lack of technical skills, commercial skills and sufficient information about the benefits, risks and implementation of RE projects hinders the uptake of this relatively new technology;
- *Market performance:* Power project developers have difficulties obtaining sufficient bank financing due to the prevailing uncertainties of long-term power purchase agreements of energy utilities. Since the innovation adoption lifecycle of RE technologies has not reached the early majority stage yet, the lack of perceived technology performance raises the required rate of return and restrains access to capital; and
- *Suitability of technologies:* Although RE offers considerable improvement in environmental integrity compared with conventional energy sources, it also impacts the environment. The applicability of renewable energy technologies depends on the availability of capital, equipment and know-how as well as resource and space accessibility. The most suitable RE mix, incurring the least costs on society and the environment, differs from country to country and national strategies are limited in their transferability (REN 21, 2012).

The reluctance of enacting policies to support RE is often attributed to a variety of barriers or conditions that prevent investments from occurring. Often the result of barriers put RE at an economic, regulatory, institutional or financial disadvantage relative to other forms of energy supply (Beck and Martinot, 2004). Table 5.1 illustrates the different barriers that could be experienced in the electricity industry by IPPs.

Generally IPPs experience policy barriers such as limitations of public finance, lack of formal institutional framework for developing and implementing energy efficiency strategies and a lack of interest from financial institutions for funding. It can be noted that the RE sector is plagued by barriers faced by IPP entrepreneurs seeking to explore feasible business opportunity in the electricity industry.

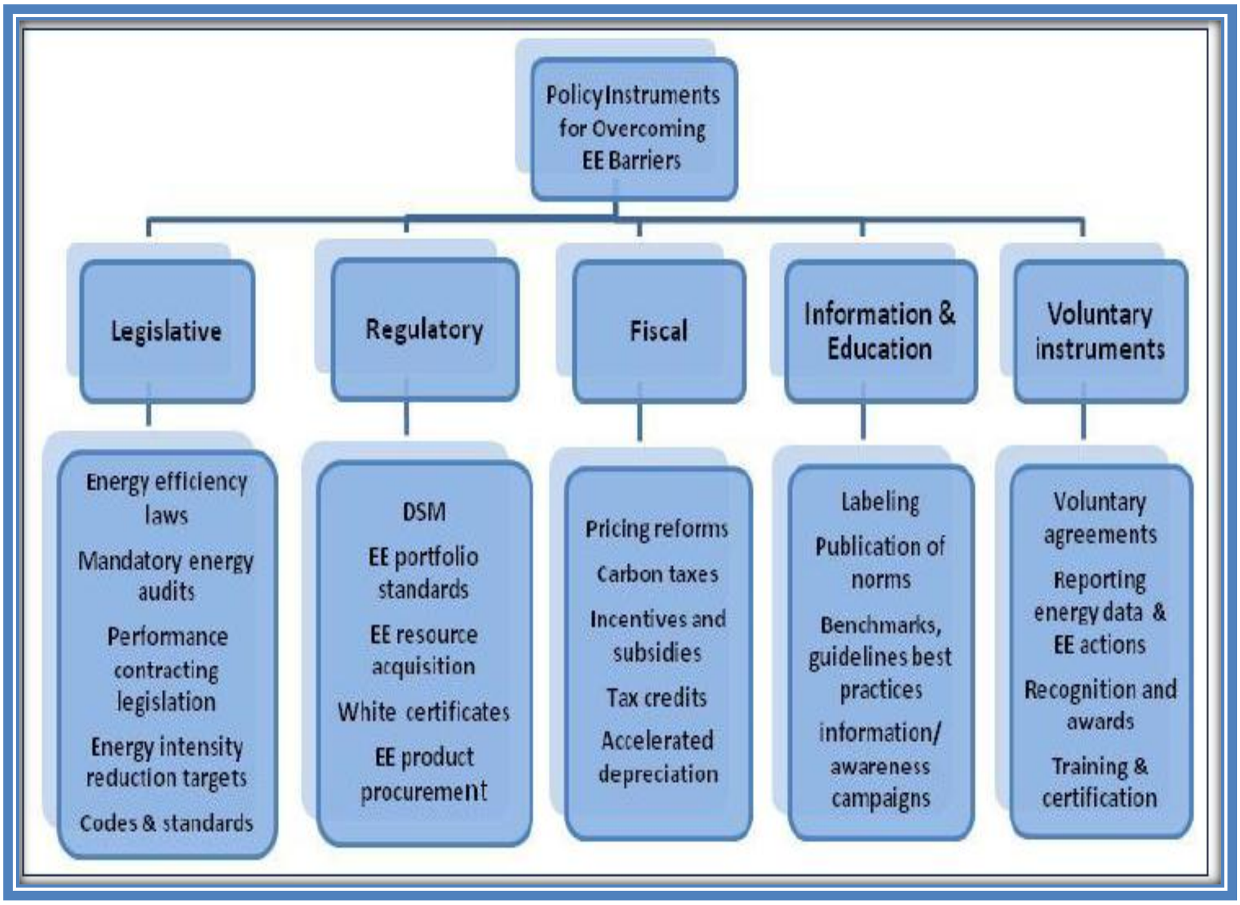
Table 5.1: Barriers to RE generation.

Policy/Regulatory Barriers	End-User Barriers	Barriers related to equipment & service providers	Institutional Barriers	Financing Barriers
Low or subsidised energy prices	High cost of energy-efficient products	Limited development of EE services market	Lack of formal institutional framework for developing and implementing energy efficiency strategies, policies and programs	Small project size
Distorted fiscal and regulatory policies	Consumer preferences	High project development and transaction cost		High transaction cost
Rigid procurement and budgeting procedures	Split incentives	Limited risk management skills	Emphasis on increasing energy supplies; not on reducing consumption	Limited availability of funds
Limitations of public financing	Low management priority on EE	Limited access to equity capital	Lack of confidence in EE improvements to deliver savings	High perceived risk
Ad hoc planning	Limited technical knowledge on EE	Lack of credibility with customers and financial institutions	Lack of champions for promoting EE	Lack of interest on the part of banks and financial institutions
Limited data availability and quality	Lack of interval funds for EE investment	Limited M&V capacity	Limited knowledge and understanding of EE by consumers	Limited development of targeted financial products for EE

Source: Limaye, 2010: 15.

Table 5.2 addresses which policy instruments to consider in the attempt to overcome barriers within the RE sector. In the context of this study, legislative, regulatory and fiscal barriers are fundamental as emerging economies depend on these instruments to ensure an enabling entrepreneurial environment for IPP activity in the RE sector.

Table 5.2: Policy instruments for overcoming RE barriers.



Source: Limaye, 2010: 21.

The policy instruments stipulated in Table 5.2 are amongst the most common barriers found within the electricity industry. In the attempt to ensure an enabling environment for IPPs in the RE sector, countries need to ensure that mitigation strategies are in place and implemented. Limaye (2010) states that whilst ensuring the eradication of such barriers, countries need to educate regulators to treat IPPs on a level playing field with regard to RE, provide detailed information to regulators on the IPP programmes, build regulatory capacity to develop and implement IPP rules and regulations and stimulate strong participation from these providers.

5.3.1 Overcoming economic barriers in RE sector

Economic barriers are those high costs and/or insufficient revenues that prevent greater investment in the deployment of renewable technologies. The purpose of policy should therefore be to remove or compensate for such obstacles, thus making renewable technologies competitive against conventional alternatives. It is noted that: (1) the economic barriers identified are basically obstacles that derive from market distortions, market failures, or other economic disadvantages that renewables suffer and (2) it is believed that once the market is corrected (the obstacles are removed or compensated for), renewable technologies will become competitive, thus increasing investment in deployment and in cost-reducing innovation (Garcia, 2013).

IEA (2006) cited the emphasis placed on the need to create the market conditions that encourage increasingly cost-effective investment in renewables through economic policy. The main goal when promoting RE is to achieve a smooth transition towards mass-market integration when promoting such renewables (IEA, 2008c). This will also require a profound evolution of markets transforming today's situation into a future energy system in which RE competes with other energy technologies on a level playing field. Once this is achieved, no or few additional economic incentives will be needed for RE and its deployment will be accelerated by consumer demand and general market forces (Garcia, 2013).

Table 5.3 depicts to the elements in a best practice model to ensure sound policy towards removing barriers and creating an enabling entrepreneurial environment for IPPs in the RE industry. It further indicates the divergence from best practice using China as an example of an emerging economy. China's lead indicators centred both on economic and non-economic barriers to entry. The RE industry faces a challenge in China as the divergence from best practice in key areas mentioned could hamper the growth of RE. Table 5.3 briefly outlines the best practice or deployment of RE and the Chinese divergence.

Table 5.3: Best Practice or the Deployment of RE and the Chinese Divergence.

	Policies and institutions for RE in best practice model	Elements typical of a liberal market economy	South African divergences with best practice
Policies to overcome economic barriers	❖ Elimination coal subsidies ❖ Compensation for the negative externalities of fossil fuels ❖ Remuneration for the positive externalities of renewables ❖ Compensation of high initial cost (mandated market policies) ❖ Increased access to capital: fiscal and financial aid ❖ Ensuring sufficient demand (PPA)	Perfection of markets: ❖ role of government is to, with an arms length approach ❖ eliminate market distortions compensate for market failures	Negative externalities not fully compensated for: ❖ Regulations focus on installed capacity rather than power generation ❖ Remuneration levels are low and duration of tariffs is short ❖ Regulations do not include enough provisions for reduction of tariffs ❖ PPA do not ensure connection
Institutions to overcome noneconomic barriers	General legal security Capable bureaucracy: ❖ coordination and cutting of red tape ❖ Quality of regulations in RE: specific, legally binding targets and predictable instruments ❖ Competition and technology-friendly policies in generation: unbundling, absence of oligopolies, openness to FDI ❖ Competition and technology-friendly policies in manufacturing: openness to external trade and FDI	Liberal market institutions: ❖ Role of government is to set formal and predictable (stable, nondiscretionary, and transparent) rules that are effectively enforced and to ensure low barriers of entry and Competition	❖ General security and uncertainties ❖ Incomplete coordination and complex and lengthy red tape ❖ Targets not compulsory and instruments lacking stability and transparency ❖ Limits to competition in generation (market concentration, public ownership and barriers to foreign entry) ❖ Limits to innovation (barriers to foreign trade and entry)

Source: Garcia, 2013: 123.

According to REN 21 (2013), regulatory policies ensure that RE is treated with the significance in the markets that it deserves, corresponding to its importance in achieving low carbon green growth. The policies should open the grid to RE, guarantee a competitive price or ensure a specific market share of RE. This can be managed with a variety of instruments:

- *Feed-in tariff:* Also known as a fixed-price policy because a government defines a fixed tariff for RE. Grid companies are required to purchase all RE power generated by the power companies. The Feed-in tariff can promote specific technologies, project locations or project sizes. Businesses appear to prefer the Feed-in tariff and its derivatives because they are more effective than other policy options;
- *Renewable portfolio standards:* Quota obligation policies, also known as renewable portfolio standards, establish a target for the share of electricity from RE sources by a certain date;

- *RE certificates:* RE certificates are granted for the production of green energy and can be traded on the market and are commonly used with a RE quota. They establish economic efficiency by enabling those businesses that can produce RE with the least cost to sell a certificate to businesses that would have to pay high up-front infrastructure investments to achieve their quota; and
- *Net metering:* Net metering describes a system in which solar panels and other small-scale RE generators are connected to a public utility power grid. Only the net difference between electricity consumption and production by the client is accredited or bought by the grid at a price that depends on the retail electricity price (REN 21, 2013).

The management of the abovementioned instruments will ensure the drive to lower carbon emissions, improve competition amongst RE providers and provide a better playing field. Thus support to IPPs in the RE sector proves to be imperative in the quest of RE implementation towards a sustainable electricity industry. Table 5.4 indicates per country (Austria, Finland, France, Germany and the United Kingdom) how RE is supported through policy and at which point integration of IPPs into the industry should be allowed. For the purpose of the study, these countries were selected as they are amongst the leading countries promoting RE support policies (REN 21, 2013).

Table 5.4: RE policy country profiles.

Country	Important policy changes	RE Support Policy	RE-Electricity Support Policy	RE- Grid Integration
France	Ministry of Economy passed a new decree on the support of photovoltaics power that brought major changes to the tariff structure. Tariffs for all sizes of installation were lowered significantly by 20 % after having been one of the highest in Europe. The revision of the policy also brought a new categorization to the tariffs that distinguishes between fully integrated and integrated installations, location (mounted to private, commercial, and public buildings; ground-mounted), and size.	A fixed feed-in tariff and a public competitive bidding scheme for biomass and offshore wind power plants are the key instruments for RES-E support in France. The feed-in tariff covers all major renewable energy technology and provides support for periods of 15 and 20 years depending on the technology.	Support for RES-E is provided by a feed-in tariff scheme. The scheme is not regulated by an own law but is integrated into the Law on the Modernisation and Development of the Public Electricity Supply.	The grid connection of all important RES-E installation is arranged by a standardised contract between the developer and the distribution system operator or in rare cases, the transmission system operator. The developer connects to the closest point on the network and the grid reinforcement costs are borne by the distribution or transmission system operator. As a general rule, all electricity is bought by the grid operator at the guaranteed feed-in tariff. RES-E installation operators do not have to sell their electricity on the market, and they are not responsible for their electricity production forecast.
Country	**Important policy changes**	**RE Support Policy**	**RE-Electricity Support Policy**	**RE- Grid Integration**
Austria		Austria passed a new green electricity act in July 2011, which in parts is still awaiting approval by the European Commission. New dynamics are already observable as additional budget to reduce the waiting list have already become effective.	After its adoption in 2002, finely tuned feed-in tariffs caused a particularly strong deployment of wind energy, biomass and biogas. After a decline of support levels and further modifications (i.e. budget restrictions and reduced guaranteed duration of support) in recent years, the development of new RES-E projects in Austria had almost stopped.	The main promotional instrument to support electricity from RES in Austria is a feed-in tariff system offering technology-specific incentives with purchase obligation. The purchase and selling of green electricity is administered by the settlement centre. The guaranteed duration of the feed-in tariff is currently 13 years for all non-feedstock dependent technologies (e.g. wind, solar) and 15 years for feedstock-dependent technologies (e.g. biomass).
Finland	No significant policy changes in Finland since March 2011	The new Law on support of RES-E production entered into force on 25 March 2011. The main support instrument for RES-E is now a feed-in premium. The calculation of feed-in premium is based on the target price and market price difference in the case of wind, wood fuel and biogas.	In order to promote RES-E, a market-based feed-in premium scheme was introduced in 2011 (effective from 25 March 2011). This scheme is based on the Law on support of RES-E production. The feed-in premium will be equivalent to the difference between the target price and the market price of electricity.	The Electricity Market Act provides guaranteed access to the grid for all electricity users and electricity-producing plants, including RES-E generators. The grid operator is obligated to grant connection for RES-E generators to the grid according to non-discriminatory criteria. RES-E projects do not have priority in grid connection in case of grid congestions.

Table 5.4 (continued): RE policy country profiles.

Country	Important policy changes	RE Support Policy	RE-Electricity Support Policy	RE- Grid Integration
Germany	Significant changes have taken place in RE. In June 2011, the German Bundestag passed a new amendment of the Renewable Energy Sources Act (EEG), which will come into effect on 1 January 2012. Being its third major revision, the law aims to make renewable energy more competitive. In parallel to the existing fixed feed-in tariffs, it introduces a market premium that allows power producers to sell RES-electricity on the electricity market.	The main support instrument for RES-E is a feed-in tariff scheme (Renewable Energy Sources Act, EEG). All relevant technologies are eligible, except for co-firing in conventional power plants. The scheme grants fixed feed-in tariffs and as option – as of 2012 – sliding feed-in premiums for a period of 20 years.	Support for RES-E is provided by the EEG, a feed-in tariff scheme. Tariff levels are differentiated by technology and project size. Under the current feed-in scheme, fixed tariffs are paid that include both the support payment and the electricity price. As of 2012, RES-E producers can choose between the fixed tariff and a feed-in premium option.	There is a "shallow" connection charge philosophy in Germany. According to the EEG, grid operators are obliged to connect, transport and dispatch RE with priority over conventional generators. Extension measures in the grid that are necessary for the connection and integration of RE are paid by the grid operator and charged to consumers through the network tariffs.
Country	**Important policy changes**	**RE Support Policy**	**RE-Electricity Support Policy**	**RE- Grid Integration**
United Kingdom	There have been a number of key RES policy updates in the UK since March 2011. In August/September 2011 feed-in tariffs (FIT) for solar PV (>50kW) were reduced and farm-scale anaerobic digestion increased following a „fast-track review" of the scheme. Government announced further reductions to solar PV tariffs in October 2011, effective from December 2011. Significant changes have also been announced for the operation of the Renewables Obligation (RO), the UK"s primary policy instrument for promoting large-scale RES-E generation.	The key policy instruments for the support of RES-E at the national level are the Renewables Obligation (RO) and the recently introduced Feed-in Tariff (FIT).	The primary support mechanism for RES-E in the UK is the Renewables Obligation (RO), a quota system with tradable green certificates known as Renewables Obligation Certificates (ROCs).	Historically, the grid operator, National Grid, was obliged to grant access to the grid according to non-discriminative criteria. RES-E was therefore not given priority (compared to conventional generators). DECC undertook two public consultations on improving grid access for RES-E (and other low-carbon generation) in 2009 and 2010348. This led to the introduction of the „Connect and Manage" (Socialised) regime for grid access in August 2010, which will enable new and existing RES-E generation projects to connect to the network more quickly.

Source: Winkel and Rathmann, 2011: 113.

Table 5.4 further indicates that for leading developed economies, policy changes and updates are priorities. The main support instrument for policy is predominantly Renewable

Energy Feed-In Tariffs (REFITs) in the RE sector. The push for REFIT in emerging economies such as South Africa comes from within NERSA despite internal opposition from the Department of Energy (DoE). Despite some continuing national resistance to renewable energy, perceived political and financial risks and hold ups in REFITs procurement process, the DoE, National Treasury and some departments of Eskom now appear resigned to REFIT and are working towards its realisation. The research found that once the process had become high profile and appeared irreversible, the DoE supported by National Treasury took over the process, removing it as much as possible from the jurisdiction of NERSA and Eskom. The integration of RE into the electricity industry remains important as it creates new market competition and ensures that the industry is reformed by the use of renewable energy sources for electricity production.

5.4 INCENTIVES FOR IPPS IN THE RE SECTOR

To make the RE sector attractive and competitive, a certain amount of attention and priority needs to be given by local government towards incentivising IPPs for electricity generation efforts. The most common and probably most effective policy instruments used in support of RE technologies are Feed-in tariffs (Mendonça, 2007). First applied successfully in Germany, the scheme has spread to more than forty countries. The idea behind a Feed-in tariff is to guarantee producers fixed tariffs for power from RE sources over a certain period of time, in most schemes from ten to twenty years. This creates a basis for long-term investment planning, since revenues are known and guaranteed in advance.

The tariffs are usually differentiated according to which renewable energy technology is supported. They exceed the normal electricity price paid by consumers and ideally enable the investor to cover costs and earn a reasonable return on investment. The additional costs due to the higher tariffs are passed on to all power consumers in the form of a premium per kilowatt hour. In some schemes, tariffs are adjusted over time to prevent consumers from paying unnecessarily high prices and to allow for technology learning curves. However, these adjustments must be predictable if investment certainty is to be maintained (Pegels, 2009).

Different incentives need to be considered to ensure an enabling entrepreneurial environment for IPPs in the RE sector. Fiscal incentives and public financing are key considerations in ensuring the sustainability of the RE sector.

5.4.1 Fiscal incentives

The IEA (2010c) indicates that fiscal incentives should reduce the costs of RE projects or improve the relative competitiveness of RE technologies, through:

- *Subsidies:* Governments subsidise different economic variables via investment subsidies or capital subsidies, output subsidies or consumer (user) subsidies;
- *Tax incentives:* To enable businesses to bridge the time and price gap of relatively expensive RE investments, governments grant tax reductions, such as annual income or fixed-assets tax decreases for investors or producers of RE, or tax exemptions for the purchase of RE technologies; and
- *Energy production payment:* Governments pay per unit of produced RE (IEA, 2010).

5.4.2 Public financing

Public financing is used to muster up the necessary capital for the RE sector, either by providing funding for RE projects or by awarding contracts:

- *Public competitive bidding:* RE projects are tendered by a government and a bidding process is used to choose investors. Power companies sign a power purchase agreement with the successful bidder within a specified period and all electricity is purchased at the bidding price. The competitive tender process can either commit successful bidders to deliver power at the price offered in their proposal or set the price for all successful bidders according to the highest accepted bid;

- *Public RE fund, loans or grants:* Due to the limited access to finance, especially for small and medium-sized enterprises, public funds, loans with favourable interest rates, grants and other financing options can be a viable means to bridge this deficiency; and

- *Public procurement:* Governments can step in and set a good example by installing RE facilities in and around government buildings and public places or by covering their energy demand with RE (IEA, 2010).

Table 5.5: Developed countries RE policy perspective.

Country	Subsidies	Tax incentives	Other incentives
Austria	Possible to receive a feed-in support for the electricity in the case of combined heat and power production.	Tax reduction for the production of RE.	With respect to biomass heating systems, investment incentives are granted in every state, but amounts and sets of conditions vary. Financial grants at the federal level are awarded on the basis of the Environmental Support Act. The corresponding support program is called "Environmental Support in the Inland".
Finland	All RE technologies are eligible for grants and there are no restrictions on sizes of plants. Among other costs, the preparation and planning costs and the cost of materials are eligible for subsidies. Only companies, municipalities and communities can apply for grants.	Taxes on heat are based on the net carbon emissions from input fuels, and are zero for RES.	Energy Grants for Residential Buildings are regulated by the Law on Energy Grants for Residential Buildings. The main beneficiaries of this instrument are households. Grants are available for investment and research projects that involve the use of RES or the application of RES technologies.
France	Feed-in tariff scheme. The scheme is not regulated by an own law but is integrated into the Law on the Modernisation and Development of the Public Electricity Supply.	A tax deduction policy.	Zero interest loan (the "Eco-Pret à Taux Zero"). A tax deduction scheme dedicated to promote RE, energy sources in heating and cooling of private households.
Germany	Low-interest loans with fixed interest rates grace years in the start-up phase. Support for RES-E is provided by the EEG, a feed-in tariff scheme.	A tax deduction policy. Pure conventional biofuels that are not mixed with conventional fossil fuels benefit from a partial tax exemption under the Energy Tax Act.	Financial incentive programme that offers investment subsidies and grants as well as long-term, low-interest loans with a fixed interest rate and redemption-free grace periods and an additional repayment bonus (financed from federal funds) for RE producing installations.
United Kingdom	Fixed FIT (fixed tariff per unit electricity regardless of the wholesale price) The Climate Change Levy (CCL) is an environmental tax on industrial and commercial users of electricity (domestic and transport sectors are excluded); RES-E generation is exempt from the levy.	Enhanced Capital Allowances provide businesses with up-front tax relief on capital investment in designated energy-saving plant and machinery.	The Renewable Heat Premium Payment gives vouchers to householders to help them buy renewable heating technologies prior to the extension of the RHI scheme to cover the domestic sector.

Source: Derived from Winkel and Rathmann, 2011: 115.

Table 5.5 depicts the RE policy incentives and subsidies undertaken by five developed countries. Indicative is the use of FIT and public incentives for used of RE technologies. Tax deductions are quite significant within the listed countries. Winkel and Rathmann (2011) comment that in order to re-shape the RE industry, past and present success of policies for RE will have to be constantly evaluated and recommendations investigated to improve future RE support schemes and sustainability of the electricity industry. The lack of providing start-up subsidies for IPPs in emerging economies proves to be a major stumbling block. This, in addition to tax incentives for RE generation, needs to be implemented as best practice in countries such as South Africa.

The RE policy perspective for developed countries has been discussed and incentives for IPPs in the RE sector have been noted. For the purpose of the study, focus must now be on the RE status quo in South Africa.

5.5 THE CURRENT ELECTRICITY STATUS QUO IN SOUTH AFRICA

Energy policy in South Africa has undergone a substantial revision and now focuses on energy for development. A multi-stakeholder consultation process to redefine the priorities and objectives ended with the publishing of the White Paper on the Energy Policy of the Republic of South Africa in December 1998 (South Africa, 1998). It describes South Africa’s general policy for the supply and consumption of energy and outlines the path for the growth and development of renewables and the improvement of energy efficiency in an effort to achieve a more sustainable energy mix that promotes the country’s economic growth (Imbewu Sustainability Specialists, 2009).

South Africa’s new energy policy priorities are spelt out, with particular emphasis on improved access to energy for communities previously disadvantaged by apartheid. Another priority that is of relevance is the dismantling of large scale monopolistic structures, notably Eskom and the synthetic fuels sector. This has so far not been achieved and is thus an on-going process. Eskom still generates more than 90% of South Africa’s electricity and is the sole transmitter (Eberhard, 2007).

South Africa’s electricity policy is facing challenges and is in the process of undergoing changes. The country is historically dependent on cheap coal for approximately 90% of its electricity generation. In December 2009, President Jacob Zuma pledged to reduce the country’s greenhouse gas emissions by 34% by 2020 and 42% by 2025 at the Copenhagen climate change summit. Baker (2011) contends that South Africa still faces the crisis of generation which resulted in rolling blackouts and mine closures across the country in 2008. The country’s monopolistic utility Eskom, which currently generates 94% of the country’s electricity, is struggling to build an additional 20 000 MW of generation capacity by 2025 (Eskom, 2010) whilst facing a funding crisis. The era of cheap electricity, of particular benefit to the country's large energy intensive users, is over. In recent months NERSA declined to approve a tariff increase of 16% and allowed utility Eskom only 8%. Through South Africa's Energy White Paper (1998), capital investment in RE generation could enable up to 30% of the country's generation from independent power producers (IPPs). Sadly, the appropriate legislation was never enacted and no private generation was incorporated. The RE White Paper (2003) allows for 10 000 GWh (0.8 Mtoe) RE contribution to final energy consumption by 2013 (Department of Minerals and Energy, 2003). South Africa's RE FIT to attract independent renewable generation was first announced in 2008. South Africa is the world's fifth largest producer of coal (World Bank, 2008). Despite the absence of national expertise, South Africa also has potential for a number of different RE technologies including: wind, solar water heaters, concentrated solar power, solar PV and biomass.

RE is also often dismissed because of the grid challenges of storing and distributing it and its inability to cater for bulk supply. This could be symptomatic of a grid that is not sophisticated and intelligent enough to enable RE. There are examples in the U.S. of solar and wind energy being generated during off-peak hours and then stored by using storage technologies. Many excellent and cheap technology options are already available. As a preferred energy source, carbon storage technology need more research and development, but a lot of what is necessary for reducing emissions and scaling up the uptake of renewable energy by Eskom is already available (Kiratu, 2010). It is evident from the literature that emerging actors in private RE generation offer an equal opportunity and challenge to the entrenched interests of the minerals-energy complex, a structure already under threat from rising coal costs, electricity supply issue, rising tariffs and a threat to the utility Eskom which is struggling to hold onto its monopoly (Baker, 2011).

Despite misalignment and delays at the level of policy, stakeholders such as Eskom, NERSA and government have achieved some success in attaining a certain level of change. Central to the success of the electricity industry in the long-term is how the South African RE sector can accommodate IPP entrepreneurs on the power grid. However, there has been limited unity of vision and purpose in formulating and implementing RE policy at the national level. Despite the great efforts of those involved in the country's potential wind industry, there is not one national champion of RE to forge a path but rather a number of different entities acting at times in competition with each other (Baker, 2011).

Furthermore these disparate strands have to compete with entrenched vested interests such as the energy intensive users group who as demonstrated by the IRP (Integrated Resource Plan) 2010 have more access to and influence over decision makers in government (Baker, 2011). Best practice needs to be considered for implementation in South Africa as the demand for electricity and especially RE targets is on the increase. Table 5.6 depicts the divergence from best practice policies implemented in developed countries. It indicates key areas where current policy can be amended or further developed.

Governments should aim at levelling the playing field for RE or eradicate market distortions and policy that currently favour fossil fuel-based energy technologies. Introducing support instruments such as access to finance for IPPs, a more streamlined registration process and improved competition in generation are key areas needed towards creating an enabling entrepreneurial environment (Garcia, 2013).

Table 5.6: Summary of Best Practice for the deployment of RE and the South African divergence from policy Best Practice.

	Policies and institutions for RE in best practice model	Elements typical of a liberal market economy	South African divergences with best practice
Policies to overcome economic barriers	❖ Elimination coal subsidies ❖ Compensation for the negative externalities of fossil fuels ❖ Remuneration for the positive externalities of renewables ❖ Compensation of high initial cost (mandated market policies) ❖ Increased access to capital: fiscal and financial aid ❖ Ensuring sufficient demand (PPA).	• Perfection of markets: role of government is to, with an arms length approach, eliminate market distortions and compensate for market failures.	Negative externalities not fully compensated for: ❖ Regulations focus on installed capacity rather than power generation ❖ Remuneration levels are low and duration of tariffs is short ❖ Regulations do not include enough provisions for reduction of tariffs or tariff reviews ❖ PPA with selected few. Other investors not assured connection.
Institutions to overcome noneconomic barriers	General legal security Capable bureaucracy: coordination and cutting of red tape Quality of regulations in RE: specific, legally binding targets and predictable instruments Competition and technology-friendly policies in generation: unbundling, absence of oligopolies, openness to FDI Competition and technology-friendly policies in manufacturing: openness to external trade and FDI.	Liberal market institutions: role of government is to set formal and predictable (stable, nondiscretionary, and transparent) rules that are effectively enforced and to ensure low barriers of entry and Competition.	General insecurity and uncertainties. Incomplete coordination and complex and lengthy red tape Targets not compulsory and instruments lacking stability and transparency Limits to competition in generation (market concentration, public ownership and barriers to entry) .

Sources: Garcia, 2013: 124.

5.5.1 The South African electricity and RE policy

According to Wlokas, Boyd and Andolfi (2013), demystifying the complexities of South Africa's energy policy in a context of constantly moving goal posts and a multitude of processes is a challenge. REIPPPP's operators and investors have shown remarkably little sensitivity to past mistakes and policy shifts in the power sector, and although they remain wary of the consequences of future policy changes or problems resulting from attempts to formalize the structure of the program, they seem remarkably confident that their projects will endure. Despite intense interest in the past few years from RE IPPs waiting to construct and connect their projects to the country's electric grid, numerous policy uncertainties and delays remain. A limited number of RE Power Purchase Agreements (PPA) has been licensed but greater clarity has now been provided by the imminent approval of the country's long-awaited IRP 2010 which is to shape the country's energy mix for the next twenty years (Wlokas, Boyd and Andolfi (2013).

The South African energy sector is very simple in structure and there is only a small number of primary energy sources, with limited substitution between energy carriers and an overwhelming reliance on coal. Coal-fired power generation provides over 80% (Imbewu Sustainability Specialist, 2009) of the country's electricity supply and through the Fischer Tropps process, Sasol's coal-to-liquids plants convert coal into a third of the country's liquid fuels supply (Winkler, 2005). Energy (and more specifically electricity) plays an essential role in the production capacity of a country. It is a crucial role, specifically for the manufacturing sector where energy is considered an irreplaceable input (Inglesi-Lotz, 2014). The development of the sector has its roots in the mining industry, with the minerals-energy complex (Fine and Rustomjee, 1996) driving South Africa's industrialisation, which has been premised on the availability of cheap and secure energy supplies. The South African economy is therefore highly energy intensive and also energy inefficient. By promoting cheap energy as one of its main sources of competitive advantage, it has continued to attract energy intensive investment up until the electricity supply crisis of 2008, where there was still talk of a developmental tariff for foreign direct investment. Therefore, virtually all types of national and local planning, public or private, requires consideration of the implications on future electricity needs in order to establish whether there is sufficient electricity supply capacity in the country to support future plans (Koen and Holloway, 2014). In Africa, Eskom is Africa's largest and the world's fourth largest energy utility tasked with electrifying the South Africa and parts of the African continent (Tyler, 2009).

The Department of Energy (DoE), until recently the Department of Minerals and Energy (DME), has policy oversight over the sector. The DoE has two branches, the electricity and nuclear branch and the hydrocarbons, energy planning and clean energy branch. Traditionally, the DoE has its strongest policy capacity in the liquid fuel's section followed by electricity (Marquard, 2006). The DoE has both a RE and energy efficiency directorate, but these have consistently suffered from lack of capacity and resources. Marquard (2006) describes the Department as having an analytical culture, with policy-making mostly happening outside the line functions, in the broader energy sector policy communities. The importance of policy most especially for the RE sector remains central to the sustainability of the electricity industry and therefore needs to be prioritised. Divergence from best practice in terms of policy necessitates capacity and resources; key areas that are facing serious challenges. South Africa is in the early stages of emerging climate change and RE mitigation policy, with only policy intentions and directions existing at this stage.

Winkler, et al. (2010) define the term *policy* in a South African context as having a number of levels and components. Following from this definition it is argued that, at the level of written and stated energy policy, the intention exists to move towards a more diverse, efficient and less carbon-intensive energy sector. A number of policy instruments are being developed which go some way towards achieving this, although targets set are too low. However, at a policy paradigm level, the dominant energy policy paradigm and the orientation and capacity of the country's energy institutions are fundamentally misaligned with the Cabinet's mitigation vision.

Policy was most developed for electricity and nuclear, with very little policy or strategy guiding coal and liquid fuels. In this era, the South African energy sector could be said to be operating within an energy supply policy paradigm (Marquard, 2006), with individual energy supply communities dominating the policy development and implementation process and acting largely in silos.

Whilst the White Paper on Energy (1998) also held significant promise of increasing alignment of energy policy with climate mitigation initiatives, the subsequent decade has shown substantial backtracking on this promise, less so in written policy than in the institutional policy environment and the sustaining of an energy supply type policy paradigm and the interests of cheap coal and high energy consumption (Department of Minerals and Energy, 2003). Winkler and Marquad (2009) posit that developments in the energy sector have the biggest influence on Green House Gas (GHG) emissions in South Africa. The key policy framework for the energy sector is contained in the White Paper on Energy (1998) and the subsequent White Paper on Renewable Energy (2003).

The Renewable Energy White Paper (2003) commits the country to 10 000 GWh contribution of RE to final energy demand. NERSA is emerging a RE Feed-in-tariff (REFIT), which pays a subsidy to RE generators. This is expected to provide a long awaited kick-start to the renewables sector in the country and enables South Africa to meet its RE target (Department of Minerals and Energy, 2003). The cost of the subsidy will be passed through to electricity consumers, with Eskom mandated to pay the premium as sole purchaser of generated electricity in the country. Whilst the pricing structure has been agreed, with the DoE providing the regulatory framework in the regulations on new generation capacity, Eskom is reportedly still to sign off on the power purchase agreements which would give effect to the first RE generation under the REFIT.

Tyler (2009) contends that planned fossil fuel infrastructure projects such as Eskom's Medupi and Kusile power stations are political realities which need to be accounted for when considering climate change policy in the country. The current energy related climate change policy direction is identified as follows:

- Emissions will peak between 2020 – 2025, plateau until 2030 and then decline to 2050;
- Renewables and nuclear will contribute in equal measure to a long-term carbon-neutral grid, with interim targets by 2030. Feed-in tariffs will support RE;
- Carbon Capture Systems (CCS) will be mandatory for new both coal-fired power generation and will be explored for existing coal plants and Coal to Liquid (CTL);
- Energy efficiency measures will be immediately implemented, building on the electricity crisis response. A mandatory national efficiency programme will be introduced;

- Economic (carbon pricing), fiscal instruments and regulation will be employed to support a low carbon economy;
- In the transport sector, vehicle efficiencies will be pursued, as well as electric vehicles, R&D for hybrids and passenger modal shift; and
- Institutional support for the above will be fast-tracked (Tyler, 2009).

The March 2009 Climate Change Policy Summit brought about the process of emerging policy, to formally support the South African cabinet's mitigation vision. From the policy processes and building blocks, clarity on a number of energy related aspects of climate change policy direction emerged (Department of Energy, 2011). In this regard, Marquard (2006) constructs a set of four possible consecutive energy policy paradigms to assist in analysing the state of energy policy in South Africa. The paradigms and analysis provide insights into the question of climate and energy policy alignment at its broadest level.

The least sophisticated paradigm is termed 'Autarky', where there is no co-ordination of the energy sector. This is followed by 'Energy supply' where the policy objective is to ensure adequate energy supply to match a growing economy. Paradigm, 'Supply demand' sees an awareness of energy demand as a factor in policy and characterises many of the OECD energy systems today. Finally the hypothetical 'Structural-cultural' paradigm includes cognisance of societal and behavioural factors as part of the energy system. Marquard (2006) proposes that the more sophisticated policy paradigms and particularly are better able to respond to policy challenges such as climate change given their expanded view of the energy system and its interactions with society as a whole.

5.5.2 Indicative requirements for South African policy alignment

During recent years promotion for RE power generation has improved significantly with more than 83 countries having RE initiatives firmly in place (REN 21, 2010). However, the high number of new climate policies was mostly due to submissions of non-binding emissions reduction targets, action plans or letters of commitment submitted under the Copenhagen Accord the concluding non-legal document of the UN climate negotiations (REN 21, 2010). RE policy is predominantly located within the framework of climate policy ('climate driver') and energy security concerns.

The current status of energy policy alignment can therefore be summarised as being strong on a high-level written policy level (White Paper on Energy, 1998), but weak in its realisation in regulation, targets and implementation (Tyler, 2009). Whilst the objectives and intentions of the 1998 White Paper which could have brought energy policy closer into alignment with the government's mitigation vision have been taken forward to some degree in written policy in the last decade. Implementation is lacking and a transition to an energy policy has been severely constrained. The primary causes of this are identified as:

- Existing and entrenched institutional orientation and capacity; and
- The lack of a single, overarching, co-ordinating energy policy institution which has sufficient power and influence to deal with the vested interests of the existing energy institutions (Tyler, 2009).

A single policy that stipulates the guidelines for energy institutions such as Eskom in an effort towards incorporating RE into the electricity industry can make inroads. Progress towards improved policy has been slow and McCrone (2012) posits that regions such as South Africa are disappointing with regard to RE processes and policy progress. South Africa has been the scene of significant policy-making and investor activity, but as with Mexico, few transactions actually closed during last year. Is this attributable to RE barriers in the country that is making it difficult for entrepreneurial activity within the industry through IPP programmes?

5.5.3 South African barriers to entry in the RE sector

Dada and Rehana, (2009) argues that RE production can also be sabotaged by power utility Eskom as it is the biggest buyer of (independent) electricity generation in the country. This option for sabotage requires a legislative approach. It is alleged that many investors are queuing up to introduce clean technologies and produce renewable energy, but encounter difficulties with Eskom, which has a bullying approach to energy production and, as one commentator puts it, needs a shift in view of the power of coal over other forms of energy production (Dada, Rehana, 2009).

Kiratu (2010) contends that RE is also often dismissed because of the grid challenges of storing and distributing it and its inability to cater for bulk supply. This could be symptomatic of a grid that is not sophisticated and intelligent enough to enable RE because there are examples in the U.S. of solar and wind energy being generated during off-peak hours and then stored using storage technologies. Many excellent and cheap technology options are already available. Power utilities such as Eskom that utilises carbon storage technology need to ensure that the necessary measures for reducing carbon emissions are enforced. Pegels (2010b) supports this notion indicating that, given Eskom's competitive advantage and core competencies in fossil fuel technologies, IPPs are considered more capable of contributing to South Africa's RE capacity. In order to achieve the 10 000 GWh RE target, the government is thus committed to strengthening competition in the electricity market.

Winkler and Marquard (2009) further state that the constraints to implementation of an aggressive mitigation programme in South Africa can be grouped into three types, namely, markets, institutions and lack of policy co-ordination. Unlike many other emerging economies, South Africa does not suffer greatly from lack of technological capacity or inability to raise finance, as has been demonstrated by large-scale and innovative projects developed in the past in the energy sector (for instance, the development of a large-scale synfuels programme in the 1970s, or the electrification programme in the 1990s). However, not all projects are pursued with equal political will or operate in a conducive economic environment (Winkler and Marquard, 2009).

The World Bank has funded the RE Market Transformation (REMT) project of the DoE, which is hosted by the Development Bank of Southern Africa. This project aims to remove the barriers and reduce the implementation costs of RE technologies in the country, with a focus on power generation and solar water heating. The project aims to assist the country meet its 2013 RE target through supporting DoE develop a regulatory and policy framework for RE and emerging institutional and financing support within the economy for RE uptake. The key barriers to the deployment of energy efficiency programmes and particularly large-scale RE technologies, are low energy prices (NERSA, 2013).

In addition to the higher risks experienced in RE, the competitive cost of RE technologies is a very significant barrier in the electricity industry of South Africa. The average price of electricity was ZAR 0.198 per kWh in 2007/2008, but since the increases in 2008 and 2009 it has been ZAR 0.334 per kWh (NERSA, 2009). This price is approximately equivalent to EUR 0.030 per kWh, compared to average European prices for households in 2008 being around EUR 0.120 per kWh (NERSA, 2009). The cost of producing electricity from wind, one of the lowest cost RE technologies, is about EUR 0.050 per kWh (IEA, 2003).

This makes wind energy almost competitive with conventional energy in Europe, where conditions are favourable and fossil fuels are comparatively expensive. However, this is not the case in South Africa. Here, the consumer price of about EUR 0.030 per kWh is not sufficient to make wind energy commercially attractive, especially as South Africa does not have wind speeds comparable with sites in northern Europe. Recent tariff increase application to NERSA saw the price of electricity increasing even further to ZAR 0.610 per kWh and expected increase over the period 2013 – 2017 to ZAR 1.280 per kWh (NERSA, 2013). Photovoltaic (PV) is an opportunity that offers RE generation in South Africa the opportunity to aid with the electricity demand and carbon emission challenge facing the country.

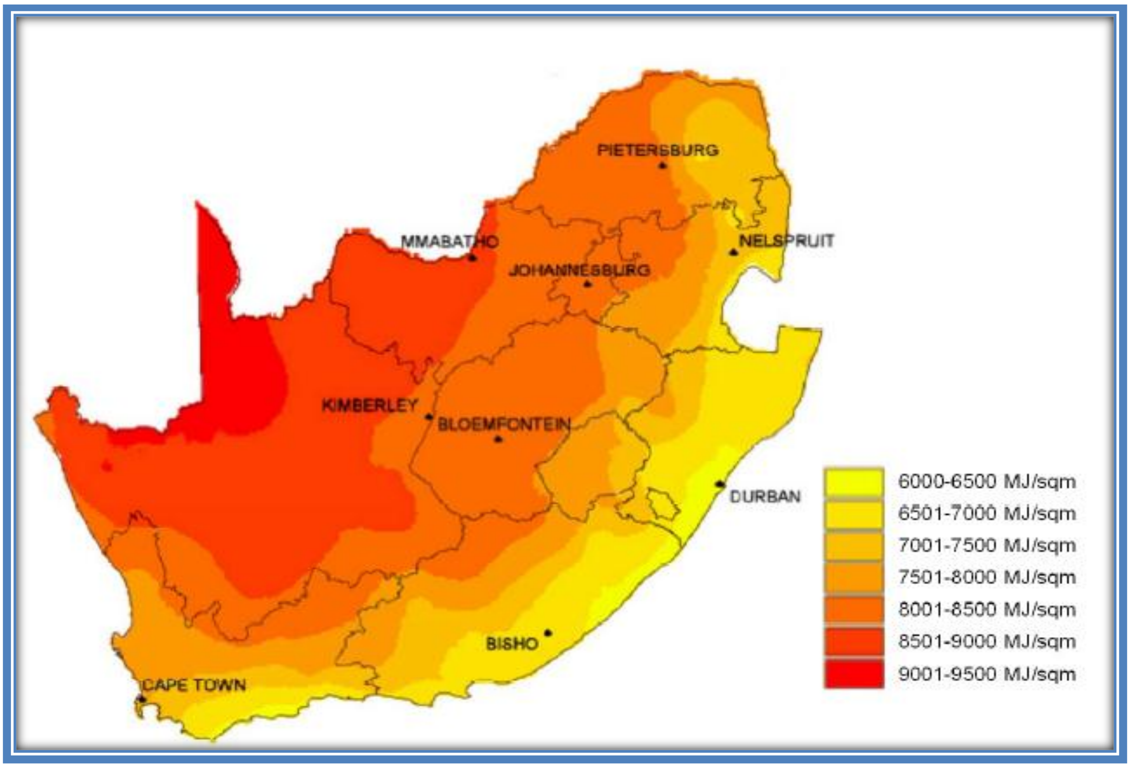
5.5.3.1 Exploiting climate change opportunities in South Africa

The renewable resource with the greatest potential in South Africa is solar energy. There are two main technologies for producing electricity from solar radiation: concentrating solar power (CSP), also known as solar thermal energy and solar photovoltaics (PV). CSP technology uses mirrors to concentrate the thermal energy of the sun and heat a transfer fluid. The heat energy is then used to produce steam, with which electricity is generated in conventional turbines. PV panels normally use silicon to convert the solar radiation directly into electricity (Pegels, 2010b). Figure 5.5 shows South Africa’s solar energy potential as the annual direct and diffuse solar radiation received on a level surface. The total area of high radiation in South Africa amounts to approximately 194 000 km^2, including the Northern Cape, one of the best solar resource areas in the world (Eskom, 2001a). Currently much development around Eskom’s solar farm initiative in the Northern Cape (Upington) is underway, a project with an estimate cost of R6 billion (Northern Cape Business, 2013).

South Africa Information (2013) states that South Africa's strong resources and supportive policies for RE make it an attractive place to invest - which is why it had the highest growth in clean energy investment in the world. This forms part of the South African Government's RE Independent Power Producer Procurement Programme (REIPPPP), which aims to have 3 725 megawatts of electricity generated from RE sources for the national power grid. Recently, Search engine giant Google invested R103 million in the Jasper power project, a 96 megawatt solar photovoltaic plant near Upington in South Africa's Northern Cape Province (South Africa information, 2013).

The potential of solar radiation in the Northern Cape Province of South Africa, plays an important role in making the solar PV plant significant to the RE sector. Projects in this area will be developed and funded by a US solar energy project development firm Solar Reserve, wind and solar farm developer Intikon Energy and empowerment investment company the Kensani Group. It is also backed by Rand Merchant Bank, the Public Investment Corporation, the Development Bank of Southern Africa and the Peace Humansrus Trust (South Africa information, 2013).

Figure 5.5: Solar radiation in South Africa.



Source: Pegels, 2010a: 4948.

In South Africa, power utility Eskom has gone from a period of electricity surplus in the 1980's with the lowest electricity prices in the world as a result of over-planning and the construction of excess generation capacity to capacity restraints, resulting in load-shedding in 2008 (Eberhard, 2011). In post-apartheid South Africa, a remarkable and rapid national electrification programme was carried out which saw the connection rate rise from 30 to 70% of the country's population (Bekker and Fisher, 2008). In light of supply shortages Eskom now imports more than it exports. Countries in the SAPP are experiencing increased energy shortages with Botswana and Namibia being particularly affected (Baker, 2011).

The South African Government seeks to support firms to build new low-carbon competitive advantages in identified areas and become market leaders in promising new technologies (like solar energy or carbon capture and storage) that leverage local resources (Winkler, et al., 2010). Given the overlap with current industrial policy objectives identified earlier, the RE sector should be identified as a key growth sub-sector within environmental goods and services (Winkler, et al., 2010).

Baker (2011) states that factors and policy-making processes in relation to:

- The potential of wind electricity generations is at an infancy stage within the industry. This is being developed largely by IPPs backed by private finance who are hoping to take advantage of the country's policy in relation to Feed-in tariff. The South African wind lobby claims that affordable wind energy could provide up to 25% of the country's electricity by 2025; and
- Eskom's Medupi 4 800 MW coal-fired power plant in Limpopo Province. Referred to by the government as "Africa's first clean coal 'supercritical' power station", when complete it will emit approximately 30 million tonnes of CO^2 per year. In April 2010, in the midst of intense environmental, economic and social debate World Bank funding for $3 billion was approved (Baker, 2011).

This case in point is examined within the context of significant policy decisions, taking place at the national level. These include the RE Feed-in tariff, the IIRP (integrated resource plan) and the industrial policy action plan and the RE white paper (Winkler, et al., 2010). The quest towards an enabling environment necessitates an effective policy model in the RE sector where incentives for IPP is a key aspect.

5.6 INCENTIVES FOR IPPS IN THE RE SECTOR – SOUTH AFRICA

Pegels (2010a) proposes that while rising electricity prices will improve the competitive position of RE technologies in the future, these technologies will still need considerable support if they are to be deployed on a commercial, large-scale basis. This support is needed as soon as possible, since investment cycles are comparatively long in the energy sector. Investments in fossil-fuel-powered stations undertaken today lock these technologies in for decades to come. The South African Government has acknowledged this and has consequently taken measures to support private investment in RE and other clean technologies.

5.6.1 Relevance of RE Feed-in tariff (REFIT)

NERSA introduced REFIT in March 2009 (NERSA, 2009). It is aimed at encouraging investment in RE by offering guaranteed tariffs that are supposed to cover generation costs and ensure profits, while at the same time creating 'a critical mass of renewable energy investment and supporting the establishment of a self-sustaining market' (Eberhard, 2002: 11). Investors are given access to the national grid and Eskom is designated as the renewable energy purchasing agency and is obligated to buy power from the IPPs through Power Purchase Agreements (PPAs). Renewable energy Feed-in tariff (REFIT) is currently applicable to four technologies: landfill gas, small-scale hydro, wind and concentrated solar power, but it is expected that the technology base will widen.

A second REFIT phase is being contemplated that is expected to look into such issues as a broader purchaser base and tariffs based on geographical variation, which would be an improvement on the scheme as it currently stands. However, some analysts allege that the tariffs offered are too low, thus providing no incentive for IPPs to enter the energy market (Kiratu, 2010). Furthermore, with Eskom being a designated buyer, there is a clear conflict of interest, since the power utility has to negotiate and sign PPA (Power Purchase Agreements) PPAs with what are essentially its competitors. This situation is further complicated by the fact that while NERSA was finalising its REFIT in early 2009, the DoE introduced the Independent Power Purchaser Regulations under the Electricity Regulation Act.

These regulations apply to renewable and co-generation technologies other than nuclear power generation and as such have a direct impact on REFIT. They effectively introduce a competitive tendering process for IPPs in order to obtain generation licences but are at cross purposes with REFIT (Fakir, 2009). RE is put at the same level as conventional energy and, given the current low cost of conventional energy, the odds are against renewable energy. There has since been no attempt to reconcile REFIT with the IPP Regulations. A positive development, however, is the plan to establish an independent system operator that will be separate from Eskom to ensure that it does not abuse its power and will be responsible for PPAs with IPPs. Whether this will materialise, however, is yet to be seen, especially considering that the White Paper on Energy Policy, published in 1998, calls for the breaking of Eskom's monopolistic hold on the industry a central point discussion.

The White Paper on Energy (1998) identifies three main barriers to the implementation of REFIT:

- Social priorities other than the deployment of RE technologies;
- A lack of coordination and capacity at the policymaking level; and
- Strong lobby groups with interests in fossil fuel technologies. These barriers not only exist in South Africa, but in most other emerging economies.

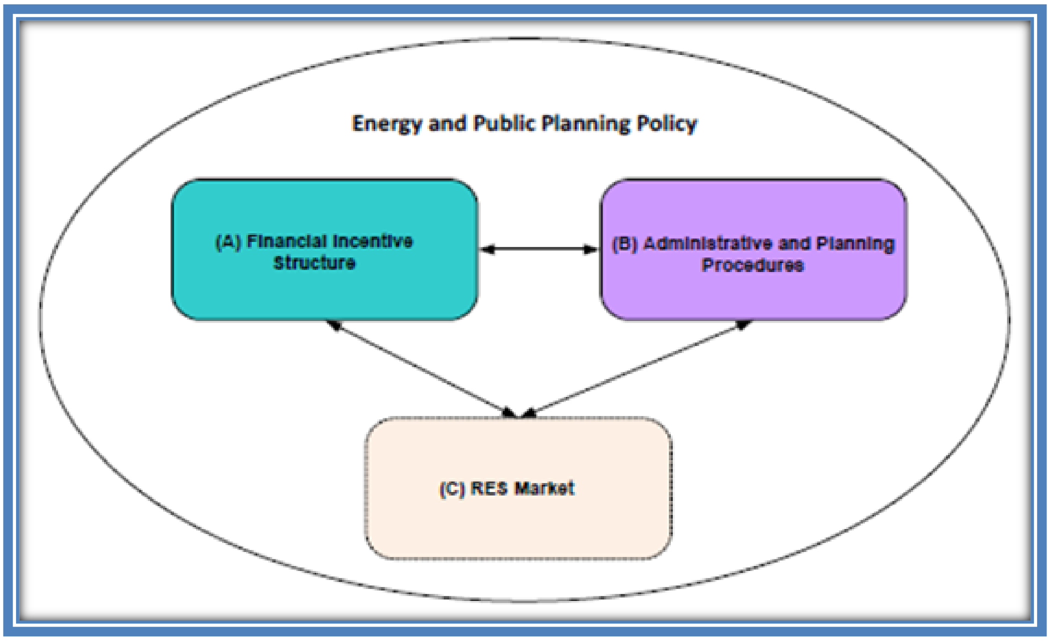
Many of the recommendations made for South Africa can be transferred to other country contexts, such as:

- Informing the public about climate change and stressing the positive side-effects of RE technologies, thereby building public support;
- Making use of international mechanisms to build political momentum;
- Forming clean-energy coalitions with powerful groups in society;
- Communicating support rules as early and clearly as possible and keeping later adjustments to the rules predictable to maintain investment certainty;
- Establishing inter-ministerial groups with oversight;
- Authority to enhance political coordination;
- Supporting established energy suppliers in their discovery of RE tariffs (RETs) as a new business field; and
- Strengthening the position and capacity of RE newcomers (Pegels, 2010b).

South Africa not only has a good RE resource potential, but also a good financial, technological and industrial capacity base. This will be conducive to the long-term development of a RE industry. However, local companies will clearly need support in the initial stage. To maximise benefits for local industry, some countries have linked RE support to local content requirements. As an example, support is only granted if a certain share of equipment and installations is purchased from domestic suppliers. China practised this strategy successfully. Until early 2010, it required wind turbines installed in the country to have at least 70% domestic content in terms of the value of incorporated materials and components. This requirement is no longer necessary, as today virtually all turbine installations are Chinese-produced. The requirement was therefore abolished in early 2010 (Altenburg, Fischer, Pegels and Stamm, 2010).

The macro perspective of the factors affecting REFIT implementation and correspondingly large-scale grid-connected RES deployment under the REFIT is depicted in Figure 5.6 and has been inspired from the one presented by Sperling, Hvelplund and Mathiesen (2010). According to Figure 5.6, there are three main coefficients that have great influence: (A) Financial Incentive Structure, (B) Administrative and Planning Procedures and (C) RES Market. At the same time, long-term national energy policy setting specific goals for RES deployment, stability in public planning policy and consistency between them, have a crucial influence as well. Therefore the three factors are embedded within the sphere of Energy and Public Planning Policy, forming the suggested macro perspective (Sperling, et al., 2010).

Figure 5.6: Factors affecting REFIT implementation.



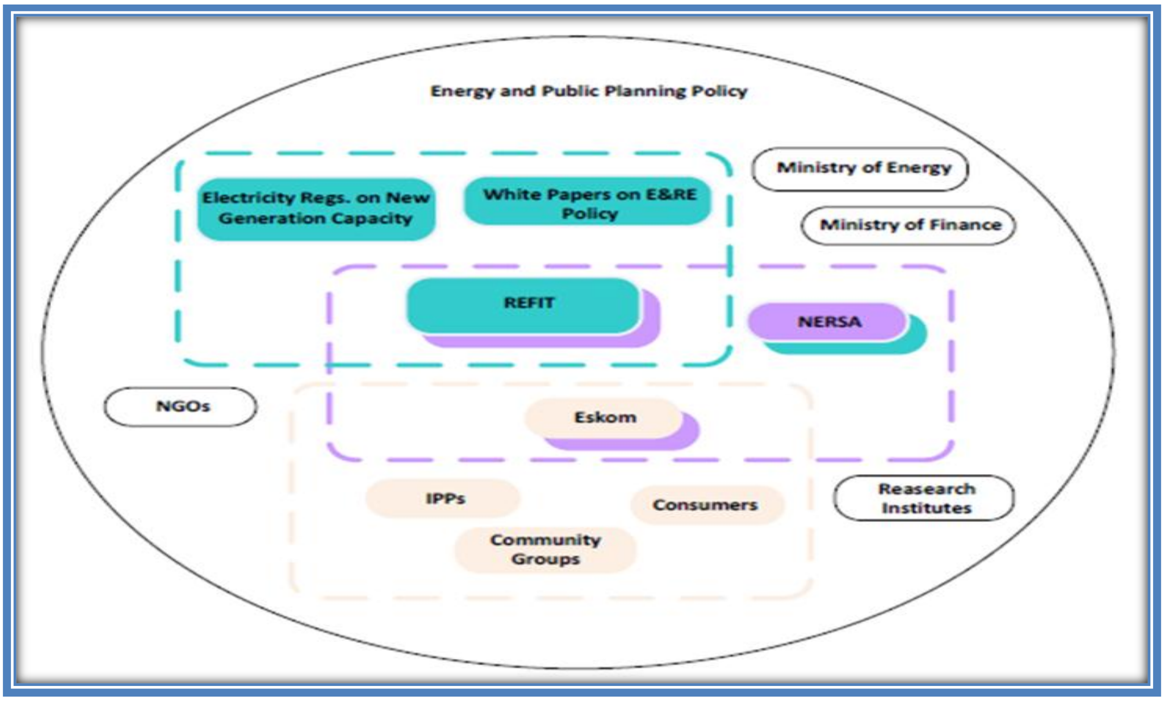
Source: Sperling, Hvelplund and Mathiesen, 2010: 18.

The White Paper on Energy Policy and the White Paper on Renewable Energy Policy have been selected together with Electricity Regulations on New Generation Capacity as the most important current policies surrounding REFIT and affect its implementation. Of course reference to other laws-policies is necessary and will be done but the focus is mostly on REFIT since it is the policy under examination.

Figure 5.7 presents a subjective approach on the main actors, legislation, organisations and institutions which affect the deployment of the considered RES technologies (PV, Wind, CSP with storage) under REFIT or in other words those that affect the successful implementation of the REFIT scheme.

Most of the stakeholders (as depicted in Figure 5.7) involved have different knowledge, rules, involvement, power, and strategy. The mentioned stakeholders will be presented in the next chapter. It should be kept in mind that leading an electricity system as coal based as South Africa's towards RES can be an extremely complex task considering the heavy influence of the strongest stakeholders on the current market design. Therefore, the stakeholders have been inspired towards REFIT implementation.

Figure 5.7: Analytical macro structure.



Source: Petsa, 2011: 20.

5.6.2 Key challenges for FIT in South Africa

The absence of a standardised and specialised PPA under the REFIT, constitutes a major administrative barrier. The current PPA was designed for conventional power plants with a capacity of up to 1 000 MW and was signed for 15 years, so it does not reflect the needs and requirements of RES plants. Under the REFIT 2011 consultation paper, NERSA announced its intention to facilitate the conclusion on the REFIT PPA and the associated commercial agreements necessary for buying and selling power between a REFIT IPP and the Buyer-Eskom (NERSA, 2011). In comparison with Germany, South African REFIT is in its infancy stage in the RE sector.

The German RE law is estimated to have caused a price increase of about 12% between 2002 and 2006 (Pegels, 2009b). This moderate increase may be due to the already comparatively high price of electricity in Germany. The situation may differ in South Africa, depending on the actual success of the REFIT. This may be another obstacle to the success of the South African REFIT scheme. Public support may wane as consumers start to feel the price increase caused by the support for RE (Pegels, 2009).

5.6.3 Other incentives for IPPs in RE sector

Lewis (2012) states that compared to 83 countries in 2009, at least 96 countries now have some type of policy target or renewable support policy to promote RE. More than half of these countries are emerging economies. The 12 most common policies can be divided into three categories:

• *Regulatory policies:*

- Feed-in tariffs;
- Electric utility quota obligation;
- Renewable portfolio standard (RPS);
- Net metering Biofuels obligation;
- Mandate Heat obligation; and
- Mandate tradable RE credit.

• *Fiscal incentives:*

- Capital subsidy, grant and rebate;
- Investment and production tax credits Reductions in sales taxes, energy; and
- Taxes, CO2 taxes, VAT and other taxes Energy production payment.

• *Public financing:*

- Public investment, loans and grants Public competitive bidding (Lewis, 2012).

Current incentives described by Lewis (2012) in Table 5.7 provide statistics on 23 countries around the world to promote RE from wind, solar, biomass, geothermal and hydro-power. These incentives also support related areas such as increased energy efficiency and Smart Grid management as mentioned in Chapter 2.

Figure 5.7 indicates below that at least 96 countries now have some type of policy to support RE generation. More than half of these countries are developing countries or those considered as ‘emerging economies’. Such policies are the most common type of renewables policy support, although many other policy types exist to support renewable energy for heating, cooling, and transports (Lewis, 2012).

Table 5.7: RE support policies.

	REGULATORY POLICIES						FISCAL INCENTIVES				PUBLIC FINANCING	
HIGH-INCOME COUNTRIES	Feed-in tariff (incl. premium payment)	Electric utility quota obligation/ RPS	Net metering	Biofuels obligation/ mandate	Heat obligation/ mandate	Tradable REC	Capital subsidy, grant, or rebate	Investment or production tax credits	Reductions in sales, energy, CO_2, VAT, or other taxes	Energy production payment	Public investment, loans, or grants	Public competitive bidding
Australia	▲			▲		●	●				●	
Austria	●			●		●	●	●			●	
Belgium		▲	●	●		●	●	●	●			
Canada	▲	▲	●	●			●	●	●		●	●
Croatia	●						●				●	
Cyprus	●						●					
Czech Republic	●			●		●	●	●	●			
Denmark	●		●	●		●	●	●	●		●	●
Estonia	●			●			●		●	●		
Finland	●			●		●	●		●	●		
France	●			●		●	●	●	●		●	●
Germany	●			●	●		●	●	●		●	
Greece	●		●				●	●			●	
Hungary	●			●			●		●		●	
Ireland	●				▲	●						●
Israel	●				●				●			●
Italy	●	●	●	●	●	●	●	●	●		●	●
Japan	●	●	●			●	●				●	
Latvia	●			●					●		●	●
Luxembourg	●						●					
Malta			●				●		●			
Netherlands				●		●	●	●	●	●		
New Zealand							●					
Norway				●		●	●		●		●	
Poland		●		●		●	●		●		●	●
Portugal	●	●	●	●	●		●	●	●		●	●
Singapore											●	
Slovakia	●						●					
Slovenia	●					●	●	●	●		●	●
South Korea[1]		●		●		●	●	●	●		●	
Spain[2]	●			●	●		▲	●	●		●	
Sweden		●		●		●	●	●	●	●		
Switzerland	●						●		●			
Trinidad & Tobago							●	●	●			
United Kingdom	●	●		●		●			●	●	●	
United States	▲	▲	▲	●	▲	●	●	●	●	●	●	●

▲ Some states/provinces within these countries have state/provincial-level policies but there is no national-level policy.

Table 5.7 (continues): Renewable energy support policies.

	REGULATORY POLICIES						FISCAL INCENTIVES				PUBLIC FINANCING	
	Feed-in tariff (incl. premium payment)	Electric utility quota obligation/ RPS	Net metering	Biofuels obligation/ mandate	Heat obligation/ mandate	Tradable REC	Capital subsidy, grant, or rebate	Investment or production tax credits	Reductions in sales, energy, CO_2, VAT, or other taxes	Energy production payment	Public investment, loans, or grants	Public competitive bidding
UPPER-MIDDLE INCOME COUNTRIES												
Algeria	●											
Argentina	●			●			●	●	●	●	●	●
Belarus									●		●	
Bosnia & Herzegovina	●											●
Botswana									●			
Brazil				●					●		●	●
Bulgaria	●			●			●		●		●	
Chile		●					●		●		●	
Colombia				●			●					
Costa Rica	●			●								
Dominican Rep.	●						●	●	●			
Iran								●		●		
Kazakhstan	●					●						
Lithuania	●										●	
Macedonia	●										●	
Malaysia	●										●	
Mauritius							●					
Mexico			●					●			●	●
Panama	●									●		●
Peru	●			●				●	●	●		●
Romania		●		●		●			●		●	
Russia						●	●					
Serbia	●											
South Africa	●					●	●					●
Turkey	●											
Uruguay		●		●					●			●

Source: Lewis, 2012: 49.

Moner-Girona (2008) suggests that the main successful policies and regulatory framework supporting RE are:

- Policies that promote production based incentives, rather than investment based incentives are more likely to spur the best industry performance and sustainability;
- Power sector regulatory policies for RE should support IPP frameworks that provide incentives and long-term stable tariffs for private power producers;

- Regulators need skills to understand the complex array of policy, regulatory, technical, financing and organisational factors that influence whether RE producers are viable; and
- Financing for renewable power projects is crucial (Moner-Girona, 2008).

These suggestions as mentioned by Moner-Girona (2008) reinforce the initiative of applying a RE regulated tariff based in the production of RE.

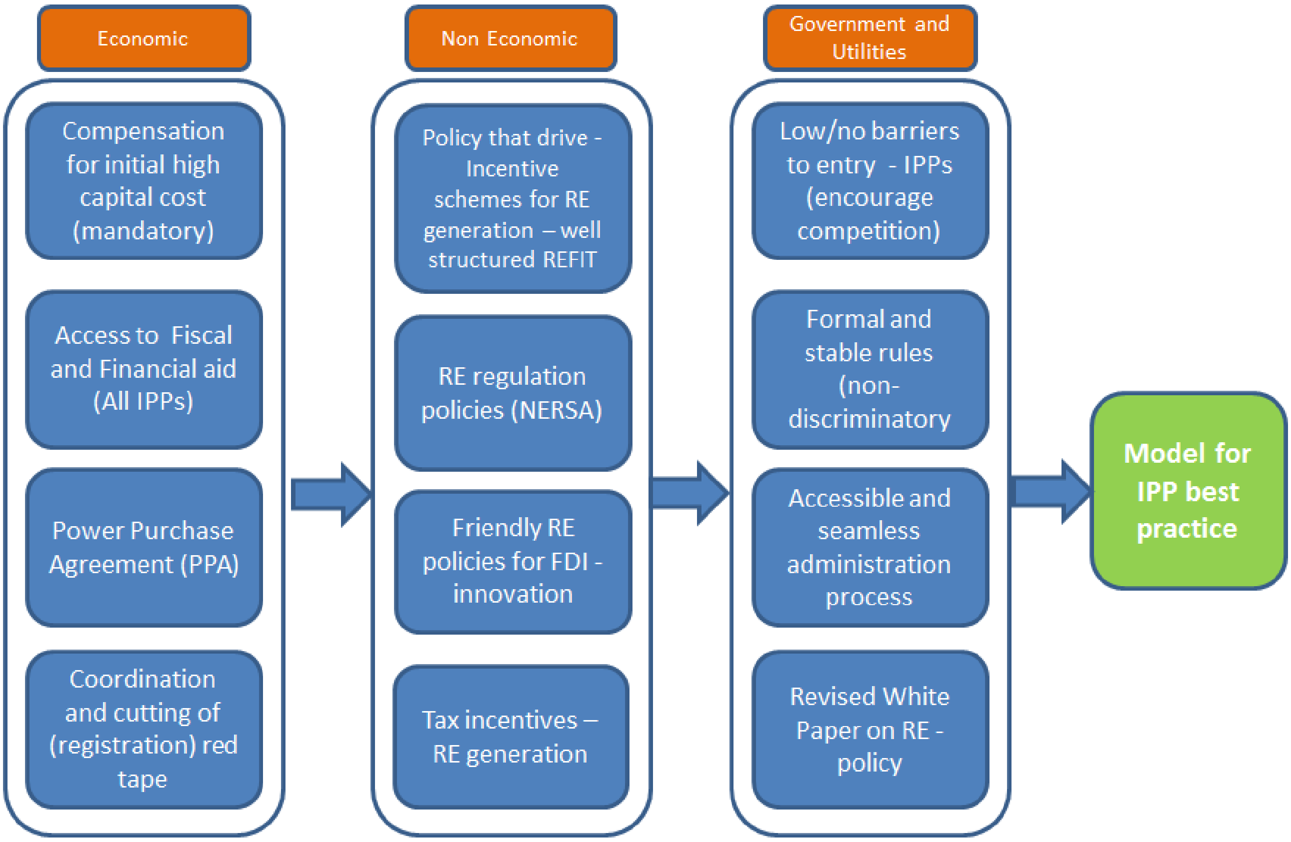
5.7 BEST PRACTICE FOR POLICY

It has been shown that a liberalisation plan, set to create market competition and efficiency in the South African electricity industry, would be affected by the change of the government's RE policy, which neglected the importance of structural change to reduce market power of the politically strong SOEs. Because of this, the implementation of corporatisation of SOEs in the South African electricity industry is needed through various policy practices.

Key areas of concern stated by Baker (2011) include: compliance with IRP 2010; acceptance of the PPA; project location that contributes to grid stabilisation; location and technology that contributes to local economic development; compliance with legislation in respect of the advancement of historically disadvantaged individuals; projects with viable network integration requirements; projects with advanced environmental impact approvals; projects demonstrating the ability to raise finance; a preference for small distributed generators over centralised generators and projects that can be commissioned in the shortest time (NERSA, 2011). IPPs are frustrated by the absence of clear selection criteria as many state they are risking large amounts of capital without knowing how their projects may be selected.

These suggestions as mentioned by Moner-Girona (2008) reinforce the initiative of applying a best practice policy model that regulates RE based production. It therefore, stands to reason that a best practice model is necessary to ensure the sustainable implementation of RE within the electricity industry. Figure 5.8 stipulates the different barriers and the eradication policy that supports the advancement of RE in the electricity industry. As stipulated, economic and non-economic barriers form the first barriers in the life-cycle of an IPP. By ensuring that these barriers are curtailed and supported by best practice policy ensures an enabling entrepreneurial environment for IPP to operate within. Figure 5.8 proposes the eradication of barriers through a supportive policy for the RE sector.

Figure 5.8: Proposed best practice model.



Source: Own construction, 2014.

The proposed model, therefore, urges that a reform of electricity policy is necessary in order to create effective regulation that helps to create an enabling entrepreneurial environment toward a competitive electricity industry which include RE. More specifically, the policy should be changed with the aim of creating a structural change and reducing the monopoly market power of SOEs. This would then facilitate the building of free and fair market competition in the South African electricity industry. The model further encourages a RE policy that would: increase access to affordable energy services; improve energy governance; stimulate economic development; manage energy related environmental impacts and secure diversity through diversity (Department of Minerals and Energy, 2003).

5.8 SUMMARY

It is widely recognised that RE represents an important part of the solution to address a more sustainable and secure energy future. The transformation of the RE sector, geared towards an economically viable and environmentally friendly system, fully integrating RE technologies, requires a comprehensive approach to the design of appropriate policy frameworks (REN 21, 2012).

The policy cycle does not occur in a vacuum, but takes place in a broad public, political and institutional context in which the enabling structures are at the same time a source of barriers to policy-making. It is important to differentiate two main phases within the RE policy cycle: policy formulation and policy implementation. Several transmission grids in Africa have been interconnected since the establishment of (Southern African Power Pool) SAPP, but many regional electricity markets are still monopolised by government power utilities and exclude IPPs from participating in the power trading market. This situation is not sustainable in light of insufficient capacity to supply electricity demand (Kiratu, 2010). These practices make implementation of a good policy difficult and create entrepreneurial and ultimately economic challenges.

IPPs are frustrated by the absence of clear selection criteria as many risk large amounts of input capital without knowing if their projects will be selected (Baker, 2011). At the national, state, provincial and local levels, policies have played a major role in driving RE markets, investments and industry growth. However, not all policies have been equally effective and success has often rested on detailed design and implementation. Consequently, governments continue to update and revise policies in response to design and implementation challenges and in response to advances in technologies and market changes. These targets and support policies will continue to exert a strong influence on national markets in the years and decades ahead. In the future, national policymakers will confront a wide range of choices and considerations in continuing, updating and retiring existing policies and creating new ones. As renewables become more integrated with existing infrastructure, policymakers will confront the need for new policies to achieve these various forms of integration (REN 21, 2013).

The RE sector comes with its own set of barriers and to address these barriers to RE deployment, South African policymakers may exchange experiences and learn from best practices in other countries. The electricity generated is to be purchased, transmitted and paid for by the grid system operators as a priority. This ensures reliable revenues of RE producers and there with investment certainty. Further support independent power producers. The missing elements are known, they have to be implemented into practise. Involve the South African public in the drafting of policies, e.g. the second Integrated Resource Plan. Transparency and public participation are crucial in decisions about long-term investments such as energy infrastructure.

A wide variety of policies are designed explicitly to promote RE, while policies focus on power sector restructuring or environmental issues more broadly and have more indirectly affected RE. Policymakers and energy sector participants should consider how best to deliver mitigation within the constraints of the existing institutional structures. Experience with RE policies globally is still emerging and more understanding is needed of the impacts of various policies. Thus many policies may still be considered experimental in nature. Policymakers and policy advocates play a major role in the contribution towards a global best practice in the RE sector in order to provide guidance and regulation.

The research question addressed in this chapter is:

- *RQ_5 – What are best practice policies that the South African RE sector could consider?*

The research objective addressed in this chapter is:

- *RO_5 - To describe policy and best practice in the South African RE sector.*

In this study the researcher evaluated the current electricity status quo and the barriers to entry for IPPs with the specific aim of creating a proposed best practice model for the South African RE sector. The deliverable to the chapter is:

- A model for best practice policy in the South African electricity industry as presented in Figure 5.8.

The following chapter will discuss Stakeholder Theory and a conceptual model for an enabling entrepreneurial environment.

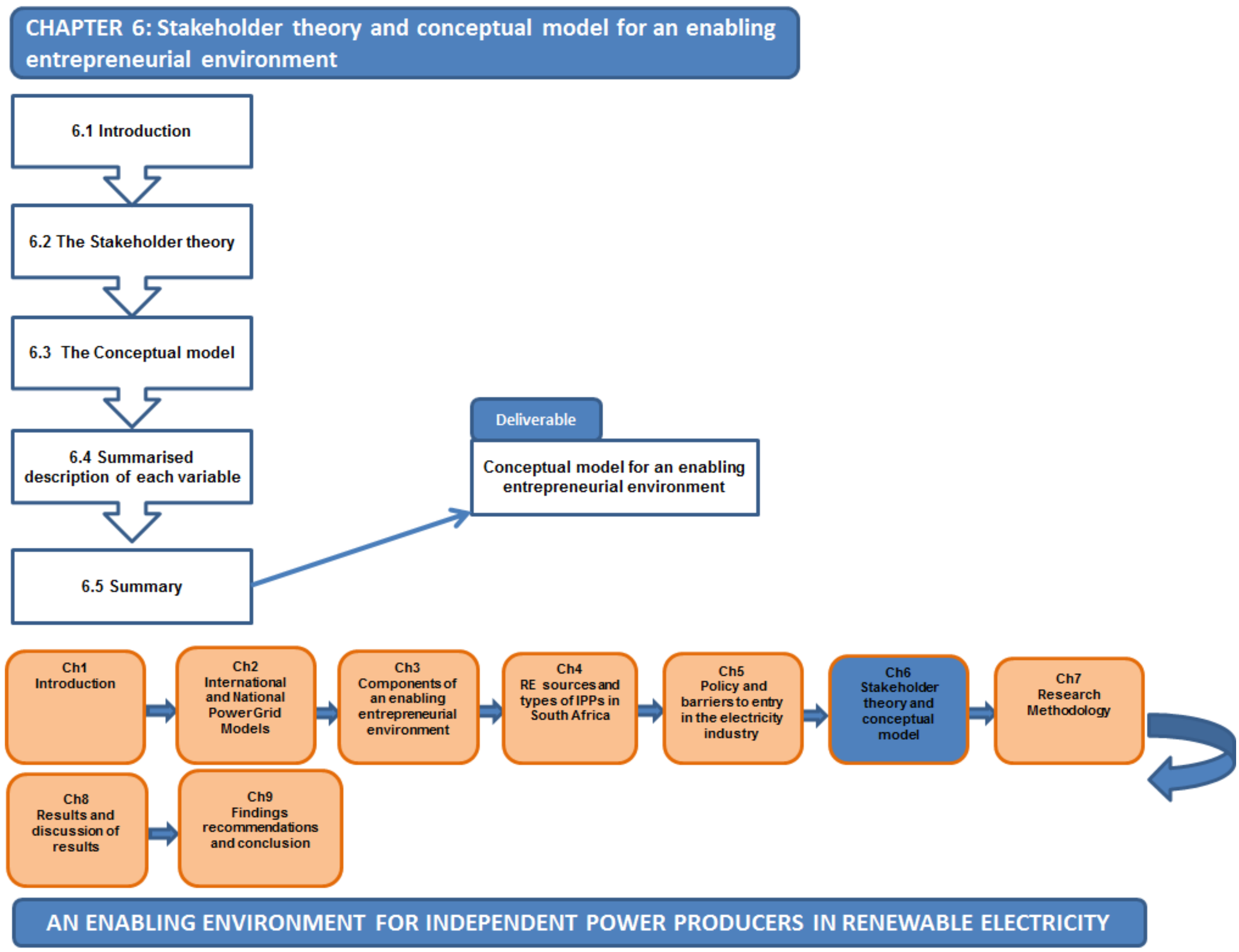


Figure 6.1: Outline of the chapter.

CHAPTER 6
STAKEHOLDER THEORY AND A CONCEPTUAL MODEL FOR AN ENABLING ENTREPRENEURIAL ENVIRONMENT

6.1 INTRODUCTION

Chapter 5 presented the literature review on how an enabling entrepreneurial environment can be established to promote IPP activity within the South African RE sector. The main aim of this chapter is to substantiate this study in academic theory and develop a conceptual model to identify and discuss the variables, which are hypothesised to influence the promotion of an Enabling Entrepreneurial Environment in the RE sector. The variable relationships are based on the discussion of the variables that influence entrepreneurial activity, as presented in the previous chapters.

The research question addressed in this chapter is:

- *RQ_6 – How do stakeholder theory and stakeholder management influence the South African RE sector?*

The research objective addressed in this chapter is:

- *RO_6 - To describe stakeholder theory and stakeholder management in the South African RE sector.*

The variables from the literature study that impact an Enabling Entrepreneurial Environment within the RE sector and the South African electricity industry as a whole were discussed in Chapters 2 to 5. These variables include:

- National Grid models;
- Mini Grid models;
- Off-Grid models;
- Access to finance;
- Research and development transfer;
- Government facilitation;
- Business incubation;

- Barriers to entry;
- Wind as a RE source;
- Solar as a RE source;
- Hydro as a RE source; and
- Best practice policy.

This chapter introduces the academic theory on which the research is based and the variables for an enabling entrepreneurial environment within the RE sector of the South African electricity industry. Figure 6.1 outlines the chapter as follows: the chapter will start with the academic theory for this study (Section 6.2). In Section 6.3 the conceptual model is discussed. Section 6.4 summarises the description of each variable and in Section 6.5 will provide a summary of the chapter.

Theory is an ordered set of assertions about a generic behaviour or structure assumed to hold throughout a significantly broad range of specific instances. Stakeholder Theory is widely recognised as management theory and makes valuable contribution to the shaping of management decision (Reynolds, et al., 2006).

6.2 THE STAKEHOLDER THEORY

This study is based on Stakeholder Theory as it has evolved in recent years and focuses attention on the importance of the relationships that companies have with stakeholders, relationships that extend beyond those that companies naturally have with shareholders (Andriof and Waddock, 2002). Freeman (1984) defines this theory as traditional theories of the organisation where the primary function of the corporation is to maximise the return on investments to the owners of the business, that is, the shareholders. Shareholders and stakeholders interest are compatible and both contribute to corporate long-term efficiency and short-term maximisation of business investment. Stakeholder Theory affirms that the business needs to consider the interests of groups affected by the organisation.

Gibson (2000) states that stakeholders are those groups or individuals with whom the organisation interacts or has interdependencies and any individual or group who can affect or is affected by the actions, decisions, policies, practices or goals of the organisation. By this analysis, stakeholders have the potential to support a company achieving its objectives. Mitchell, Agle and Wood (1997) argue that stakeholder theory attempts to articulate a fundamental question in a systematic way: which groups are stakeholders deserving or requiring management attention and which are not? In this section the researcher examines how scholars have so far answered these central questions: Who is a stakeholder and what is a stake? and What does stakeholder theory offer that is not found in other theories of the organisation?

The stakeholder theory constitutes a core issue in ‘pseudo’ disputes today, a state of affairs attesting to the status of “the serious thing that is the firm and translating the existence of an intellectualism in the field of management sciences” (Damak-Ayadi, 2004: 14). Organisations still need to consider the interests of key stakeholders, since they have the latent potential to significantly affect the firm. For the purpose of this study, RE plays a key role in how modern electricity is generated, where environmental groups, government and RE generating entrepreneurs as stakeholders play an integral role (Carrol, 1996). For example, environmental groups could target power utilities for their excessive use of conventional energy instead of RE which could have a high impact on carbon emissions and global warming. The sustainability of the industry is another aspect stakeholders, such as the government would be majorly concerned with as the availability of reliable networks and quality of supply of such utilities impacts the country’s economy. South Africa proves no different as Eskom serves as the primary electricity generating power utility, generating 87.2% coal based electricity (Roos, 2009).

Harrison and Wick (2013) state that for power utilities, stakeholder theory has infiltrated the academic dialogue in management and a wide array of disciplines such as health care, law and public policy. Considerable attention has been paid to some basic themes that are now familiar in the literature – that organisations have stakeholders and should proactively pay attention to them (Freeman, 1984), that stakeholder theory exists in tension (at least) with shareholder theory (Friedman, 1970), that stakeholder theory provides a vehicle for connecting ethics and strategy (Phillips, 2003) and that firms that diligently seek to serve the interests of a broad group of stakeholders will create more value over time.

Booth and Segon (2008) describe three levels in the stakeholder theory:

- The strategic level, which advocates taking into account the (non-owner) stakeholders' interests as a means of achieving the company's (economic) goals but without any moral content;
- The multiple-trustee approach which, on a moral level, attributes a fiduciary responsibility to the company's managers towards all of the stakeholders alike, whether they be owners or non-owners; and
- The new synthesis proposed, which distinguishes between certain fiduciary responsibilities towards the owners and other restricted, non-fiduciary responsibilities towards the other stakeholders (Booth and Segon, 2008).

According to Bryson (2004), the stakeholders in an organisation are any group or individual who may affect or be affected by the obtainment of the company's goals. However, a stakeholder theory based on this definition lacks any normative rationale or criteria for identifying who the stakeholders are or for allocating the rights corresponding to each one. Bryson (2004) further indicates that stakeholders should be taken into account in the company's decision making because they affect (or may affect) and influence the company's performance, now or at any point in the future.

According to Damak-Ayadi (2004), as a theory of organisations, stakeholder theory has helped to found a relational model of the organisation. The relations in question could in fact start to form an organisational 'substance', but the perspective would then remain relatively functionalist in nature. Once again, organisational sciences are predicated here on the implicit postulate of the following continuum: individual, group, community, organisation, institutions and state. This explains why stakeholder theory is considered a likely way of offering scientific substance to the explanation of what institutions are really made of, since these entities can then be studied by means of organisational concepts. In this way, stakeholder theory leads to the organisation being reified in a historical dimension, an act that reduces their formal diversity and diminishes its institutional and political nature (Damak-Ayadi, 2004).

6.2.1 The Stakeholders

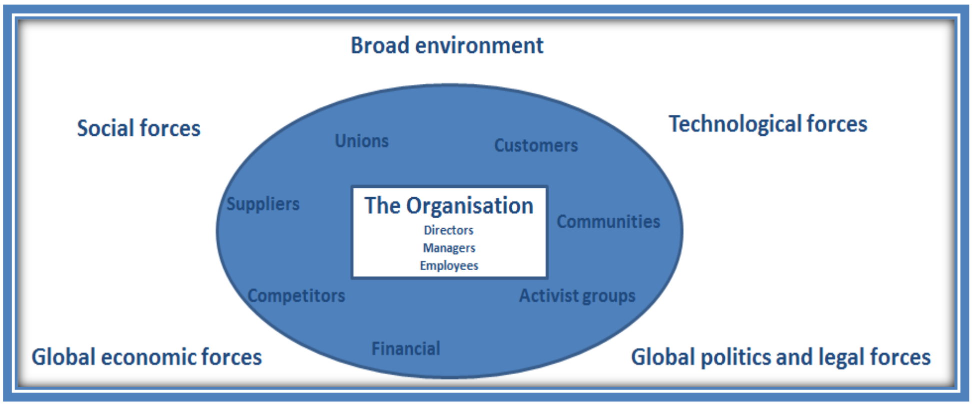
The stakeholder theory raises questions about how parties can be counted. Lepineux (2003b) suggests therefore that it is classified into different categories of actors:

- Shareholders;
- Internal stakeholders (employees, labour unions, etc.);
- Operational partners (customers, suppliers, etc.); and
- The social communities.

According to Freeman (1984), stakeholders are any group or individuals who may affect or be affected by the obtainment of the organisation's goals. However, a stakeholder theory based on this definition lacks any normative rationale or criteria for identifying who the stakeholders are or for allocating the rights corresponding to each one.

The typical stakeholders are considered to be consumers, stakeholders, government, competitors, communities, employees and of course, stockholders, although the stakeholder map of any given corporation with respect to a given issue can become quite complicated (Carroll, 1996). Gibson (2000) argues that businesses should look after stakeholders properly even if it is not profitable. It helps to understand the idea of a stake to appreciate the concept of stakeholders. A stake is an interest or share in an undertaking. A stake is also a claim. A claim is an assertion to a title or a right to something (Gibson, 2000).

Figure 6.2: Stakeholders in an organisation.

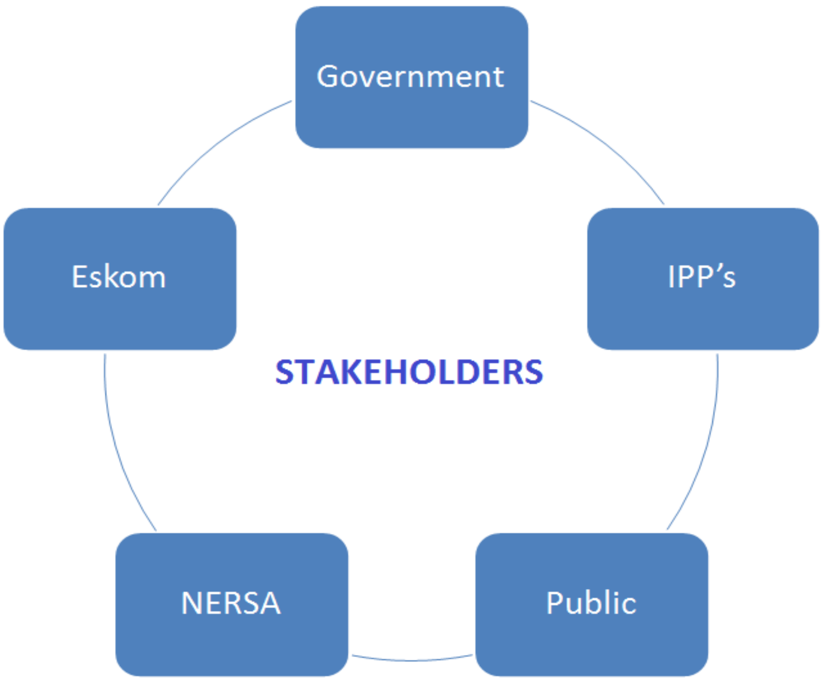


Source: Lepineux, 2003a: 11.

The stakeholder issue raises questions about how parties are to be counted. In Figure 6.2, Lepineux (2003a) suggests classifying stakeholders into different categories of actors: shareholders; internal stakeholders notably employees and labour unions. It also centres around a shareholder activism that can be implemented either working alone or else with other investors who also want to get their resolutions adopted. Stakeholders are further categorised into operational partners such as customers, suppliers, banks and insurance companies (Lepineux, 2003a).

The U.S. Green Buildings Council (2009) states that RE industry stakeholders include: energy producers (renewable/non-renewable), distributors, end users, consultants and government/NGO officials working in energy policy management. For the purpose of this study, the stakeholders in the RE sector and the electricity industry as a whole are illustrated in Figure 6.3 and include, government, Eskom as electricity generating, distributing and transmitting utility, IPPs, NERSA and the public.

Figure 6.3: Stakeholders in the South African electricity industry.



Source: Own construction, 2014.

Austen, Seymour, Brown, Furneaux and McCabe (2006) posit that power utilities in electricity generation and distribution have focused on planning and managing the complex array of activities required from generation to distribution. Being able to manage stakeholder's expectations and concerns is a crucial skill for managers of projects, as failure to address these has resulted in countless project failures, primarily because construction stakeholders tend to have the resources and capability to stop construction projects. Successful completion of projects is therefore dependant on meeting the expectation of stakeholders. Stakeholders include clients, project managers, designers, subcontractors, suppliers, funding bodies, users, owners, employees and local communities (Newcombe, 2003).

6.2.2 Stakeholder Management

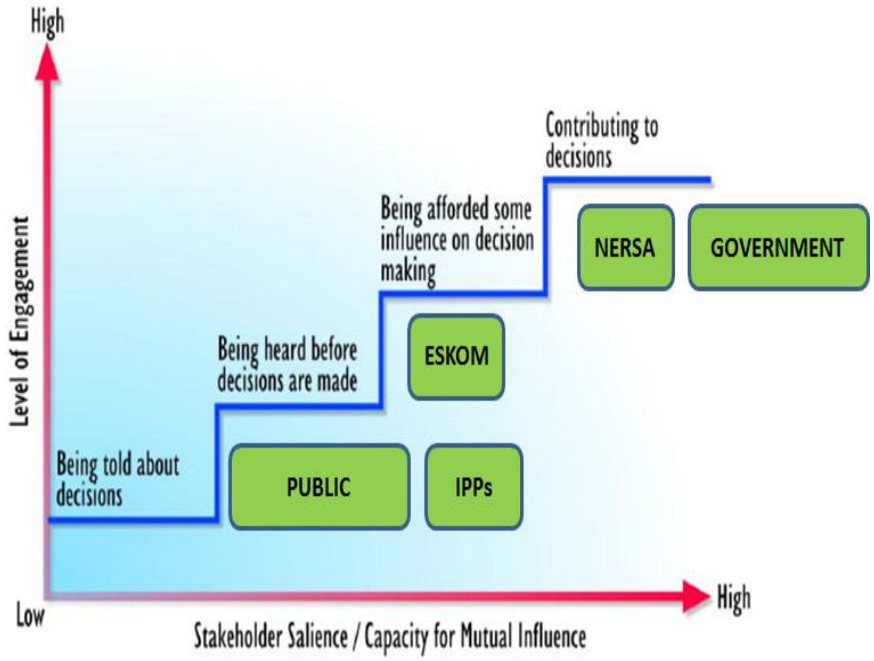
Stakeholder management involves taking the interests and concerns of these various groups and individuals into account in arriving at a management decision, so that they are all satisfied at least to some extent, or at least that the most important stakeholders with regard to any given issue, are satisfied. The very purpose of the organisation is to serve and co-ordinate the interests of its various stakeholders and it is the moral obligation of the organisation's managers to strike an appropriate balance among stakeholder interests in directing the activities of the firm (Buchholz and Rosenthal, 2005).

Newcombe (2003) argues that effective stakeholder management begins with the identification of key stakeholders, establishing the strategic importance of stakeholder groups. Stakeholder groups in turn, help organisations determine what the nature of their stakeholder management strategies should be. The management of stakeholders plays an integral role for any organisation as it too has a stake in the modern business environment. Freeman (1994) indicates that the theory does not give primacy to one stakeholder group over another, though there will surely be times when one group will benefit at the expense of others. Boatright (2006) states that stakeholder management is agreed on the purpose of an organisation, to conduct economic activity in ways that benefit everyone. For the RE sector this is fundamental as government strives towards sustainability within the electricity industry supported through RE initiatives.

It is thus important at the outset to distinguish two forms of stakeholder management. The main point of difference is whether stakeholder management is compatible with and an alternative to the prevailing form of corporate governance, or whether it is a managerial guide that can be followed within corporations as they are currently legally structured. First, it is a simple fact that a corporation has stakeholders in the sense of groups who can affect, or who are affected by, the activities of the firm (Freeman, 1984). Any successful corporation must manage its relations with all stakeholder groups, if for no other reason than to benefit the shareholders. To manage stakeholder relations is not necessarily to serve each group's interest (although this might be the effect), but to consider their interests sufficiently to gain their co-operation (Boatright, 2006).

Stakeholder management holds that stakeholder interests should be central to the operation of a corporation in much the same way that shareholder interests dominate in the conventional shareholder-controlled firm. In general, it is contended that in making key decisions, managers ought to consider all interests; those of shareholders and non-shareholders alike and balance them in some way (Boatright, 2006). How these stakeholders are engaged plays a vital role in the effective management of these role players in supporting industry. Figure 6.4 illustrates the stakeholder engagement framework with specific indication of where each stakeholder within the RE sector is engaged.

Figure 6.4: Stakeholder Engagement Framework.



Source: Ferrari, 2008: 5.

In Figure 6.4, Ferrari (2008) states that the key factor in successful internal take-up of the Stakeholder Engagement Framework is effective internal collaboration on its design, as well as effective communication to encourage adoption of the system and the approaches to stakeholder engagement that it reflected, i.e.: designed to embed the function into normal business practice and organisational culture. The Stakeholder Engagement Framework provides an effective management system for corporate stakeholder engagement within the organisation. It has proven to be successful in enhancing stakeholder engagement and associated business performance (Ferrari, 2008).

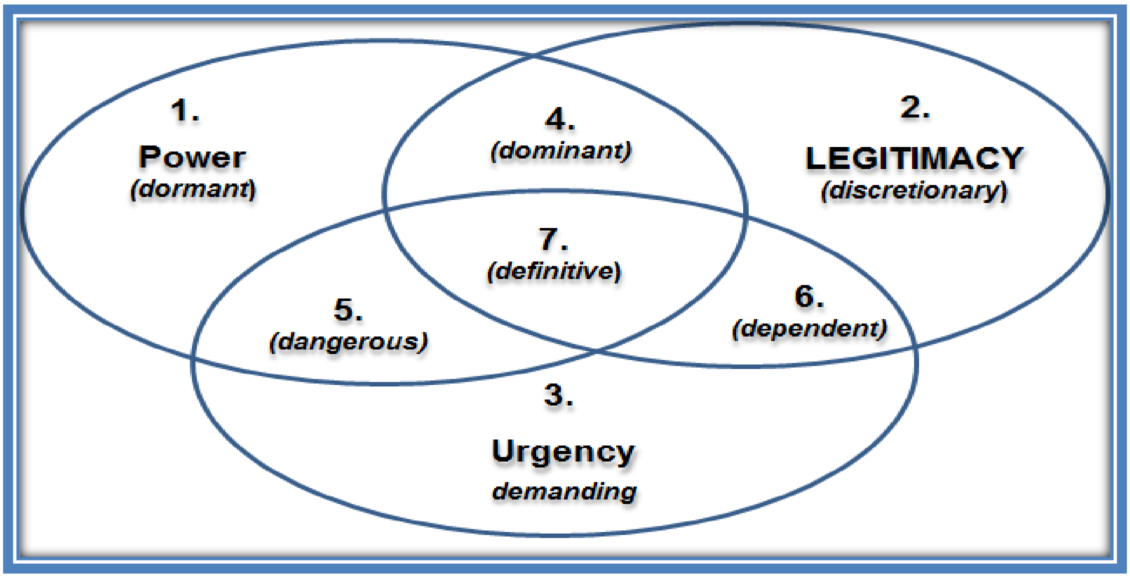
For the purpose of this study, it can be deduced from Figure 6.4 that the National Energy Regulator of South Africa (NERSA) and Government act as the decision contributors within the RE sector. Eskom power utility is given the opportunity to influence decision making within the electricity industry at large. The public and IPPs are being awarded the opportunity to be heard prior to decision making. The role of each stakeholder proves to be an important component for key decision making and the influence they have needs to be valued. Thus each stakeholder has power to impose its will on the firm, especially through the control of resources.

6.2.3 Stakeholder Power

Jeffery (2009) states that a stakeholder group has power when it can impose its will on the organisation, especially through the control of resources, while legitimacy implies that a stakeholder group reflects the prevailing opinions and beliefs of society. Urgency is characterised as stakeholder sensitivity to the response time of managers. It has been attempted to operationalise stakeholder power through the deployment of various static grids and matrices which assess the salience of various stakeholders on project outcomes based on their power, legitimacy and urgency (Newcombe, 2003).

Figure 6.5 illustrates how stakeholders are mapped according to their behaviour and are classified respectively as dormant (1); discreet (2); and demanding (3). These stakeholders may also be called latent. Meanwhile, stakeholders which combine two attributes – power and legitimacy; power and urgency; urgency and legitimacy – would correspond respectively to the ‘dominant’ (4); dangerous (5); and dependent (6) types. They are recognised as ‘moderate’ stakeholders or even ‘spectator’ stakeholders because they are always expecting something. Finally, the interested parties which exert power, legitimacy and urgency in an articulate manner, classified as definitive (7) stakeholders, are the most important groups, because they use the three attributes combined to influence the organisation in their favour.

Figure 6.5: Power, Legitimacy and Urgency Model.



Source: Newcombe, 2003: 77.

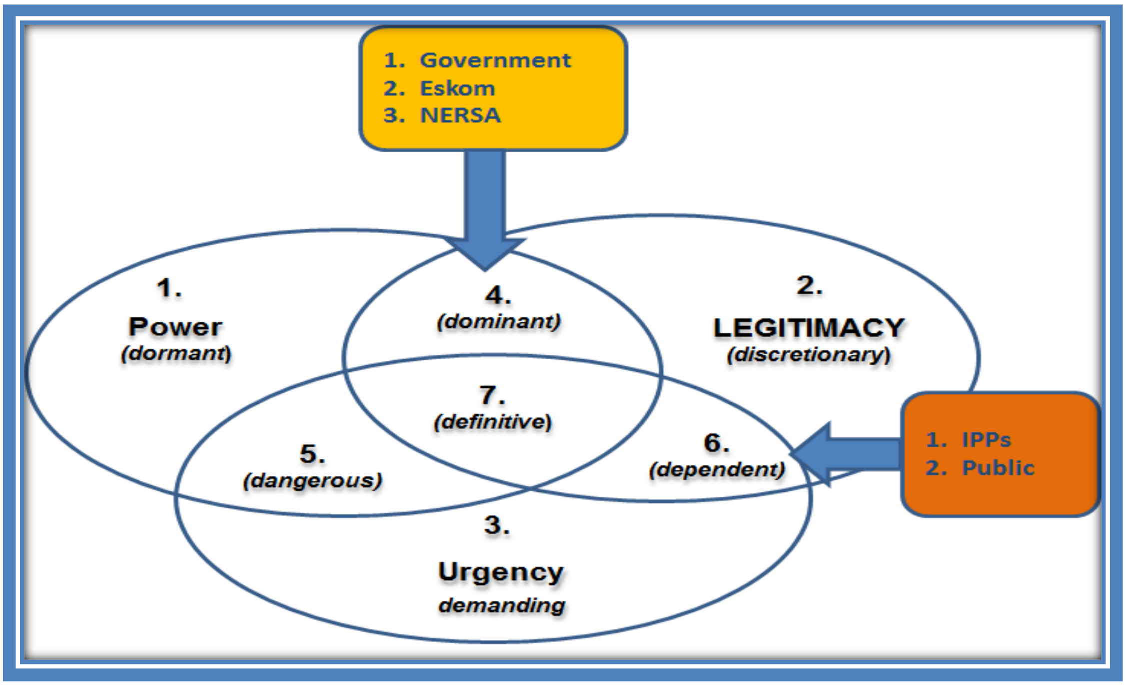
This classification can help to assess with whom an organisation should interact, e.g. those with power may have an enhanced capacity to disrupt and therefore capture public attention (Jeffery, 2009). Prioritisation in such segmentation is usually according to a predetermined set of characteristics. Jeffery (2009) further states that most models utilise two of the three dimensions listed below (or all three), defining discrete groups and prioritising these for differentiated attention and according to the level of stakeholders:

- Interest: the degree to which stakeholders are motivated by and mobilise around an issue;
- Influence: the ability of stakeholders to galvanise public interest and receptivity of the public to an issue; and
- Salience: the degree to which organisations feel that an issue and a stakeholder's stance on an issue, is of importance or relevance to them.

However, precisely because stakeholders are not homogenous, taking the analysis a step further provides significant additional critical information regarding their 'wants' and 'needs' in relation to the organisation (Grunert and Konig, 2012). Dominant stakeholders have both power and legitimate claims in the organisation giving them strong influence. Dependent stakeholders such as IPPs and the public lack power, but have urgent and legitimate claims pertaining to RE generation and usage in the electricity industry. The theory is used to describe and sometimes to explain, specific corporate characteristics and behaviours. Stakeholder theory has been used to describe the nature of the firm, the way managers think and how board members think about the interests of corporate constituencies and how some corporations actually are (Donaldson and Preston, 1995).

Figure 6.6 depicts the power, legitimacy and urgency of mentioned stakeholders within the RE sector and electricity industry of South Africa at large. From the illustration, it can be noted that Government, Eskom and NERSA exert both power and legitimate claims within the industry thus giving them strong influence. Such stakeholders normally need to be managed closely as these are the primary drivers within any industry. Within the South African context, Government, Eskom and the regulator NERSA work in tandem ensuring delivery on key imperatives such as RE projects. It stands to reason that each stakeholder is reciprocal, since each can affect the other in terms of harms and benefits as well as rights and duties (Bosse, Phillips and Harrison, 2008).

Figure 6.6: Power, Legitimacy and Urgency Model for the electricity industry.



Source: Jeffery, 2009: 17.

6.2.4 Summary

According to Boatright (2006), the fundamental mistake of stakeholder management is a failure to see that the needs of each stakeholder group, including shareholders, are different and that different means best meet these needs. The protection that shareholders derive from being the beneficiaries of management's fiduciary duty and having their interests as the objective of the firm fit their particular situation as residual claimants with difficult contracting problems. Thus employees, customers, suppliers and other investors (such as bondholders, who provide debt rather than equity) are better served by other means, which include contractual agreements and various legal rules.

The stakeholder theory proves to be instrumental within the RE sector and the electricity industry of South Africa at large as the mentioned role players have a reciprocal role to play. Managing these stakeholders is thus critical to ensure the effective participation and integration to ensure increased entrepreneurial activity within the environment and thereby ensuring an enabling entrepreneurial environment in the RE sector, proves to be imperative for the electricity industry. Thus, protecting the interests of each stakeholder group empirically ensures best practice to support the prevailing stockholder-centered system within the sector.

6.3 THE CONCEPTUAL MODEL

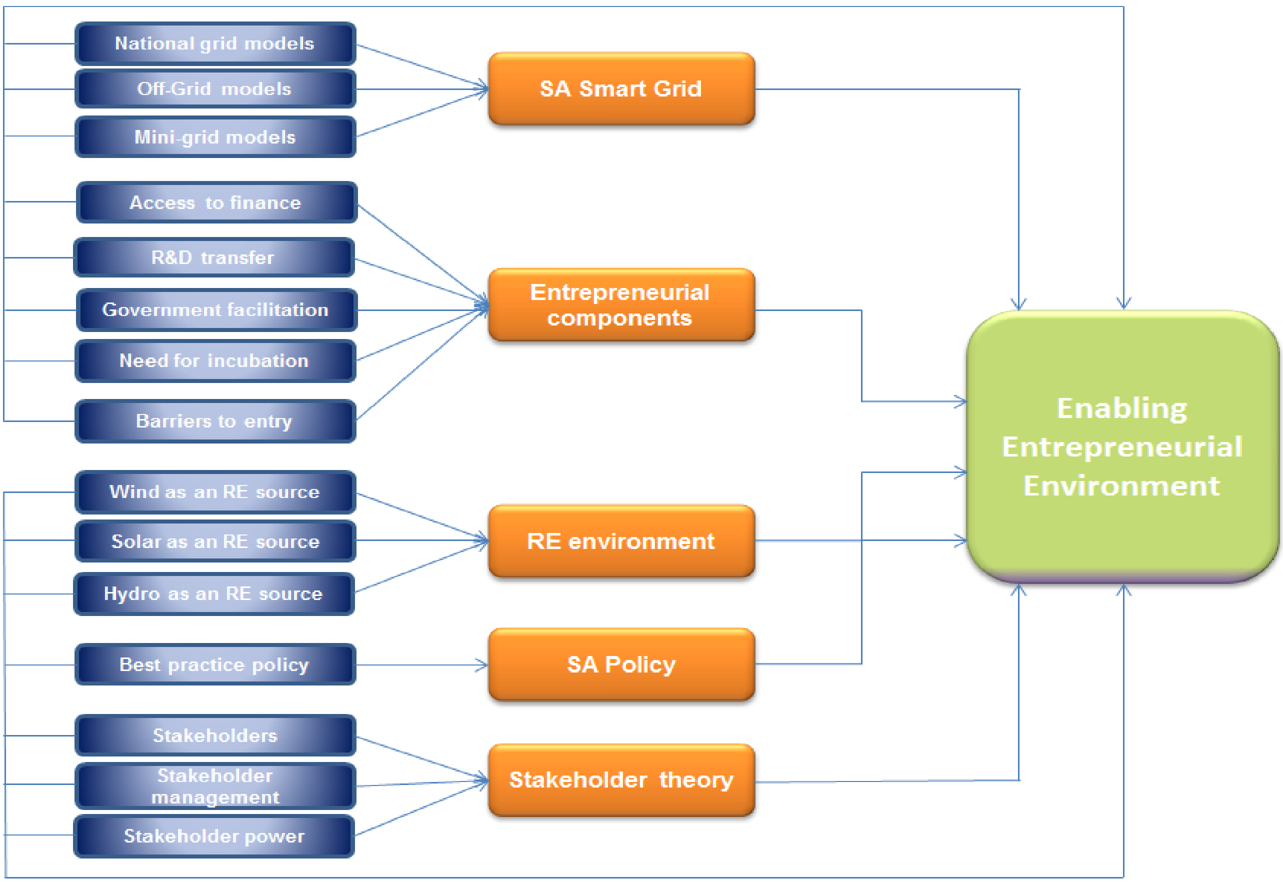
The next section of the chapter formulates the conceptual theoretical model for an enabling entrepreneurial environment and discusses the identified variables, which are hypothesised to influence the promotion of an enabling entrepreneurial environment in the RE sector of South Africa. The variable relationships are based on the discussion of the variables that contribute to the establishment of an enabling entrepreneurial environment, as presented in the previous chapters.

The variables from the literature study that impact an enabling entrepreneurial environment within the RE sector and the South African electricity industry as a whole were discussed in Chapters 2 to 5. These variables include National Grid models, Mini Grid models, Off-Grid models, Access to finance, Research and development transfer, Government facilitation, Business incubation, Barriers to entry, Wind as a RE source, Solar as a RE source, Hydro as a RE source and Best practice policy.

Bearing these views in mind, the author contends that although alternative forms of electricity exist, an enabling entrepreneurial environment for entrepreneurs to flourish is lacking. In an attempt to contribute to the livelihood of the electricity industry and the economy, the researcher henceforth proposes the development of an enabling RE entrepreneurial environment. The research problem in Chapter 1 was stated as: *The electricity industry does not provide an enabling entrepreneurial environment for IPP entrepreneurs.*

The dependent variable in the proposed model for an enabling entrepreneurial environment is identified as *an enabling entrepreneurial environment* in the RE sector in South Africa. The proposed conceptual model is presented in Figure 6.7.

Figure 6.7: Conceptual Entrepreneurial model to promote RE activity.



Source: Own construction, 2014.

The conceptual model as depicted in Figure 6.7, proposes 15 independent variables namely: National Grid models, Off-Grid models, Mini Grid models, Access to finance, R & D transfer, Government facilitation, Business incubation, Barriers to entry, Wind as a RE source, Solar as a RE source, Hydro as a RE source, Best practice policy, Stakeholders, Stakeholder Management and Stakeholder power. Each of these components is hypothesised to relate to variables influencing the creation of an enabling entrepreneurial environment within the RE sector of the electricity industry. The independent variables with the intervening variables and the hypotheses are grouped and numbered in the proposed model and presented in the discussions from Section 6.4.1 – Section 6.4.21. In this study these variables are discussed and measured by using the dependent variable namely: an enabling entrepreneurial environment.

This study attempts to categorise the variables influencing an enabling entrepreneurial environment in the RE sector of South Africa. Some variables could however be categorised under a different intervening variable. The grouping of the variables is justified by the sufficiency of literature derived from Chapters 2 to 5. A number of hypotheses can be formulated with regard to the relationships between the independent, intervening and the dependent variable. This study identified the relationships presented in the conceptual model and hypotheses are formulated to address these relationships only.

The proposed model went through various interventions and drafts with discussion with academics, promoters and the Nelson Mandela Metropolitan University (NMMU) statistical research assistant. This process finally produced the proposed entrepreneurial model in Figure 6.7. Each variable in the model was associated and supported by questions obtained from literature studies in order to quantitatively evaluate the model.

6.4 SUMMARISED DESCRIPTION OF EACH VARIABLE

In this section the variables are discussed individually and the hypotheses aligned with the literature study. Each variable was identified from the literature and teh associated question to evaluate and validate the variable identified from the literature.

6.4.1 Dependent variable: Enabling entrepreneurial environment

A prerequisite for nurturing entrepreneurship is the creation of an enabling entrepreneurial environment which is understood to be at the heart of economic liberalisation initiatives (Sharma, Garg and Kumar, 2006). Markley and Dabson (2006) state that the key parameters of an enabling entrepreneurial environment include smooth flow of information; ease of starting a business and obtaining various clearances and permits; ease of filing taxes; an efficient legal system; enabling legislations and regulations; absence of corruption and world-class infrastructure facilities. This environment not only needs to support and welcome entrepreneurs, but the creation of the right conditions for entrepreneurs to thrive is paramount.

The entrepreneurship arena is dynamic and its changing nature has intensified the need to ensure that an enabling environment is established for entrepreneurs. This enabling entrepreneurial environment is fashioned through essential components needed to seize opportunities and advance the economy in a country. Developed countries have supported emerging countries and economies in transition in opening up their regulations to RE generation (Barbut, 2009).

The various variables influencing an enabling entrepreneurial environment have been identified in the literature and the conceptual model (Figure 6.7) describes the relationships. In total, 15 independent variables have been identified, together with 5 intervening variables. The variables; *SA Smart Grid Model, Entrepreneurial components, RE environment, SA Policy and Stakeholder Theory* will be accounted for as the intervening variables for this study. The independent variables accounted for are identified as *National Grid models, Off-Grid models, Mini Grid models, Access to finance, R & D transfer, Government facilitation, Business incubation, Barriers to entry, Wind as a RE source, Solar as a RE source, Hydro as a RE source, Best practice policy, Stakeholders, Stakeholder Management and Stakeholder power.*

Entrepreneurs in the electricity sector are termed Independent Power Producers (IPPs). These IPPs play a pivotal role in the RE sector as they strive to capitalise on opportunities emerging in the sector. In order for these IPPs to flourish, the sector seeks an enabling entrepreneurial environment. In order to support this, the independent variables are grouped with the intervening variables as proposed in the conceptual model. Each variable is discussed individually in the next section.

6.4.2 Independent variable: National Grid Models

The mentioned international and national grid models that are in operation can stimulate entrepreneurial involvement in an effort to address the challenge of high carbon emissions and the spiralling electricity demand through the use of RE technologies. Pegels (2010b) posits that the carbon intensity in countries such as South Africa is amongst the highest in the world. A Smart Grid model encompasses more than just the 'Grid'. It encompasses topics to integrate renewable energy sources and energy storage devices into the existing power grid and doing so with no compromises in reliability. This is an international best practice model that suits the South African situation well as the mix of generation resources which is sought after.

It is therefore hypothesised that:

H1: There is a positive relationship between National Grid models and an enabling entrepreneurial environment in the electricity sector.

H1a: There is a positive relationship between National Grid models and South African Smart Grid model.

6.4.3 Independent variable: Off-Grid models

Small-scale decentralised distributed generation avoids the bureaucracy. The key is to develop a system of incentives sufficiently attractive for these players to do business in Off-Grid areas. The goal is to help build sustainable local markets that would persist beyond the development assistance phase, which helped initiate them.

It is therefore hypothesised that:

H2: There is a positive relationship between Off-Grid models and an enabling entrepreneurial environment in the electricity sector.

H2a: There is a positive relationship between Off-Grid models and the South African Smart Grid model.

6.4.4 Independent variable: Mini-Grid Models

A Mini-Grid combines at least two different kinds of technologies for power generation and distributes the electricity to several consumers through an independent grid. Thus, the Mini-Grid is supplied by a mix of RE sources. Mini-Grids provide capacity for both domestic appliances and local businesses and have the potential to become the most powerful technological approach for accelerated rural electrification (Alliance for Rural Electrification, 2008).

Contrary to the Off-Grid access model, the consumer (e.g. a household) in a Mini-Grid system does not perform maintenance or manage the equipment. Instead, system maintenance and management is the responsibility of the private investor or at management committee elected by the members in a group or co-operative (CAMCO, 2010).

It is therefore hypothesised that:
H3: There is a positive relationship between Mini-Grid models and an enabling entrepreneurial environment in the electricity sector.
H3a: There is a positive relationship between Mini-Grid models and the South African Smart Grid model.

6.4.5 Intervening variable: SA Smart Grid Model

Smart Grids include electricity networks (transmission and distribution systems) and interfaces with generation, storage and end-users. According to the Smart Grid Information Report (2011), many countries have already begun to 'smarten' their electricity system and will require significant additional investment and planning. The promotion of RE and the reduction of carbon emissions will be critical in achieving the benefits of Smart Grids as power utilities seek to diversify electricity generation. By using this model, new Smart Grid applications can be easily implemented to augment the existing utility capabilities. The model also provides the flexibility needed to add new capabilities as the requirements arise with the aim of achieving a smarter grid. Smart Grids are an evolving set of technologies that could be beneficial to the promotion of an enabling entrepreneurial environment for entrepreneurs.

It is therefore hypothesised that:

H16: There is a positive relationship between the SA Smart Grid model and an enabling entrepreneurial environment in the electricity sector.

6.4.6 Independent variable: Access to finance

Ready access to early-stage finance, especially seed capital, is a critical factor in a favourable entrepreneurial ecosystem. This is especially important for younger and first-generation entrepreneurs (Goswami, et al., 2008). Thus access to finance is the seed to start-up and early-stage of the entrepreneurial process in which financing remains a major challenge for many entrepreneurs, particularly in today's financial environment (Mason, 2008). Ready access to early-stage finance, is a critical factor in an enabling entrepreneurial environment. It is a key factor in deciding whether to become an entrepreneur as well as in deciding the nature of the enterprise to promote (Goswami, et al., 2008). The availability of affordable finance remains a key barrier for RE investments, especially in emerging economies such as South Africa.
It is therefore hypothesised that:

H4: There is a positive relationship between access to finance for entrepreneurs and an enabling entrepreneurial environment in the electricity sector.

H4a: There is a positive relationship between access to finance for entrepreneurs and entrepreneurial components.

6.4.7 Independent variable: Research and development (R & D) transfer

Dean and McMullen (2007) recognise different forms of sustainable entrepreneurship as responses to different types of market failures. Market development is important, but sustainable development requires interplay between market and institutional developments.
It is therefore hypothesised that:

H5: There is a positive relationship between research and development (R & D) transfer and an enabling entrepreneurial environment in the electricity sector.

H5a: There is a positive relationship between research and development (R & D) transfer and entrepreneurial components.

6.4.8 Independent variable: Government facilitation

Providing start-up resources to entrepreneurs proves to be imperative in facilitating entrepreneurship. Some entrepreneurs believe that while the government has some significant policies to help entrepreneurs, the implementation of these policies is extremely poor (Goswami, et al., 2008). According to the GEM (2011b), in South Africa, national experts are of the opinion that although some government policies (e.g. the new Companies Act, BBBEE Act 53 of 2003) are contributing to creating a supportive environment for entrepreneurial activity, South Africa still faces its challenges with facilitation. Furthermore, the area of government policy emerged as the second-highest ranked factor facilitating entrepreneurship – second to education.

It is therefore hypothesised that:

H6: There is a positive relationship between government facilitation and an enabling entrepreneurial environment in the electricity sector.

H6a: There is a positive relationship between government facilitation and entrepreneurial components of entrepreneurship.

6.4.9 Independent variable: Business Incubation

The process of Business Incubation for Entrepreneurship (BIE) is a critical organisational support mechanism for fledgling entrepreneurs at the initial stage. The quality and scale of BIE could become one of the most important tools to enhance the entrepreneurial ecosystem. A typical Business Incubator provides the following services to a budding entrepreneur: physical infrastructure, administrative support, management guidance, help in formulation of a business plan, technical support, Intellectual Property (IP) advice where applicable, facilitating access to finance and encouraging networking with the greater and relevant business community (Goswami, et al., 2008).

At the start-up stage, the entrepreneur is beset with significant challenges of marketability and resources (financial and otherwise), which successful incubation can help address. To meet these new challenges, widening scope and scale of business and rapidly changing technology, it is expected that BIE will further develop the entrepreneur in this regard (Goswami, et al., 2008).

The process will thus provide entrepreneurs with an enabling entrepreneurial environment at the start-up stage of the organisation development, to help reduce the cost of launching the enterprise, increase the capacity of the entrepreneur and link the entrepreneur to the resources required to start a competitive enterprise (Khalil and Olafsen, 2009). BIE is a key contributor to developing an enabling entrepreneurial environment.

It is therefore hypothesised that:
H7: There is a positive relationship between Business Incubation and an enabling entrepreneurial environment in the electricity sector.
H7a: There is a positive relationship between Business Incubation and entrepreneurial components.

6.4.10 Independent variable: Barriers to entry

The need for enacting policies to support RE is often attributed to a variety of barriers or conditions that prevent investments from occurring. Often the result of barriers is to put RE at an economic, regulatory, or institutional disadvantage relative to other forms of energy and ultimately electricity supply. Barriers include subsidies for conventional forms of electricity, high initial capital costs coupled with lack of fuel-price risk assessment, imperfect capital markets, lack of skills or information, poor market acceptance, technology prejudice, financing risks and uncertainties, high transactions costs and a variety of regulatory and institutional factors (Dean and McMullen, 2007). Barriers could be considered market distortions that unfairly discriminate against RE, while others have the effect of increasing the costs of RE relative to the alternatives. Barriers are often quite situation-specific in any given region or country (Beck and Martinot, 2004).

It is therefore hypothesised that:

H8: There is a positive relationship between barriers to entry and an enabling entrepreneurial environment in the electricity sector.
H8a: There is a positive relationship between barriers to entry and entrepreneurial components.

6.4.11 Intervening variable: Entrepreneurial components

Dean and McMullen (2007) state that the key to achieving an enabling entrepreneurial environment lies in overcoming barriers to the efficient functioning of markets for environmental resources. Subsequently, the unique characteristics of many environmental resources do not tend to be easily amenable to market allocation. Environmental entrepreneurs create and improve markets for such resources through entrepreneurial action that results in the development of property rights and economic institutions, the reduction of transaction costs, the dissemination of information and the motivation of government action (Dean and McMullen, 2007). Through the resulting development of markets, entrepreneurs can profit from the economic value created while reducing environmental degradation and enhancing ecological sustainability.

It is therefore hypothesised that:
H17: There is a positive relationship between entrepreneurial components and an enabling entrepreneurial environment in the electricity sector.

6.4.12 Independent variable: Wind as an RE source

Wind has considerable potential as a global clean energy source, being both widely available, though diffuse and producing no pollution during power generation. Wind energy has been one of humanity's primary energy sources for transporting goods, milling grain and pumping water for several millennia (Herzog, et al., 2009). The wholesale cost of wind power appears to be competitive in some locations and there are three principal problems with wind. The first is that good wind sites are generally located far from load centres. Transmitting the electricity 1 000 miles from the wind site to the city would double the delivered cost. The second is that the wind generally does not blow when electricity demand is high. In emerging countries RE grid connection often is economically prohibitive or a potential scenario in the far distanced future (Herzog, et al., 2009).

In recent years, wind electricity has seen a phenomenal boom (Herzog, et al., 2009). After many years in which the technical and environmental promise of wind clearly exceeded the commercial reality, wind has turned the corner and is now a commercially proven, reliable and cost-competitive option for producing utility-scale electricity. Herzog, et al. (2009) believe that wind energy is currently one of the most cost-competitive RE technologies.

It is therefore hypothesised that:
H9: There is a positive relationship between wind as an RE source and an enabling entrepreneurial environment in the electricity sector.
H9a: There is a positive relationship between wind as an RE source and the RE environment.

6.4.13 Independent variable: Solar as an RE sources

Apt, et al. (2008) claim that the most popular RE source with the public is solar power and this is either photovoltaic or solar thermal power. According to Timilsina, Kurdgelashvili and Narbel (2011), solar energy has experienced an impressive technological shift. While early solar technologies consisted of small-scale photovoltaic cells, recent technologies are represented by solar concentrated power and also by large-scale PV systems that feed into electricity grids. The rapid expansion of the solar energy market can be attributed to a number of supportive policy instruments, the increased volatility of fossil fuel prices and the environmental externalities of fossil fuels, particularly greenhouse gas emissions (Timilsina, et al., 2011a).

The potential of solar resources in the electricity industry is significant. In theory, solar panels covering less than 10% of Colorado, for example, could provide enough electricity to power the entire United States (Komor, 2009). Solar is virtually a limitless resource. It is free of greenhouse gas emissions, widely thought to contribute to global climate change (Gandhi and Middendorf, 2009). It stands to reason that in developed countries the use of appliances in industry is deemed to be relatively high. Thus, the demand for electricity would be high creating a need for more solar generation during these peak times that would be of great benefit to the industry. Once installed, solar systems can function for 25 or more years with little maintenance or oversight (Gandhi and Middendorf, 2009).

It is therefore hypothesised that:
H10: There is a positive relationship between solar as an RE source and an enabling entrepreneurial environment in the electricity sector.
H10a: There is a positive relationship between solar as an RE source and the RE environment.

6.4.14 Independent variable: Hydro as an RE sources

The world over, water scarcity concerns are often used to dismiss out-of-hand the potential for hydro-power. Hydro-power is one of the most widely known forms of RE (Yermoli and Krishnan, 2010). In reality, energy derived from extracting the potential energy of elevated water during its descent has an important role to play. This is especially important when one considers the volumes of water that are moved around the country in balancing the supply and demand for water and the fact that the energy content of this water is seldom considered (Banks and Schäffler, 2006). Hydro-power provides about 96% of the RE in countries such as the United States. Whiriskey and McCarthy (2006) postulate that by investing in a small hydro-power system, it is possible to reduce exposure to future fuel shortages and price increases and help reduce air pollution. Improvements in small turbines and generator technology mean that micro technology (under 100 kW) hydro schemes are an attractive means of producing electricity.

Hydro-electric projects have some dependability, in the sense that they can be counted on to supply power at times of peak demand. Storage hydro has greater dependability than run-of-river hydro because the stored water can be used when it is most needed. Dependability is the main reason why hydro-electric power is preferred as a RE source (Yermoli and Krishnan, 2011).

It is therefore hypothesised that:
H11: There is a positive relationship between hydro as an RE source and an enabling entrepreneurial environment in the electricity sector.

H11a: There is a positive relationship between hydro as an RE source and the RE environment.

6.4.15 Intervening variable: RE environment

Energy related activities are the major source of carbon emissions and for this reason, the provision of electricity from renewable sources requires priority through the extension of energy sources. According to Schwan (2011), the development mechanisms that address barriers to RE programmes and promote low-carbon development are needed. The integration of RE sources thus cannot be solved in isolation from the other challenges facing modern electricity industries (Bull and Kelly, 2007). Moreover, many countries are undertaking processes of electricity industry restructuring, which involve disaggregation of formerly vertically integrated monopoly supply utilities and the introduction of competition and enhanced end-user participation in the form of IPPs (Bull and Kelly, 2007).

It is therefore hypothesised that:
H18: There is a positive relationship between RE environment and an enabling entrepreneurial environment in the electricity sector.

6.4.16 Independent variable: Best practice policy

Policy is one of the main drivers in moderate and high-renewable scenarios in the electricity industry. The environmental effects of electricity generation are not addressed by normal incentives in competitive markets and the need therefore arises for energy and electricity policies to address the need for market incentives. Environmental benefits are classical public goods and liberalised electricity markets will not adequately account for their value – or for the cost of their potential loss. Policy intervention is therefore needed to ensure these benefits are appropriately accounted for. Policies motivated by environmental and climate change concerns are already having serious impacts on liberalised electricity markets, as was intended (IEA, 2005).

Moner-Girona (2009b) states that that the emphasis should be on the need to create market conditions that encourage increasingly cost-effective investment in renewables through well-grounded economic policy and an enabling entrepreneurial environment for IPPs to operate within.

It is therefore hypothesised that:
H12: There is a positive relationship between best practice policy and an enabling entrepreneurial environment in the electricity sector.
H12a: There is a positive relationship between best practice policy and SA policy.

6.4.17 Intervening variable: SA policy

According to Baker (2011), demystifying the complexities of South Africa's energy policy in the context of constantly moving goal posts and a multitude of processes is an enormous challenge. Despite intense interest in the past few years from RE IPPs waiting to construct and connect their projects to the country's electric grid, numerous policy uncertainties and delays remain. Policy is one of the main drivers in moderate and high-renewable scenarios in the electricity industry. A single policy that stipulates the guidelines for energy institutions such as Eskom in an effort towards incorporating RE into the electricity industry can make inroads. Progress towards improved policy has been slow and McCrone (2012) posits that regions such as South Africa are disappointing with regard to RE processes and policy progress. South Africa has been the scene of significant policy-making and investor activity.

It is therefore hypothesised that:
H19: There is a positive relationship between SA policy and an enabling entrepreneurial environment in the electricity sector.

6.4.18 Independent variable: Stakeholders

Austen, et al. (2008) posit that power utilities in the electricity generation and distribution, as a field of research have tended to focus on planning and managing the complex array of activities required from generation to distribution. Being able to manage construction, stakeholder's expectations and concerns is a crucial skill for managers of construction projects, as failure to address these has resulted in countless project failures, primarily because construction stakeholders tend to have the resources and capability to stop construction projects (Lim, Ahn and Lee, 2005). Successful completion of construction projects is therefore dependant on meeting the expectation of stakeholders. Stakeholders, include clients, project managers, designers, subcontractors, suppliers, funding bodies, users, owners, employees and local communities (Newcombe, 2003). As a consequence a robust construction management literature has developed on how to identify and manage stakeholder interests and relationships.

Stakeholder theory asserts that the business needs to consider the interests of groups affected by the firm. Stakeholders are "those groups or individuals with whom the organisation interacts or has interdependencies" and "any individual or group who can affect or is affected by the actions, decisions, policies, practices or goals of the organisation" (Hodge, 2011: 4). By this analysis, stakeholders have the potential to help or harm the company.

It is therefore hypothesised that:

H13: There is a positive relationship between stakeholders and an enabling entrepreneurial environment in the electricity sector.

H13a: There is a positive relationship between stakeholders and the stakeholder theory.

6.4.19 Independent variable: Stakeholder management

Newcombe (2003) argues that effective stakeholder management begins "with the identification of key stakeholders establishing the strategic importance of stakeholder groups then helps organisations determine what the nature of their stakeholder management strategies should be". Various authors have attempted to operationalise this imperative through deployment of various static grids and matrices which assess the salience of various stakeholders on project outcomes based on their power, legitimacy and urgency.

It is therefore hypothesised that:

H14: There is a positive relationship between stakeholder management and an enabling entrepreneurial environment in the electricity sector.

H14a: There is a positive relationship between stakeholder management and the stakeholder theory.

6.4.20 Independent variable: Stakeholder power

Jeffery (2009) states that a stakeholder group has power when it can impose its will on the firm, especially through the control of resources, while legitimacy implies that a stakeholder group reflects the prevailing opinions and beliefs of society. Urgency is characterised as stakeholder sensitivity to the response time of managers. This classification can help to assess with whom an organisation should interact, e.g. those with power may have an enhanced capacity to disrupt and therefore capture public attention (Jeffery, 2009).

It is therefore hypothesised that:

H15: There is a positive relationship between stakeholder power and an enabling entrepreneurial environment in the electricity sector.
H15a: There is a positive relationship between stakeholder power and the stakeholder theory.

6.4.21 Intervening variable: Stakeholder Theory

Stakeholder theory began as a response to the belief that the owners of shares of stock should be the prime beneficiary of the organisation's activities. The theory suggests that there are multiple groups having a stake in the operation of the firm all of whom merit consideration of managerial decision making (Jeffery, 2009). Stakeholder theory asserts that the business needs to consider the interests of groups affected by the firm. Stakeholders are those groups or individuals with whom the organisation interacts or has interdependencies and any individual or group who can affect or is affected by the actions, decisions, policies, practices or goals of the organisation (Jeffery, 2009). By this analysis, stakeholders have the potential to help or harm the company.

It is therefore hypothesised that:
H20: There is a positive relationship between stakeholder theory and an enabling entrepreneurial environment in the electricity sector.

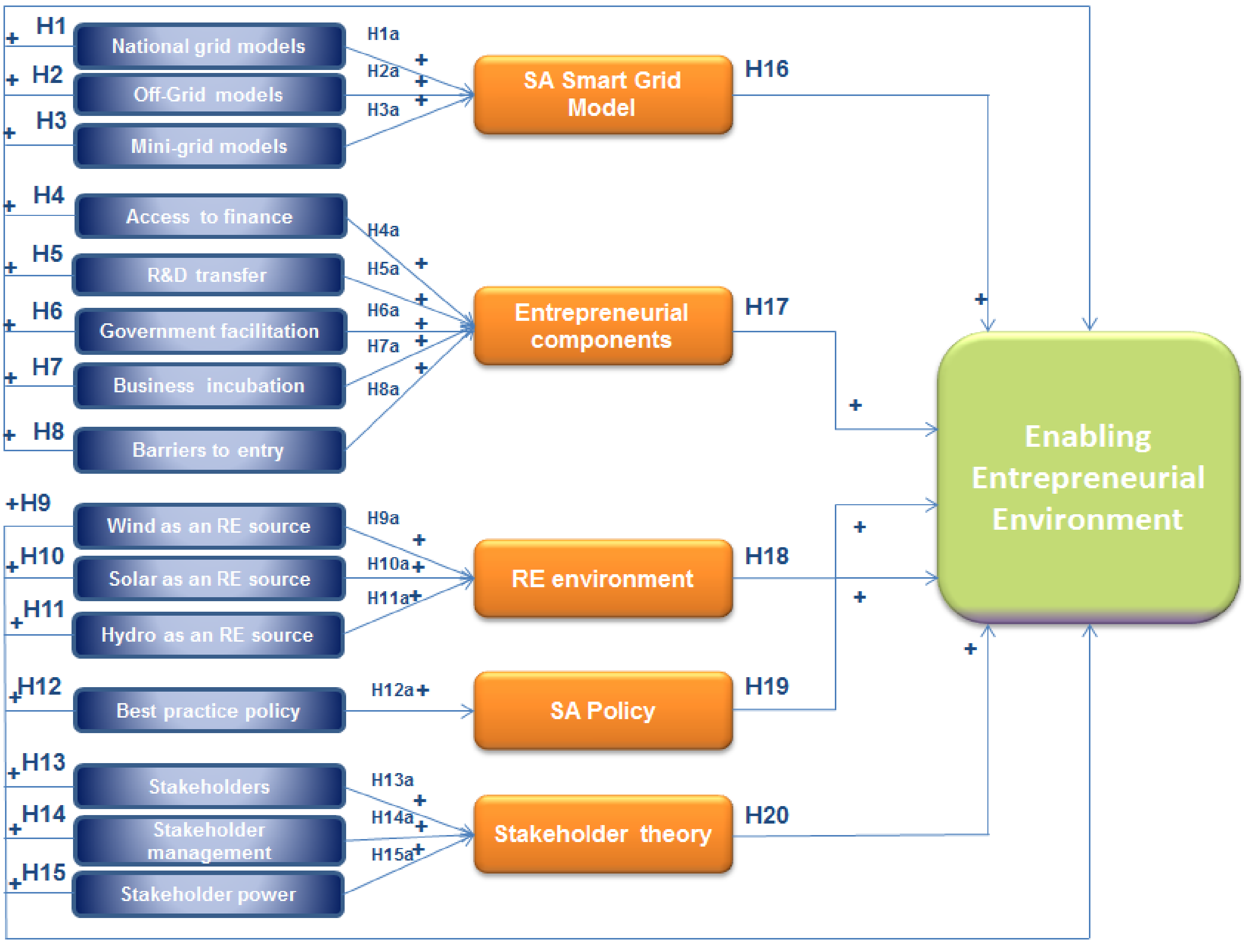
It is evident from the literature presented in this chapter that stakeholder theory must account for power and urgency as well as legitimacy, no matter how distasteful or unsettling the results. Organisations are advised to know about entities in their environment that hold power therefore it is imperative that power and urgency be attended to if organisations are to serve the legal and moral interests of legitimate stakeholders.

6.5 SUMMARY

This chapter presented the stakeholder theory on which the study is based and the development of a theoretical model to be empirically tested. It can be argued that stakeholders have the potential to support an organisation to achieve its objectives. Mitchell, et al. (1997) argue that stakeholder theory attempts to articulate a fundamental question in a systematic way: which groups are stakeholders that deserve or require management attention and which are not?

In this chapter stakeholders in the RE sector of the electricity industry were identified, prioritised and a model proposed towards establishing an enabling entrepreneurial environment for such stakeholders within the RE sector of the electricity industry. The deliverable from this chapter, a conceptual model for an enabling entrepreneurial environment is underpinned by variables that contribute to the establishment of such model. These variables were hypothesised and outlined and a conceptual hypothesised model is thus presented (Figure 6.8).

Figure 6.8: Conceptual hypothesised model.



Source: Own construction, 2014.

The research question addressed in this chapter is:

- *RQ_6 – How do stakeholder theory and stakeholder management influence the South African RE sector?*

The deliverable to this chapter was the establishment of a conceptual hypothesised model for IPPs in the RE sector of the electricity industry (Figure 6.8).

Therefore, a conceptual hypothesised model was constructed addressing all relevant variables having an impact on an enabling entrepreneurial environment within the RE sector of the electricity industry of South Africa. Figure 6.8 illustrates the variables that influence an enabling entrepreneurial environment for IPPs in the RE sector have been found to be 20 major determinants, namely National Grid models, Off-Grid models, Mini Grid models, SA Smart Grid models, Access to finance, Research and development (R & D) transfer, Government facilitation, Business incubation, Barriers to entry, Entrepreneurial components, Wind as a RE source, Solar as a RE source, Hydro as a RE source, RE environment, Best practice policy, SA policy, Stakeholders, Stakeholder Management and Stakeholder power. A total of 35 hypotheses have been discussed and proposed. In Chapter 7, the research methodology will be discussed and the instruments used to measure the conceptual hypothesised model will be defined.

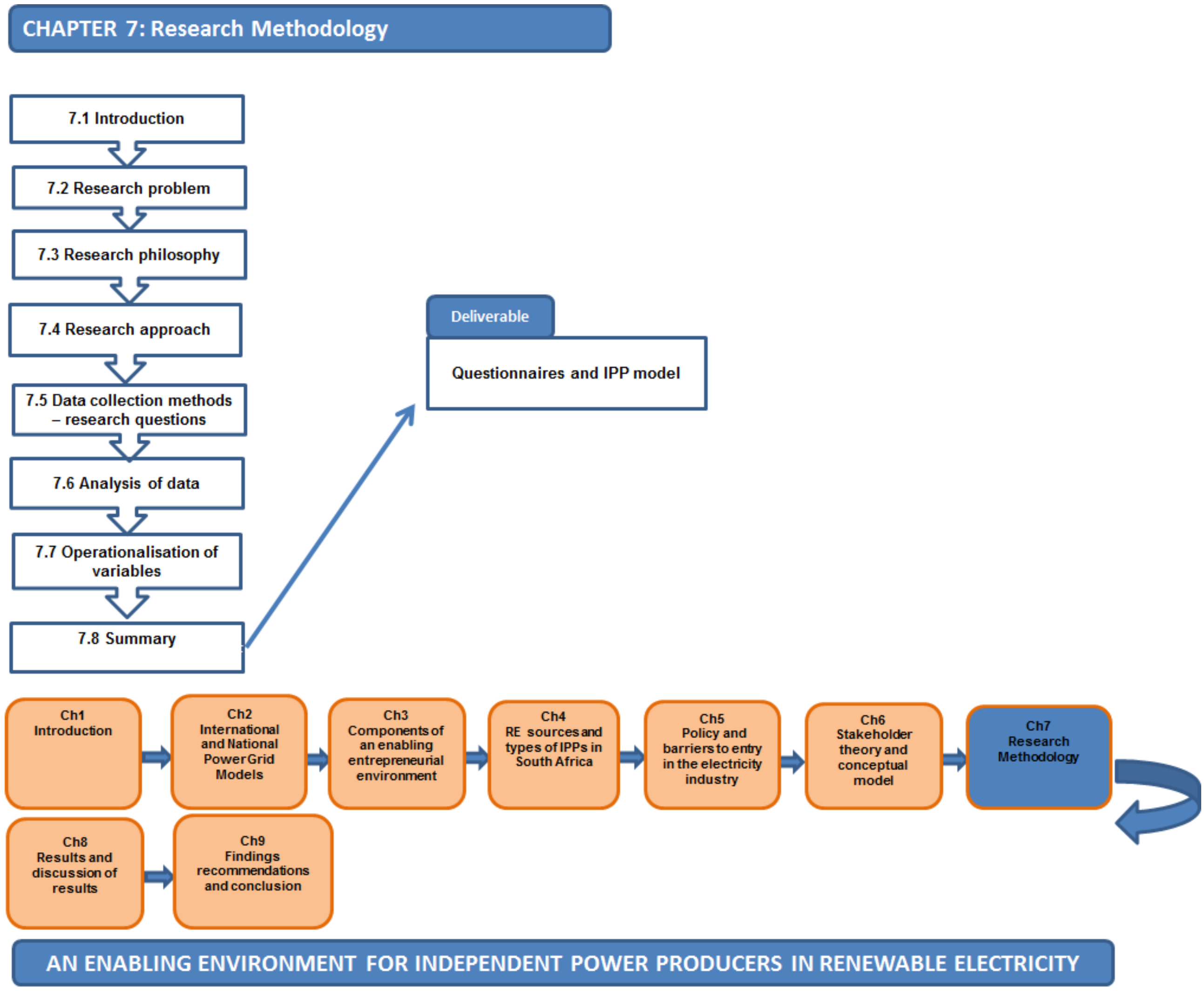


Fig 7.1: Outline of the chapter.

CHAPTER 7
RESEARCH METHODOLOGY

7.1 INTRODUCTION

The literature study covered in Chapters 2, 3, 4, 5 and 6 validated this study in academic literature. A conceptual model was developed to identify and discuss the variables towards the promotion of an enabling entrepreneurial environment in the RE sector. This chapter presents the method and processes that were used to obtain data from the research participants in order to develop a model to assist in the creation of an enabling environment for IPP entrepreneurs in the RE sector of the electricity industry in South Africa.

The present study investigates the key components of an enabling entrepreneurial environment for IPPs in the RE sector by providing possible ecopreneurial solutions as enablers. The chapter further considers conditions for the suitable application of research philosophy, approach, strategy and appropriate data collection methods. A survey strategy will be used to collect data in order to analyse the data and address the aims of the study and answer the main research question (RQ_m): *What components need to be included in a model to promote an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector?*

In order to collect data for analysis and to address the objectives of the study, questionnaires were administered to Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Approved and Non-Approved IPPs respectively. The questionnaires consisted of fixed response questions utilising a 5-point Likert scale and open-ended questions. Personal interviews were also conducted with Industry experts. The research approach utilised in this study was both quantitative and qualitative in nature.

The purpose of this chapter is thus to identify the research methodology most appropriate to address the identified research problem: *The electricity industry does not provide an* *enabling entrepreneurial environment for IPP entrepreneurs.* This will be done by discussing the research design and methodology and outlining the population and sampling techniques employed to gather data for this investigation. Upon completion of the literature study, a proposed IPP industry model of hypothesised variables that influence an enabling entrepreneurial environment in the RE sector was constructed. It is this proposed conceptual model and the variables from which it is built that constitute the focus of the empirical investigation. This chapter therefore addresses the seventh research question and objective:

- *RQ_7 - What are the components of a proposed model for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector?*
- *RO_7 - To propose a model for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector.*

Figure 7.1 outlines the chapter as follows: Section 7.2 presents the research problems while Section 7.3 provides the research philosophy for this study. In Section 7.4 a focus on the research approach and strategy are provided. Section 7.5 is devoted to the data collection methods and Section 7.6 to the analysis of data. In Section 7.7 the variables are operationalised and a summary of the chapter is provided in Section 7 8.

7.2 RESEARCH PROBLEMS

Based on the research problems identified in Chapter 1, the research focus in this study is to propose an enabling entrepreneurial environment which may promote increased entrepreneurial activity for IPPs in the RE sector of the electricity industry, by exploring problems experienced at organisational, legislative and entrepreneurial levels.

These research problems identified in this study are outlined as follows:

Organisational level

- Existing structures of the electricity industry do not accommodate IPPs in RE sector;
- No alignment of IPP initiatives with organisational imperatives;

- No integration of RE entrepreneurship into Eskom's existing strategy; and
- Electricity policies are not aligned to RE generation (Wisuttisak, 2012).

Legislative level

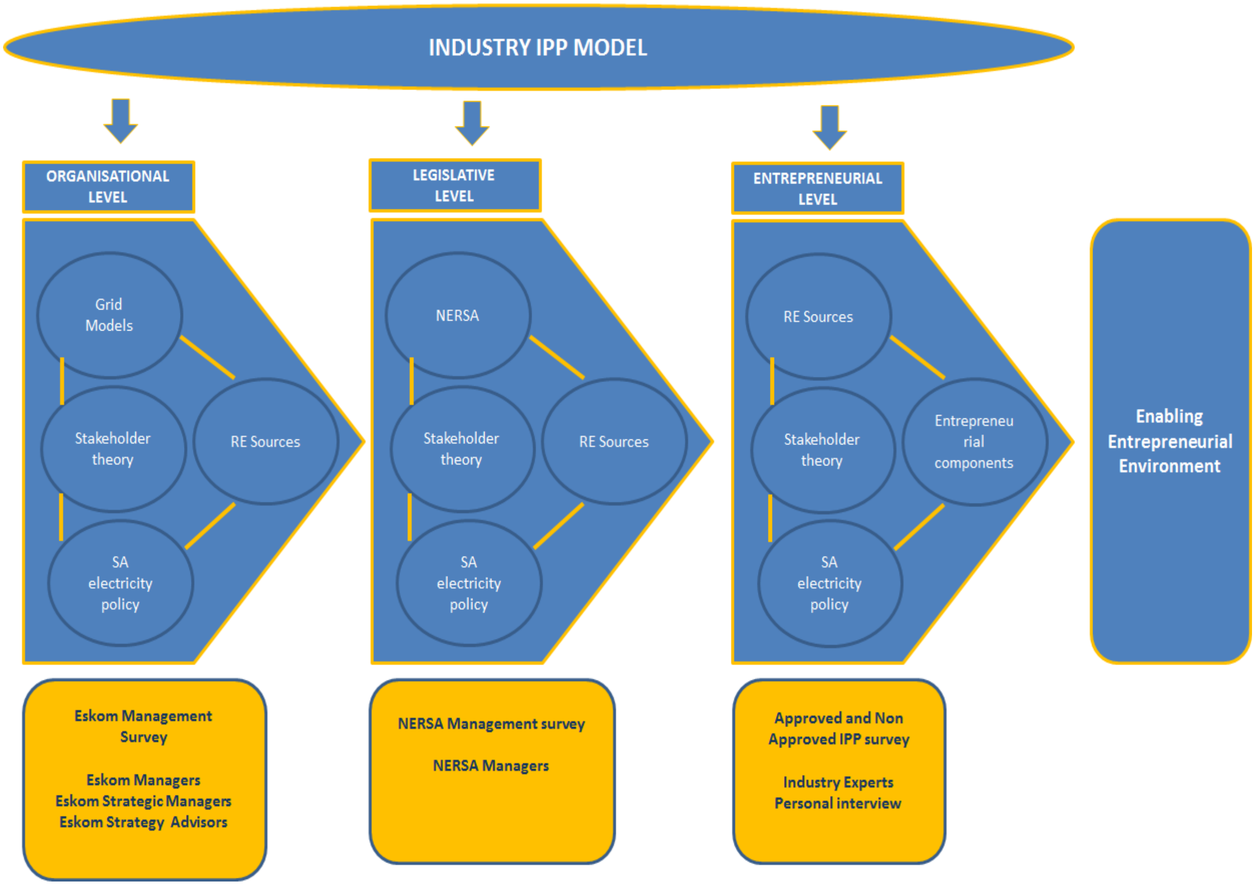
- A lack of operational objectives governing IPP activity;
- RE policy creating barriers to entry; and
- Inappropriate policy geared more towards coal generation than RE (Booth and Segon, 2008).

Entrepreneurial level

- Limited industry and governmental facilitation for IPPs to gain access to the grid;
- Unrealistic industry requirements for entrepreneurial activity;
- Start-up finance for IPP entrepreneurs; and
- Poor stakeholder facilitation (Booth and Segon, 2008).

The research problems identified have led to the proposal of a model (Figure 7.2) towards an enabling entrepreneurial environment in the RE sector of South Africa, which forms the basis of this study.

Figure 7.2: The industry IPP Model.



Source: Own construction, 2014.

The orange output boxes at the bottom of Figure 7.2 indicate the research surveys being conducted at each level of the Industry IPP Model. The problems experienced at the different levels and the three research studies conducted at each of the levels in the Industry IPP Model are indicated in Table 7.1.

Table 7.1: Research problems and survey questionnaires.

Level	Identified problem	Investigation method
Organisational level	• Existing structures of the electricity industry do not accommodate IPPs in RE sector; • No alignment of IPP initiatives with organisational imperatives; • No integration of RE entrepreneurship into Eskom's existing strategy; and • Electricity policies are not aligned to RE generation.	Eskom Management – questionnaire • Eskom Strategic Managers • Eskom Strategy Advisors • Eskom Managers
Legislative level	• Restrictive legislation that does not aid entrepreneurial activity; • A lack of operational objectives governing IPP activity; • RE policy creating barriers to entry; and • Inappropriate policy geared more towards coal generation than RE.	NERSA Management – questionnaire • NERSA Managers
Entrepreneurial level	• Limited industry and governmental facilitation for IPPs in gaining access to the grid; • Unrealistic industry requirements for entrepreneurial activity; • Start-up finance for IPP entrepreneurs; and • Poor stakeholder facilitation.	Approved and Non- Approved IPPs – questionnaire • Approved and Non-Approved IPPs Industry experts – personal interviews • Industry experts

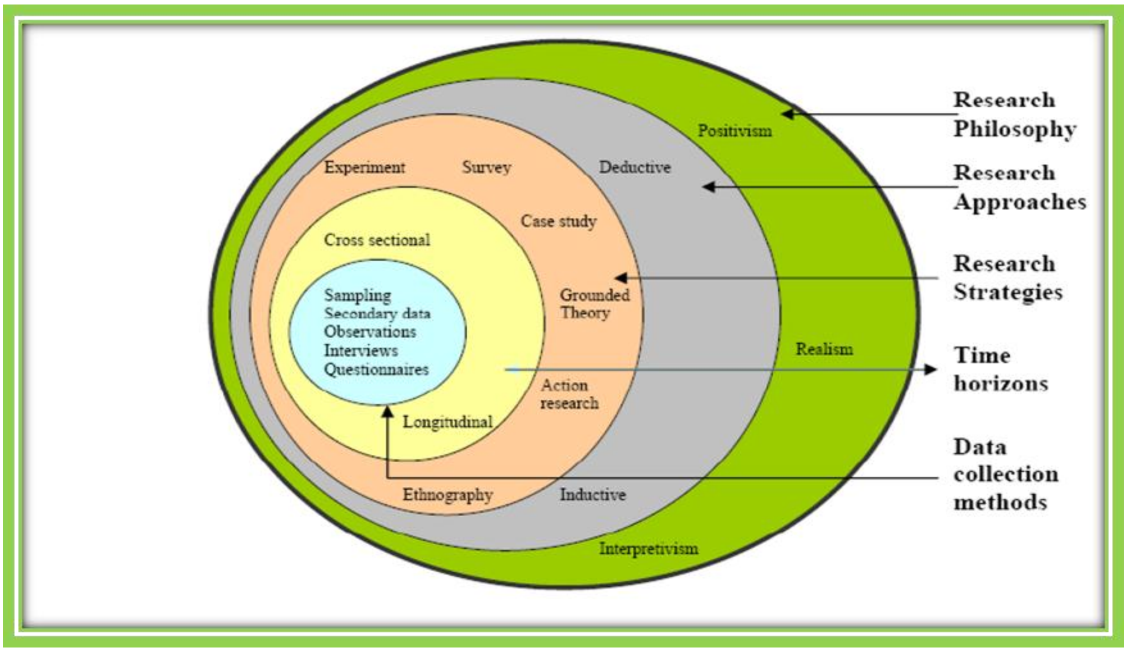
The research ethics approval for all questionnaires utilised in this study (Appendix A) and correspondence have been approved by the NMMU Research Ethics committee. Approval to conduct research at Eskom and NERSA was obtained from Eskom Head office and NERSA Head office (Appendix B and Appendix C).

7.3 RESEARCH PHILOSOPHY

Research philosophy provides the researcher with a roadmap as to the manner in which research may be carried out, by outlining how the world is perceived by the researcher, what constitutes reality, the understanding of the reality, as well as the methods that may be employed to gather more knowledge about the reality (Saunders, et al., 2009). A research philosophy is defined as "a framework that guides how research should be conducted, based on people's philosophies and their assumptions about the world and the nature of knowledge" (Collis and Hussey, 2009: 34).

Figure 7.3 depicts the research process used to define the research philosophy of this study in detail. The research onion illustrates a generic research process showing the relationship between the various aspects of the research process (Collis and Hussey, 2003) and attempts to contextualise the study according to the onion.

Figure 7.3: The research onion.



Source: Saunders, et al., 2009: 5.

The following aspects will be discussed in detail:

- Research philosophy;
- Research strategy; and
- Data collection methods.

The study follows the Critical Realism (CR) paradigm which is located in postmodernism. As a research philosophy, realism provides a world view in which an actual social phenomenon can be ascertained even though it is imperfect and probabilistically comprehensible. For critical realists the social world is ‘real’, in the sense that it generates results and exists independent of its identification (Alliance for Rural Electrification, 2011). Critical realists also seek to express the power of embedded meanings, practices and relationships as structures that affect people; yet such powers are themselves sustained by people (Kempster and Parry, 2011). In the next section an exposition of CR for this research is provided.

7.3.1 Locating and understanding Critical Realism (CR)

The application of CR to entrepreneurship research is particularly relevant for this study. Neergaard and Parm Ulhoi (2007) propose that research, drawing on a CR perspective, is capable of delivering more informed explanations of entrepreneurial activity. It reflects repeated calls to move beyond conceptual integration and attempts to replicate it in concrete, empirical research. The principal case for CR is that it offers the social scientist a distinctive methodological approach, which rejects both the naive optimism of those expecting to uncover law-like regularities from empirical data and the defeatism of those who deny any possibility of generalising understanding of idiosyncratic phenomena such as entrepreneurship (Neergaard and Parm Ulhoi, 2007).

Entrepreneurship in the RE sector is on the increase and it has gained unprecedented importance on a worldwide scale as it is regarded as a substantial source of new employment, innovation and economic growth (Morales-Gualdron and Roig, 2005). Parrish (2008) reiterates that entrepreneurship has reinterpreted some of the long running themes in the field, such as opportunity identification, unique entrepreneurial characteristics, risk or uncertainty-bearing and the link between entrepreneurs and enterprise success. These themes were applied in this study which makes a case for an enabling environment for IPP activity in the RE sector. Section 7.3.2 outlines the application of CR to entrepreneurship research.

7.3.2 Applying CR to entrepreneurship research

In view of CR research, Neergaard and Parm Ulhoi (2007) centre their argument around five themes: first, that CR can help to revive a longstanding realist tradition in entrepreneurship research; second, that CR can promote the much-needed contextualisation of entrepreneurial phenomena in research studies; third, that CR can facilitate greater theoretical integration between disciplines and across multiple levels of analysis; fourth, that CR can enhance the explanatory potential of existing qualitative research techniques and fifth, that as a consequence, CR has the potential to contribute more useful knowledge, unlike rival paradigms (Neergaart and Parm Ulhoi, 2007). CR has deep intellectual roots in entrepreneurship research and its contributory disciplines (Neergaart and Parm Ulhoi, 2007). Critical realism allows researchers flexibility in the interpretation of the data and comfort in terms of validity not being constrained within the data. Researchers can accept that respondents might not consciously be aware of or be able to describe or appreciate social processes shaping leadership manifestation (Kempster and Parry, 2011).

7.3.3 Contextualising entrepreneurship

CR raises questions about precondition for social phenomena. It is therefore well placed to frame an investigation into contextual and process issues found in the electricity industry. In considering the context in which entrepreneurship occurs, important questions can be raised about boundaries both temporal and spatial (Neergaart and Parm Ulhoi, 2007). According to O'Gorman (2010), CR is a philosophical perspective which holds that reality is made up of a number of strata. The approach also holds open the possibility for countervailing mechanisms where a previous or expected operation of underlying mechanisms is obstructed by some opposing forces which, if removed, would yield the previous or expected result.

According to Brannick and Coghlan (2007), CR also holds that the researcher can use his own experience and pre-existing knowledge as an aid to develop an understanding of the phenomenon explored. The rigorous researcher must ensure that this experience does not dominate the empirical data and must effectively ensure that the issues of insider research are robustly addressed (Brannick and Coghlan, 2007). Qualitative methods can assist in addressing the substantive issues in entrepreneurship research. By questioning the reliance on quantitative methods, researchers call for methods which can incorporate experiences of working with and studying entrepreneurs (Gartner and Birley, 2002).

CR seems well-placed to deliver a more informed understanding of concrete situations of entrepreneurial activity in the RE sector of the electricity industry. In Section 7.4 the selection of a research approach for this study is justified.

7.4 RESEARCH APPROACH

The purpose of this chapter is to identify the research methodology most appropriate to address the research problem: *The electricity industry does not enable entrepreneurial activity.* This will be done by discussing the research design and methodology and by outlining the population and sampling techniques employed to gather data for this investigation.

Deductive reasoning moves towards hypothesis testing, after which the principle is confirmed, refuted or modified. Collis and Hussey (2003) posit that deduction involves the development of a theory that is subjected to a rigorous test. Through inductive reasoning, plans are made for data collection after which the data are analysed to see if any patterns emerge that suggest relationships between variables. Through induction, the researcher moves towards discovering a binding principle, taking care not to jump to hasty inferences or conclusions on the basis of the data. The research conducted in this study, required a combination of inductive and deductive reasoning due to the number of surveys conducted.

7.4.1 Research design

The study covers research at organisational, legislative and business entrepreneurial levels within the RE sector of the South African electricity industry. The research process is used to define the research strategy of this study in detail. The size and nature of this study required the author to utilise a number of research strategies and data-gathering techniques. As indicated in Section 7.3.1, the study follows the CR paradigm, where experience and pre-existing knowledge are used as an aid to develop an understanding of the phenomenon explored.

7.4.2 Quantitative and qualitative research method

This study utilises a combined quantitative and qualitative research method. Utilising a quantitative method means using measurements and numbers to help formulate and test ideas. This is a non-experimental method that is looking at what there is and trying to make sense of how different variables may affect each other (Wilson and Palmer, 2009). However, quantitative and qualitative researchers differ in their view of the world and they lean towards using different methods to seek knowledge (Gay and Airasian, 2003). The reason for quantitative research is that it is linked to control of a phenomenon while that of qualitative research is to understand a social situation from participant's perspectives (McMillan and Schumacher, 1993). Moreover, quantitative and qualitative methods should be viewed as balancing methods that when used jointly, give more options for studying an array of important topics (Gay and Airasian, 2003).

In a quantitative method, the researcher tests a theory by specifying a narrow hypothesis and collecting data to support or refute the hypothesis. The quantitative research method associated with this study can be classified as a descriptive study. In order to yield data for the quantitative method, surveys were conducted with Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Approved and Non-Approved IPPs. The number of participants that participated in this research study amounted to 225. The participants were closely associated to the electricity industry and provided in-depth knowledge and experience in the industry. In order to yield data for the qualitative method, personal interviews with Industry experts were further conducted.

According to Pietersen and Maree (2007), quantitative research is a route that is procedural and objective in its ways of utilising numerical data from a selected sample of a population to generalise the findings to the population that is being studied. In support of a post-modernist research paradigm, the researcher deemed it suitable to use a combination of qualitative and quantitative research methods to address the stated questions.

7.4.3 The research strategy

According to Auerbach and Silverstein (2003), hypothesis testing research investigates a phenomenon in terms of a relationship between an independent and dependent variable, both of which are measurable numerically. This relationship is called a hypothesis. The aim of the research is to test whether the hypothesised relationship for this study is true, by using statistical methods. The statistical hypothesis test is one of the basic elements of the toolbox of the empirical researcher in the social and behavioural sciences.

While hypothesis tests have been applied routinely by hosts of social and behavioural scientists, there have been continuing debates, sometimes vehement and polemic, about their use, among those inclined to support this philosophical or foundational discussion (Nickerson, 2000). According to Popper (2005), a research hypothesis is a deductive approach to a problem. It generates predictions about the problem, which can be tested. In the formal testing of predictions by using statistical methods, a statistical hypothesis is defined as analysis that provides a rigorous test of a prediction. Most science is ultimately quantitative and the hypothesis-led approach demands a quantitative approach both to developing the hypothesis, its predictions and testing the predictions.

In a hypothesis-led approach, descriptive statistics provide the tools to inspect data, from the simple calculation of averages and measures of variability through to the multivariate techniques used to make sense of very large and complex datasets. In addition, inferential statistics are designed to test for patterns in data (Popper, 2005). Estimation techniques are used to quantify variability, for instance, through the construction of confidence intervals. Statistical-hypothesis testing procedures are, as their name suggests, used to test particular types of hypotheses in relation to predictions (Popper, 2005). The researcher will utilise hypothesis testing as a research strategy in this study.

7.5 DATA COLLECTION METHODS – RESEARCH QUESTIONNAIRES

When developing quantitative and qualitative studies, it is important to identify the individuals from whom data will be collected (Edmonds and Kennedy, 2013). A data-collection instrument is a research instrument which is used to compute, examine or report data. In this study qualitative and quantitative data were collected concurrently (Creswell, 2009).

7.5.1 Quantitative and qualitative data

Both quantitative and qualitative data were obtained through the distribution of questionnaires and personal interviews. The quantitative data were obtained through the distribution of questionnaires to Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Approved and Non-Approved IPPs. Wilkinson and Birmingham (2003) posit that an effective questionnaire is one that enables the transmission of useful and accurate data from the participant to the researcher. This is a complex process which involves presenting questions in a clear and unambiguous way so that the participant may interpret them, articulate his or her response and transmit it effectively to the researcher. Qualitative data were obtained by means of personal interviews and open-ended or free response questions for Industry experts. Quantitative data were obtained by means of fixed response questions in the form of surveys. Table 7.2 depicts the approaches utilised in this study.

Table 7.2: Data collection approaches.

Group	Method	Approach	How Administered
Eskom Management questionnaire • Eskom Strategic Managers • Eskom Strategic Advisors • Eskom Managers	Questionnaire	Electronic survey	Participants to be informed when survey is ready.
NERSA Management questionnaire • NERSA Managers	Questionnaire	Electronic survey	Participants to be informed when survey is ready.
Approved and Non-Approved IPPs questionnaire • Approved and Non-Approved IPPs	Questionnaire	Electronic survey	Participants to be informed when survey is ready.
Industry experts-	Personal interviews	Face to face	Pre-arranged 30 minute session

personal interview • Industry experts			

The Eskom Management, NERSA Management and Approved and Non-Approved IPPs questionnaires were administered utilising an electronic survey approach, while the Industry expert's participation in the study was conducted using face-to-face personal interviews. The questionnaires for Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Non-Approved IPPs consisted of fixed response questions. The questionnaires were administered to the identified groups weekly for consistency and to ensure the availability of participants.

7.5.1.1 The compilation of research questionnaires and survey method

Table 7.2 below reflects the sample size for each level of participants. Questionnaires were used to gather information from Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Approved and Non-Approved IPPs. A personal interview was administered to the Industry experts.

Table 7.3: The questionnaires and interviews utilised (Total responses n=150).

Questionnaires	*Origin*	*Sample size (n=225)*	*Responses (n=150)*
Eskom Management questionnaire	Compiled by author	n=50	n=47
NERSA Management questionnaire	Compiled by author	n=50	n=36
Approved and Non-Approved IPPs questionnaire	Compiled by author	n=100	n=62
Industry experts (Personal interviews)	Compiled by author	n=25	n=5

The validity and reliability of research instruments in quantitative and qualitative research need to be established (Saunders, et al., 2009). Validity is the most important consideration in developing and evaluating measuring instruments. Historically, validity was defined as the extent to which an instrument measured what it claimed to measure. The focus of recent views of validity is not on the instrument itself but on the interpretation and meaning of the scores derived from the instrument (Ary, Jacobs and Sorensen, 2010). Validity and the qualitative method include focusing on the trustworthiness of the data and the rigour and quality of the data collection procedures (Edmonds and Kennedy, 2013).

According to Arthur, Waring, Coe and Hedges (2012), the specific threats to the validity of data analysis include unreliable data elements and incorrect analysis. This means invalid summary of data elements and incorrect data elements (including using invalid measurements, focusing data collection on the wrong participants or being deceived by informants).

The reliability of a measuring instrument is the degree of consistency with which it measures whatever it is measuring. Thus, reliability proves to be essential in any kind of measurement. On a theoretical level, reliability is concerned with the effect of error on the consistency of scores. In this world, measurement always involves some error (Ary et al., 2010). There are two kinds of errors: random errors of measurement and systematic errors of measurement. Random error is error that is a result of pure chance. Random errors of measurement may inflate or depress any subject's score in an unpredictable manner. Systematic errors, on the other hand, inflate or depress scores of identifiable groups in a predictable way. Systematic errors are the root of validity problems, random errors are the root of reliability problems (Ary, et al., 2010).

In order to test reliability, Gliem and Gliem (2003) theorise that Cronbach Alpha is a technique that requires only a single test administration to provide a unique estimate of the reliability of a given test. Cronbach Alpha is the average value of the reliability coefficients one would obtain for all possible combinations of items when split into two half-tests. Cronbach Alpha reliability coefficient normally ranges between 0 and 1. However, there is actually no lower limit to the coefficient. The closer Cronbach Alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale.

The Cronbach Alpha for this study was conducted to ensure validity and reliability of data. Pietersen and Maree (2007) further state that when the coefficient is used to measure the internal reliability of an instrument, it is called Cronbach Alpha coefficient and is based on the inter-item correlations. If the items are strongly correlated with each other, their internal consistency is high and the alpha coefficient will be close to one. If, on the other hand, the items are poorly formulated and do not correlate strongly, the alpha coefficient will be close to zero. The Cronbach Alpha measures how well a set of items or variables measures a single construct.

The validity of a research instrument indicates that, in fact, it measures what it intends to measure. Qualitative data validity can be addressed through the honesty, depth, richness and scope of the data acquired, including the extent of triangulation and objectiveness of the researcher. The validity of quantitative data can be improved by careful sampling, appropriate instrumentation and appropriate statistical analysis. Reliability in quantitative research focuses on dependability, consistency and reliability over time and in groups of respondents. An aspect of reliability that can be tested statistically is the internal consistency of scores derived from a research instrument. Cronbach Alpha coefficient is the statistic typically used to test the internal consistency of summated scores, with values of 0.6 to 0.7 deemed the lower limit of acceptability (Hair, et al., 2006).

7.5.1.2 Design of the questionnaires

The questionnaires used in this research paper were developed by using information obtained from the literature study. The questions were carefully selected to address each of the variables that could have an impact on an enabling entrepreneurial environment in the RE sector of South Africa. Questionnaires are tools for collecting information and this section outlines the reasons, formats, advantages and disadvantages of using them (Muijs, 2004). For the purposes of the study, questionnaires were distributed to 50 Eskom Management, 50 NERSA Management and 100 Approved and Non-Approved IPP participants. This formed part of the quantitative method of data collection. The qualitative data was collected from 25 Industry experts during the pilot study execution.

Welman, Kruger and Mitchell (2005) note that it is important for researchers to think carefully about what kind of questions are asked. Welman, et al. (2005) further mention that when designing a questionnaire, the concepts and variables involved and the relationships being investigated - possibly in the form of hypotheses, theories, models or evaluative frameworks - should be clear and should guide the questionnaire design process. Scott and Morrison (2006) suggest that the key issue is that questionnaires are designed to provide measurement. Above all, this requires questions that must be judged in terms of the question’s capacity to promote responses that are linked directly to what the researcher set out to measure and an equivalence in each question and its asking.

Muijs (2004) contends that it is imperative that researchers take note not only of the way in which questionnaires are designed, but also of how questions are worded as these aspects will affect the answers participants give. The researcher designed structured questionnaires which served as useful data-collection tools that were quick and easy to answer. The questionnaires were constructed for stakeholders which included Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Approved and Non-approved IPPs with the specific intent of making participants aware of the aim of the investigation within the South African RE sector. Questionnaires had clear and concise instructions on how participants should complete them. The questionnaires were designed in such a way that they held the participant's interest. The goal was to make the participants want to complete the questionnaire. This was done by providing the participants with a variety of items and by varying the questioning format.

Once the overall research question has been determined, the next task is to construct instruments that will provide the desired information. Two basic types of questions were used: closed-ended or fixed alternative (Quantitative) and open-ended or free response questions (Qualitative). A well-constructed questionnaire is an important factor influencing the response rate. All questionnaires comprised a 5-point Likert scale. When the questionnaires were administered, the researcher instructed participants to mark the most suitable answer. The scale ranged from 1 to 5 as follows:

1. Strongly disagree;
2. Disagree;
3. Neutral;
4. Agree; and
5. Strongly agree.

According to De Vos, Strydom, Fouché and Delport (2011), the Likert scale is probably the most widely used scale in survey research. The Likert scale is used in research in which people express attitudes or other responses in terms of ordinal-level categories that are ranked along a continuum. Likert scales normally ask respondents to indicate if they agree or disagree with a statement (De Vos, et al., 2011).

7.5.1.3 Suitability of the questionnaire as research instrument for this study

Questionnaires were appropriate as research instruments for this study as they helped elicit responses connected to specific attitudes, perspectives or perceptions. The participants were Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Approved and Non-Approved IPPs. Personal interviews with Industry experts followed the same trend of appropriateness as a research instrument. Their responses led to identifying the urgency to develop a model as a possible solution to assist current and aspiring IPPs in creating an enabling environment for entrepreneurial activity within the RE sector of the South African electricity industry.

The questionnaires consisted of two sections:

- Section A: This section collected biographical information of the all participants pertaining to aspects such as race, age, gender, province and department, position in organisation, years of experience and qualifications.

- Section B: This section covers the hypothesised IPP Model and reflects the sections and sub-sections outlined therein. This section explored Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers and Approved IPPs and Non-Approved IPPs perceptions on change within the electricity industry and the role of Eskom as agent of change in creating an enabling entrepreneurial environment.

7.5.1.4 Qualifying questions

For the purpose of the study, the sample unit of 225 was identified as an enabling entrepreneurial environment and is described as a single element or group of elements subject to selection in the sample. An enabling entrepreneurial environment refers to the optimal business elements needed for full participation in the RE sector. If this is facilitated within the RE sector of the electricity industry, the implication is clear: the IPP is not hampered from engaging in entrepreneurial opportunity both from a business and industry perspective.

In order to ensure that the participants meet the qualifying criteria to participate in this study, qualifying questions were constructed to confirm valid participation. Participants were asked to respond to questions probing the nature of entrepreneurial activity within the RE sector. Also, participants had to reflect on how entrepreneurs could promote and contribute to the establishment of an enabling entrepreneurial environment within the RE sector of the South African electricity industry.

7.5.1.5 Administration of questionnaire

All questions to the target group were posed in English. As mentioned, lists were compiled from the Eskom IPP licensee and vendor database for Approved and Non-approved IPPs. An organisational structure listing all Eskom Strategic Managers, Eskom Managers and all Eskom Strategic Advisors was made available by Eskom head office. The final email list of the 225 targeted participants contained details of all Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers, Approved IPPs and Non-Approved IPPs and Industry experts and was used to request participation in completing the questionnaire. The geographical location of the participants was requested in the survey to compare different provinces in South Africa where they operate from. In addition, the author compiled an email list of Industry experts who are currently actively participating in business activities in the RE sector. A pilot survey was published for each questionnaire and the questionnaires were administered. In the next section the individual questionnaires are discussed. The pilot studies were completed by 5 respondents and minor changes were made to the questionnaires.

7.5.1.5.1 Eskom Management – questionnaire (Appendix D)

As in any industry, entrepreneurship in the electricity industry stems from the actions of individuals and organisations seeking new business opportunities. National investments into education and research transfer into growing businesses only when there are sufficient incentives to gather complementary assets for business development (Hokkanen, 2009).

The pressure on power utilities to lower carbon emissions of conventional electricity production and produce cleaner electricity in the form of RE creates an opportunity for entrepreneurs to exploit (Pickering, 2010). For the electricity industry, the IPP plays a key role as entrepreneur of this industry. These entrepreneurs are able to spot latent opportunities, commercialise them and direct the growth of a new industry, while being well-positioned to capture very large economic gains for their firms and for society (Valliere and Hrelja, 2011).

In order to address the electricity and environmental challenges, Pickering (2010) advances that although both Government and Eskom continue to make positive statements about the need for IPPs to enter the sector, through both RE power projects, progress has been painfully slow. Without clear signals as to the nature of the future power market, private developers are understandably reluctant to invest significant resources in the expensive business of project development. This drastically limits the access of IPPs to the RE sector. The electricity crisis in South Africa accentuated the need for electricity generation alternatives. RE expansion and integration into the electricity industry through improved IPP activity is considered a potential solution to the challenges experienced in the South African electricity industry. Currently, the slow and cumbersome administration policy guiding IPP activity in the RE sector has an adverse effect on entrepreneurial activity in the electricity industry.

The Eskom Management questionnaire was administered to Eskom Strategic Managers, Eskom Strategic Advisors and Eskom Managers. This was conducted in Eskom Operating Units in South Africa, as the potential for entrepreneurial activity in these areas is on the increase. The questions were standardised for both operating units in order to obtain a unified view of problems in both areas.

7.5.1.5.2 NERSA Management – questionnaire (Appendix E)

There are legislative, technological and market drivers that make new environmental initiatives possible, by providing opportunities and at the same time, the desire to improve the world (whether that desire is held by inventors or environmentalists) offering motivation and thus opportunities for entrepreneurs (Thompson and Scott, 2010). The National Energy Regulator of South Africa (NERSA) and the Government act as the decision contributors within the RE sector. Eskom power utility is given the opportunity to influence decision making within the electricity industry at large however, NERSA ensures that the industry is well regulated by ensuring policies are implemented within the industry (NERSA, 2012).

The public and IPPs are being given the opportunity to be heard prior to decision making. The role of each stakeholder proves to be an important component for key decision making and the influence they have needs to be valued. The NERSA Management questionnaire was constructed and administered to participants at their head office as there are no site offices in the provinces. The questionnaire was electronically distributed to all 50 NERSA Managers. The NERSA Management questionnaire intended to obtain the following information:

1. Legislative background information – policies and rules instituted over the years in the industry;
2. Background information – city, country, employment level;
3. RE environment and feasibility of electricity sources; and
4. Administrative support given to entrepreneurs.

7.5.1.5.3 Approved and Non-Approved IPPs – questionnaire (Appendix F)

The combined opportunity for private power generation from IPPs, the recognition of the possible cost competitiveness and environmental and economic benefits of RE and energy efficiency suggest the viability of a new form of energy supply enterprise, the IPP (Woodhouse, 2005a). The IPP concept is an extension of the market-driven bidding processes that have provided alternatives to traditional ways of meeting the demand for energy services. IPPs therefore focus on private generation in state-dominated power markets. The Approved and Non-Approved IPPs questionnaire was compiled using the framework for Approved IPPs currently registered with power utility Eskom in South Africa.

Studies have shown that because climate change has become an important cross-border environmental issue, IPPs are under gradually increasing pressure on regulators and the public to demonstrate their commitment to limiting further greenhouse gas emissions (Nathwani, Lindb and Chen, 2012). In addition, studies show that the contribution RE can make to alleviate the current electricity demand is worth investigating. The Approved and Non- Approved IPPs questionnaire was intended to obtain the following information:

1. Personal background information – years in industry;

2. Background information – city, country, number of employees employed;
3. Legislative requirements – current and future;
4. Administrative support; and
5. Perceptions of the IPP process of electricity generation.

Woodhouse (2005a) states that the need for new power capacity along with a halting reform of the power sector has produced three types of enterprise that are often referred to as IPPs. These include state IPPs, classic IPPs and captive generation enterprises found within the electricity industry. The present pattern of economic growth has led to severe degradation of environmental quality and a rapid depletion of natural resources. Hence, there is a need for urgent solutions to sustain the electricity industry (Ojha, 2009). An IPP is a power generating company setup under the principles of social market economy to meet the electricity demand and at the same time diversify the current electricity mix (Ojha, 2009). IPPs are typically considered non-public, power-generating utilities.

Private sector participation in the electricity industry (in the form of IPPs) can contribute to expanded access, provided there is concession within the industry (Clark, et al., 2005). RE is particularly challenging for grid operators, since it is generally not a dispatchable form of generation and it tends to be located in areas of the country which are not presently well served by the grid (Pickering, 2010). The challenge still exists for emerging economies where new RE sites are located far from the existing grid and this demand substantial investment in transmission lines to deliver their power to consumers (De Oliveira, et al., 2005).

7.5.2 Pilot study

Yin (2009) suggests that the purpose of a pilot study is to help the researcher to refine data collection plans in terms of the content of the data-collection model, procedures for analysing data and methods for presenting findings. The pilot study thus assisted in improving understanding of the questionnaires within the context of the RE sector of the electricity industry of South Africa. Results from the pilot study resulted in changes to some of the questions that were seen to be confusing and over elaborate. In addition, some wording was simplified to enhance understanding. The author conducted a pilot study in the Eastern Cape and Free State region in order to validate the questionnaire.

Eskom Managers (n = 3) and NMMU academics (n = 2) participated in the pilot study. The research problems identified have culminated in the development of a proposed Industry IPP business model towards an enabling RE environment in the electricity industry, forming the basis of the entire study. As depicted in Table 7.4, a pilot survey was completed to test each questionnaire amongst a sample of all directly targeted respondents on each questionnaire.

Table 7.4: The pilot study utilised (Total responses N=5).

Pilot study	*Origin*	*Sample size (n=15)*	*Responses (n=5)*
Eskom Management	Compiled by author	n=5	n=3
NERSA Management	Compiled by author	n=5	-
Approved and Non-Approved IPPs	Compiled by author	n=5	n=2

The results were subjected to a preliminary reliability assessment. On receipt, the responses of the pilot study were reviewed and revised where necessary and any changes to the final questionnaire amended accordingly. The final items were coded sequentially and then randomly positioned in the questionnaire.

7.5.3 The population

The population composition included those stakeholders that align themselves with the electricity-industry policy and can influence entrepreneurial activity within the RE sector specifically. The composition of the targeted population proposed for this study included a sample of active stakeholders from the following categories within the RE sector of the electricity industry:

1. Eskom Strategic Managers;
2. Eskom Strategic Advisors;
3. Eskom Managers;
4. NERSA Managers;
5. Approved and Non-Approved IPPs; and
6. Industry experts.

These stakeholders may provide insight into Eskom's strategic objectives and how the power utility is shaped to achieve its strategic imperatives and on its path, create an enabling entrepreneurial environment. In addition, Industry experts were directly targeted to complete the personal interviews. The Industry experts bring necessary subject knowledge and had previous interactions with IPPs in the electricity industry. In terms of IPPs, some are registered generation plants while other IPPs (Non-Approved) are in the process of being approved with the power utility Eskom. For the RE sector both Approved and Non-Approved IPPs prove to be vital in the electricity industry. Thus, including both in the survey proves to be imperative to the study.

7.5.4 The sample size

Sample size provides the basis for the estimation of sample error and impacts on the ability of the model to be correctly estimated (Hair, et al., 2006). As with any statistical method, the critical question is how large a sample size is needed. Strydom, (2005) proposes that sampling means taking any proportion of a population or universe as representative of that population or universe. This definition implies that the sample is considered representative.

In order to achieve the aims of this study, a representative sample will be purposively selected. Purposive sampling will be used as the author intends to identify key stakeholders in the electricity industry for an in-depth investigation. The sample selected for this study comprised 225 participants within an existing business environment and operational in the RE sector of the South African electricity industry. Invitations to participate were directed at Eskom Strategic Managers, Eskom Strategic Advisors and Eskom Managers by means of email facility with a direct link to an electronic survey. The same method was utilised for NERSA Management and Approved and Non-Approved IPPs. In order to glean data from Industry experts, face-to-face interviews were conducted.

A database of email addresses was compiled and requests to complete a survey were sent to all the target participants, except Industry experts with whom a personal interview was conducted. The target sample is categorised in Table 7.5.

Table 7.5: Target Sample.

Source	Population Quantity	Geographical area
Eskom Strategic Managers, Eskom Strategic Advisors and Eskom Managers	50	National
Approved and Non-Approved IPPs	100	National
NERSA Managers	50	Head office
Industry experts	25	Eastern Cape and Free State
Total	225	

Hair, et al. (2006) suggest that although there is no correct sample size, recommendations are for a size ranging from 50 to 200, with 200 being the proposed critical sample size. Table 7.2 (Section 7.5.1.1) depicts the sample size and population source for this research study.

Described as a subgroup of the population, sampling refers to the activities involved in selecting a subset of persons or things from a larger population, also known as a sampling frame. Methods used to select the sample will determine the nature and validity of the findings that are generated from the study of that sample (Scott and Morrison, 2006; Hoy, 2010). Strydom (2005) reiterates this, stating that sampling means taking any proportion of a population or universe as representative of that population or universe. This definition implies that the sample is considered representative. A population is the totality of persons, events, organisation units, case recordings or other sampling units with which the research problem is concerned (Strydom, 2005).

7.5.4.1 Purposive sampling

This method of sampling is used in special situations where the sampling is done with a specific purpose in mind (Maree, 2010). Rule and John (2011) state that it is often impossible for a researcher to consult everyone involved in a case. The researcher therefore, has to choose people who can shed the most light or different light on a case. This is known as purposive sampling where the people selected as research participants are deliberately chosen because of their suitability in advancing the purpose of the research (Rule and John, 2011).

In order to achieve the aims of this study, a representative sample was purposively selected. Purposive sampling was therefore used as the researcher intended to identify Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers, NERSA Managers, Approved and Non-Approved IPPs and Industry experts for an in-depth investigation. Christensen (2001) believes this technique to be valid as it provides a sample that is representative of the population. The selected participants of the study are all associated with or involved in the RE sector of the electricity industry in South Africa. Thus, their relevance and credibility as participants of the industry can be seen as reliable. In this study, the researcher employs non-probability sampling, namely purposive sampling. The researcher selected individuals to participate based on a specific need or purpose (i.e. based on the research objective, design and target population).

7.6 ANALYSIS OF DATA

The data collection, processing and analysis followed the survey research. The NMMU survey instrument was used to collect data and the STATISTICA Software package was used to analyse the results. The quantitative data for this study were analysed by using the statistical package SPSS. A professional statistician of the Nelson Mandela Metropolitan University was approached for support concerning the analysis and interpretation of data collected from questionnaires.

The qualitative data were analysed by utilising item analysis in which the items for the hypothesised model, which emerged from the personal interviews, were listed and analysed accordingly. The questionnaires were validated and checked for reliability by means of statistical analysis. The questionnaires being utilised were distributed both manually and electronically. Multivariate statistics were used to analyse the data. The statistical analysis and interpretation of results were conducted with the assistance of the NMMU statistical research consultant. The validity and reliability of the measuring instrument proposed was assessed before proceeding to evaluate the strength of relationships in an empirical model. The description of the statistical techniques used to test the validity and reliability in this study is discussed next.

Qualitative data analysis is generally based on an interpretative research philosophy where responses were collected by means of open-ended questions. The data were categorised, coded and sorted after which the data were analysed and interpreted. Patterns and relationships were identified in the data in order to reach conclusions. The data were then usually presented in a narrative summary. The statistical analyses conducted in this study include, frequency distribution, Cohen's d practical significance test, paired difference test (t test), Pearson's correlation coefficient, Cronbach Alpha and Inferential statistics for hypothesis testing. In the next section the operationalisation of variables will be discussed.

7.7 OPERATIONALISATION OF VARIABLES

The research-measuring instrument was defined earlier in this chapter. Questions were formulated in such a way as to ensure that every variable in the measuring instrument was measured at least five items. In order to remove ambiguity in written work and research, all relevant variables for this study must be accurately and clearly defined. This process is known as operationalising variables. The twenty hypotheses, including sub-hypotheses, listed in Table 7.6, are statistically analysed using Pearson Chi-square analysis, t-tests and the results are presented in Chapter 8.

Table 7.6: Hypotheses – Enabling Entrepreneurial Environment.

Hypotheses – Enabling Entrepreneurial Environment (EEE)		
H1	International Grid models have a positive relationship with EEE.	Independent Variable
H2	National Grid models have a positive relationship with EEE.	Independent Variable
H3	Mini grid models have a positive relationship with EEE.	Independent Variable
H16	*Smart Grid*	*Intervening Variable*
H4	Access to finance has a positive relationship with EEE.	Independent Variable
H5	Research and Development (R&D) transfer has a positive relationship with EEE.	Independent Variable
H6	Government facilitation has a positive relationship with EEE.	Independent Variable
H7	Business incubation has a positive relationship with EEE.	Independent Variable
H8	Barriers to entry have a positive relationship with EEE.	Independent Variable
H17	*Entrepreneurial components*	*Intervening Variable*
H9	Wind as a RE source has a positive relationship with EEE.	Independent Variable
H10	Solar as a RE source has a positive relationship with EEE.	Independent Variable
H11	Hydro as a RE source has a positive relationship with EEE.	Independent Variable
H18	*RE environment*	*Intervening Variable*

H12	Best practice policy has a positive relationship with EEE.	Independent Variable
H19	*SA Policy*	*Intervening Variable*
H13	Stakeholders have a positive relationship with EEE.	Independent Variable
H14	Stakeholder Management has a positive relationship with EEE.	Independent Variable
H15	Stakeholder Power has a positive relationship with EEE.	Independent Variable
H20	*Stakeholder Theory*	*Intervening Variable*
Dependent variable: an Enabling Entrepreneurial Environment for the RE sector within the South African electricity industry.		

Based on these hypotheses, a hypothesised model is presented in Figure 6.2. Various methods used to investigate the relationships presented in this model are discussed in the following sections.

In order to develop the items measuring the various dimensions of an enabling entrepreneurial environment, the following were used: the intervening variables SA Smart Grid, Entrepreneurial barriers, RE Environment, SA Policy, Stakeholder Theory and the dependent variable an enabling entrepreneurial environment and several existing items that have been proven valid and reliable in previous studies were also used. Where necessary, the items were rephrased to make them suitable to the present study. The various variables, their operational definitions as well as the sources of the items measuring each variable are discussed in the sub-sections below. Operationalisation describes the conversion of an idea into a measurable factor (Csiernik, Birnbaum and Pierce, 2010). Whether the factor to be described is highly abstract or physical, the definition must identify the features of the variable and how these features are to be perceived (Cooper and Schindler, 2001).

In order to identify the items measuring the dependent variable, an enabling entrepreneurial environment, numerous previous studies were consulted. Five items were finally determined based on this study. Where necessary, the items were rephrased to make them more appropriate for the present study. Table 7.7 below presents these items, their sources and operationalisation.

Table 7.7: Operationalisation of the dependent variable.

Dependent Variable: An Enabling Entrepreneurial Environment	Sources of items
1. I am satisfied with the entrepreneurial environment created for business.	Juha-Pekka and Hokkanen, 2009
2. No barriers exist that hamper entrepreneurial activity.	Juha-Pekka and Hokkanen, 2009
3. Smart Grids accommodate alternative electricity provision sources in the electricity industry.	Petri, 2008
4. In this industry the grid model finds it easy to accommodate alternative electricity generation.	Garcia, 2013
5. Best-practice policy has a positive relationship with EEE.	Harrison and Wicks, 2013
Operationalisation: In this study, an ***Enabling Entrepreneurial Environment*** describes the extent to which an industry can create a conducive environment that promotes entrepreneurial activity clear of any barriers. It also refers to entrepreneurs (IPPs in the electricity industry) being satisfied with the way in which stakeholders work together in the business.	

Six items (Table 7.8) were determined to assess the intervening variable SA Smart Grid. Four items were sourced from the Smart Grid Information Report (2011) and the remaining two items were sourced from the study of Petri (2008). All the items were rephrased to make them more suitable for this study.

Table 7.8: Operationalisation of the intervening variable.

Intervening Variable: SA Smart Grid	Sources of items
1. Smart Grids enable entrepreneurship.	Smart Grid Information Report, 2011
2. In this industry, mini grids form part of Smart Grids.	Smart Grid Information Report, 2011
3. Smart Grids accommodate alternative electricity provision sources in the electricity industry.	Petri, 2008
4. Mini grids enable good Smart Grid operations.	Petri, 2008
5. Smart Grids are future Grid models.	Smart Grid Information Report, 2011
6. The Smart Grid model IPPs embraces IPP activity.	Smart Grid Information Report, 2011
In this study ***Smart Grid*** refer to an automated, widely distributed electricity delivery network characterised by a two-way flow of electricity and information, capable of monitoring and responding to changes in everything from power plants to customer preferences to individual appliances.	

Five items (Table 7.9) were finally determined to assess the independent variable Off-Grid models. Three items were sourced from the study of Saghir (2008), one item was sourced from the study of Reiche, Covarrubias and Martinot (2000) and the remaining items were sourced from this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.9: Operationalisation of the independent variable.

Independent Variable: Off-Grid model	**Sources of items**
1. In this industry, Off-Grid models form an integral part of Smart Grids.	Saghir, 2008
2. Off-Grid models can operate independently of the Smart Grids.	Saghir, 2008
3. In this industry Smart Grid model finds it challenging to accommodate new generation in the form of Off-Grid models.	Martinot, 2002
4. Alternative electricity provision sources can be accommodated in the electricity industry in the form of Off-Grid models.	Reiche, Covarrubias and Martinot, 2000
5. Off-Grid electrification projects have benefit-cost ratios that may exceed those of grid extension.	Saghir, 2008
In this study ***Off -Grid*** refers to not being connected to a grid, mainly used in terms of not being connected to the main or national transmission grid in electricity. In terms of electricity, Off-Grid may imply stand-alone systems or Mini-Grids typically to provide a smaller community with electricity.	

Six items (Table 7.10) were determined to assess the independent variable Barriers to entry. Three items were sourced from the study of Woo (2005), one item was sourced from the study of Clemensson and Christensen (2010) and the remaining items were sourced from the study of Juha-Pekka and Hokkanen (2009). All the items were rephrased to make them more suitable for this study. Some items were slightly modified to be more appropriate for this study.

Table 7.10: Operationalisation of the independent variable.

Independent Variable: Barriers to entry	Sources of items
1. Entrepreneurship is critical to the development and well-being of society	Clemensson and Christensen, 2010
2. Feasible entrepreneurship exists in the electricity industry.	Juha-Pekka and Hokkanen, 2009
3. IPPs are seen as the vehicle for entrepreneurship in the RE sector.	Woo, 2005
4. In this industry, no entrepreneurial barriers exist.	Woo, 2005
5. The eradication of entrepreneurial barriers is imperative to create an enabling environment.	Woo, 2005
6. IPPs effectively deal with barriers in the industry.	Juha-Pekka and Hokkanen, 2009
In this study ***Barriers to entry*** refers to the extent to which any entrepreneur/IPP's freedom to conduct business in the industry is hampered or impeded.	

Six items (Table 7.11) were determined to assess the independent variable Access to finance. Three items were sourced from the study of Fogel, Hawk, Morck and Yeung (2006), one item was sourced from the study of Mason (2008) and the remaining items were sourced from the study. All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.11: Operationalisation of the independent variable.

Independent Variable: Access to finance	Sources of items
1. Early-stage finance is often perceived as one of the biggest barriers for young and start-up entrepreneurs	Mason, 2008
2. In this industry, obtaining access to finance for start-up proves not to be difficult.	Barbut, 2009
3. RE start-up businesses enjoy good financial support.	Barbut, 2009
4. Access to finance proves to be an enabler for entrepreneurial activity.	Fogel, Hawk, Morck and Yeung, 2006
5. Entrepreneurs effectively deal with financial barriers in the industry.	Fogel, Hawk, Morck and Yeung, 2006
6. To improve the entrepreneurial process, access to financial assistance needs to be prioritised.	Fogel, Hawk, Morck and Yeung, 2006
In this study **Access to finance** refers to the extent to which any entrepreneur/IPP is able to obtain funding and financial assistance to start a business in the industry.	

Four items (Table 7.12) were determined to assess the independent variable, R & D transfer. Two items were selected from the study of Haw and Hughes (2007) and the two other items were from the study of Dean and McMullen (2007). All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.12: Operationalisation of the independent variable.

Independent Variable: R & D transfer	Sources of items
1. In this industry, research and development is high priority.	Haw and Hughes, 2007
2. Investment in research and development with specific focus on RE is on the increase.	Haw and Hughes, 2007
3. IPPs enjoy good support and focus on policies and regulation for RE.	Dean and McMullen, 2007
4. A fair and transparent enforcement of competition, health, safety and environment regulations is encouraged through research and development.	Dean and McMullen, 2007
In this study, **R & D transfer** refers to the extent to which interplay between market and institutional developments exists. Research and development should thus provide fair and transparent enforcement of competition, health, safety and environment regulations	

Five items (Table 7.13) were determined to assess the independent variable Government facilitation. Three items were selected from the study of Goswami, et al. (2008) and the two other items were from GEM (2011b). All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.13: Operationalisation of the independent variable.

Independent Variable: Government facilitation	Sources of items
1. IPPs are satisfied with the extent to which government facilitates start-up processes for entrepreneurs.	Goswami, et al., 2008
2. Government facilitation ensures monitoring the impact of new IPP agreement.	Goswami, et al., 2008
3. Current government facilitation encourages RE participation.	Goswami, et al., 2008
4. IPPs believe that the government has some very significant policies to assist them as industry entrepreneurs.	GEM, 2011a
5. IPPs believe government facilitation is positively contributing to creating a supportive environment for entrepreneurial activity.	GEM, 2011a
In this study, **Government facilitation** refers to the extent to which government facilitation ensures monitoring the impact of new IPP agreement and focus on conventional and RE. Furthermore, it warrants good facilitation of government policy.	

Five items (Table 7.14) were identified to assess to assess the independent variable Business Incubation. Two items were selected from the study of Goswami, et al. (2008), two items from the study of Naudé, et al. (2011) and another item from GEM (2011). All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.14: Operationalisation of the independent variable.

Independent variable: Business incubation	Sources of items
1. Start-up entrepreneurs enjoy the support of business incubation.	Goswami, et al., 2008
2. Business incubation further develops the entrepreneur to face challenges in the industry.	Goswami, et al., 2008
3. IPPs find that the process of business incubation is a critical organisational support mechanism for fledgling entrepreneurs in the initial stage.	Naudé, et al., 2011
4. IPPs agree that to maximise the chances of success in the industry business incubation is essential.	Naudé, et al., 2011
5. The process of starting a business has been made easier with the implementation of business incubation.	GEM, 2011
In this study, **Business incubation** refers to the extent to which organisational support mechanism for fledgling entrepreneurs in the initial stage RE is available. Furthermore, it simply assists business in making the start-up easier and more controlled.	

Five items (Table 7.15) were identified to assess the intervening variable RE environment. Three items were selected from the study of Outhred (2007a) and the other items were from studies of Banks and Schäffler (2006), Schwan (2011) and Larsen and Russo, 2010 respectively. All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.15: Operationalisation of the intervening variable.

Intervening variable: RE environment	Sources of items
1. Growing concerns about electricity security.	Outhred, 2007a
2. Climate change has heightened interest in harnessing RE sources.	Outhred, 2007a
3. Integration of RE generation power utilities is welcomed.	Outhred, 2007a
4. A sustainable energy mix for power utilities is encouraged in the RE sector.	Banks and Schäffler, 2006
5. Lower carbon emission is experienced though RE production.	Schwan, 2011
6. It is feasible to have a mix of solar, hydro and wind alternatives feeding the national grid.	Larsen and Russo, 2010
Intervening variable: RE environment	
In this study **RE environment** refer to the sources of electricity production available to the national grid. These sources include solar, wind and water. The successful integration of RE generation into power utilities is thus essential.	

Five items (Table 7.16) were identified to assess the independent variable Solar as a RE source. Items were selected from the studies of Apt, et al. (2008), Timilsina, Kurdgelashvili and Narbel (2011a), Gandhi and Middendorf (2009), Komor (2009) and Horacek (2011) respectively. All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.16: Operationalisation of the independent variable.

Independent variable: Solar as a RE source	Sources of items
1. IPPs claim that the most popular RE source with the public is solar power.	Apt, Lave and Pattanariyankool, 2008
2. IPPs are confident large-scale PV systems can feed into electricity grids.	Timilsina, Kurdgelashvili and Narbel, 2011
3. Solar generates more electricity needed during times of peak electricity usage.	Gandhi and Middendorf , 2009
4. IPPs are confident that the potential of solar resources in the electricity industry is significantly huge.	Komor, 2009
5. PV systems are declining in cost, improving in efficiency and increasing rapidly in sales.	Horacek, 2011

Table 7.16: (Continued).

In this study **Solar as a RE source** refer to an alternative source of electricity production available to the national grid. It is claimed to be the most popular RE source with the public is solar power and this is either photovoltaic or solar thermal power.

Five items (Table 7.17) were identified to assess the independent variable Wind as a RE source. Three items were selected from the study of Herzog,et al. (2010) and the others from studies of Dorji (2007) and Katontoka (2012) respectively. All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.17: Operationalisation of the independent variable.

Independent variable: Wind as a RE source	Sources of items
1. IPPs claim that the wind makes a valuable contribution to the national grid.	Herzog, Lipman and Kammen, 2010
2. IPPs are confident that sufficiently powerful winds exist to sustain a network.	Herzog, Lipman and Kammen, 2010
3. Enough transmission is built to transmit the peak power capacity of an intermittent power source such as wind.	Herzog, Lipman and Kammen, 2010
4. Sufficient public and private sector participation in the form of IPPs, to achieve equitable distribution of wind-generated electricity.	Dorji, 2007
5. Wind is a promising alternative that has evolved to maturation of small-scale Off-Grid and Mini-Grid systems.	Katontoka, 2012
In this study **Wind as a RE source** refers to an alternative source of electricity production available to the national grid. It is claimed to make significant contribution to the national grid as a sustainable source for power generation.	

Five items (Table 7.18) were identified to assess the independent variable Hydro as a RE source. Three items were selected from the studies of Davidson and Winkler (2003), Ojha (2009), Rogers (2004), Dorji (2007) and Yermoli and Krishnan (2010) respectively. All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.18: Operationalisation of the independent variable.

Independent variable: Hydro as a RE source	Sources of items
1. RE sources such as hydro is another major option for increasing electricity diversity.	Davidson and Winkler, 2003
2. In the promotion of energy diversity, hydro is securing an optimal energy mix.	Ojha, 2009
3. It is believed that with Hydro as energy source intermittency poses no challenge.	Rogers, 2004
4. Hydro generation can make a difference of several thousand megawatts on the electricity grid.	Dorji, 2007
5. Hydro generation in the form of pumped storage is an asset to the network.	Yermoli and Krishnan, 2010
In this study **Hydro as a RE source** refers to an alternative source of electricity production available to the national grid. It is claimed to make significant contribution to the national grid as a sustainable source for power generation.	

Seven items (Table 7.19) were identified to assess the intervening variable SA policy. Items were selected from the studies of REN 21 (2013), IRENA (2012), Tyler (2009), IEA (2005b) and Garcia (2013) respectively. All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.19: Operationalisation of the intervening variable.

Intervening variable: SA policy	Sources of items
1. Policy is one of the main drivers in RE scenarios in the electricity industry.	IEA, 2005
2. It is believed that new policies for RE match existing policies for electricity.	REN 21, 2013
3. Stakeholders are confident that existing policy stays abreast with changes within the industry.	REN 21, 2013
4. Enabling structures exist for good policy-making.	IRENA, 2012
5. Existing electricity policy is aligned with climate mitigation.	Tyler, 2009
6. SA policy compensates for any barriers by making RE technologies competitive.	Garcia, 2013
7. SA Policy ensures resources for IPPs to start business are available and accessible in the industry.	IRENA, 2012
In this study **SA Policy** refers to the ability to enable essential facilities to establish rules that will give fair access to new entrants in the electricity industry. It is instrumental to achieving good governance, thus having a number of components, ranging from the broad policy paradigm which guides the approach to policy development in a particular area, to statements and intentions, written documents and institutional orientation and capacity.	

Five items (Table 7.20) were identified to assess the independent variable. Best practice policy. Four Items were selected from the studies of REN 21 (2013) and one item from Eberhard (2007). All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.20: Operationalisation of the independent variable.

Independent variable: Best practice policy	Sources of items
1. Best practice regulatory policies ensure that RE is treated as significance in the market.	REN 21, 2013
2. Best-practice policy ensures the importance of achieving low carbon green growth is upheld.	REN 21, 2013
3. It is believed that Best practice policy promotes an increased share of power generation from RE.	REN 21, 2013
4. Best-practice policy encourages the development of a sustainable RE industry with IPPs.	REN 21, 2013
5. IPPs are confident that policy assists them in an enabling entrepreneurial environment.	Eberhard, 2007
In this study **Best-practice policy** refers to policy being practised to the sustainability of the electricity industry specifically the RE sector. Divergence from best practice in terms of policy necessitates capacity and resources, key areas that are facing serious challenges.	

Four items (Table 7.21) were finally identified to assess the intervening variable Stakeholder Theory. Four Items were selected from the studies of Andriof and Waddock (2002), Friedman (1970), Harrison and Wicks (2013) and Damak-Ayadi (2004) respectively. All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.21: Operationalisation of the intervening variable.

Intervening variable: Stakeholder Theory	Sources of items
1. Stakeholder theory concentrates on improved stakeholder relationships in the industry.	Andriof and Waddock, 2002
2. Stakeholder theory affirms what the business needs in industry are.	Friedman, 1970
3. It is believed that stakeholder theory has infiltrated the academic dialogue in management and public policy.	Harrison and Wicks, 2013
4. Stakeholder theory has helped to found a relational model of the organisation.	Damak-Ayadi, 2004
In this study **Stakeholder Theory** is referred to as traditional theories of the organisation where the primary function of the corporation is to maximise the return on investments to the owners of the business, that is, the shareholders.	

Five items (Table 7.22) were identified to assess the independent variable Stakeholders. Five Items were selected from the studies of Andriof and Waddock (2002), Friedman (1970), Harrison and Wicks (2013) and Damak-Ayadi (2004) respectively. All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.22: Operationalisation of the independent variable.

Independent variable: Stakeholders	Sources of items
1. Relationships that companies have with stakeholders in the electricity industry are healthy.	Andriof and Waddock, 2002
2. Interest of shareholders and stakeholders are compatible.	Andriof and Waddock, 2002
3. An enabling entrepreneurial environment creates confident stakeholders that stay abreast with changes within the industry.	Andriof and Waddock, 2002
4. Stakeholders contribute to corporate long-term efficiency and short-term maximisation of an enabling entrepreneurial environment.	Andriof and Waddock, 2002
5. It is believed that the electricity industry serves the interests of its various stakeholders	Andriof and Waddock, 2002
In this study **Stakeholders** are considered to be consumers, stakeholders, government, competitors, communities, employees and of course, stockholders, although the stakeholder map of any given corporation with respect to a given issue can become quite complicated. Typical stakeholders in the RE sector are: Eskom, Government, IPPs, Public and NERSA.	

Five items (Table 7.23) were identified to assess the independent variable Stakeholder management. Five Items were selected from the studies of Buchholz and Rosenthal (2005), Newcombe (2003), and Boatright (2006) respectively. All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.23: Operationalisation of the independent variable.

Independent variable: Stakeholder management	Sources of items
1. The interests of the various stakeholders are taken into account in arriving at a management decision within the RE sector.	Buchholz and Rosenthal, 2005
2. It is believed that identification of key stakeholders is done through stakeholder management.	Newcombe, 2003
3. Through stakeholder management, stakeholder interest is found to be central to the operation of a corporation.	Boatright, 2006
4. It serves as a managerial guide that can be followed within the electricity industry.	Boatright, 2006
5. Stakeholder management holds central to RE sector of the electricity industry.	Boatright, 2006
In this study **Stakeholder management** refers to the ability of taking the interests and concerns of these various groups and individuals into account in arriving at a management decision, so that they are all satisfied at least to some extent, or at least that the most important stakeholders with regard to any given issue, are satisfied.	

Five items (Table 7.24) were identified to assess the independent variable Stakeholder power. Five Items were selected from the studies of Jeffery (2009), Newcombe (2003), Donaldson and Preston (1995) respectively. All the items were rephrased to make them more suitable for this study. The wording of these items was modified to make them more appropriate to the current study.

Table 7.24: Operationalisation of the independent variable.

Independent variable: Stakeholder power	Sources of items
1. A strong power for stakeholder groups to keep control in the electricity industry exists.	Jeffery, 2009
2. The power of the stakeholder to influence the organisation exists.	Newcombe, 2003
3. It is believed that stakeholders have power to influence the RE sector.	Newcombe, 2003
4. Government, Eskom and NERSA exert power within the RE sector thus giving them strong influence.	Donaldson and Preston, 1995
5. Stakeholder power is not misused in the industry.	Newcombe, 2003
In this study **Stakeholder management** refers to the ability of stakeholders to impose their will on the organisation, especially through the control of resources, while legitimacy implies that a stakeholder group reflects the prevailing opinions and beliefs of society.	

Based on the operationalisation, the variables lead to the establishment of the three questionnaires:

- Eskom Management questionnaire (Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers);
- NERSA Management questionnaire (NERSA Managers); and
- Approved and Non-Approved IPPs questionnaire (Approved and Non-Approved IPPs).

Table 7.25 depicts the sections, relevant literature chapters and corresponding operationalisation table.

Table 7.25: Questionnaire and Operationalisation alignment.

Eskom Management questionnaire (Appendix D)		
Questionnaire Section	**Literature**	**Operationalisation table**
B	Chapter 1	7.6
C	Chapter 2	7.7; 7.8
D	Chapter 3	7.9; 7.10; 7.11; 7.12; 7.13
E	Chapter 4	7.14; 7.15; 7.16; 7.17
F	Chapter 5	7.18; 7.19
G	Chapter 6	7.20; 7.21; 7.22; 7.23
NERSA Management questionnaire (Appendix E)		
Section	**Literature**	**Operationalisation table**
B	Chapter 2	7.7; 7.8
C	Chapter 4	7.14; 7.15; 7.16; 7.17
D	Chapter 5	7.18; 7.19
E	Chapter 6	7.20; 7.21; 7.22; 7.23
Approved and Non-Approved IPP questionnaire (Appendix F)		
Section	**Literature**	**Operationalisation table**
B	Chapter 1	7.6
C	Chapter 3	7.9; 7.10; 7.11; 7.12; 7.13
D	Chapter 4	7.14; 7.15; 7.16; 7.17
E	Chapter 5	7.18; 7.19
F	Chapter 6	7.20; 7.21; 7.22; 7.23

7.8 SUMMARY

This chapter set out the methods for data collection and analysis. The study incorporated a combination of the qualitative and quantitative research methods in an investigation into establishing an enabling entrepreneurial environment for IPPs in the RE sector. Denzin and Lincoln (2003) state that qualitative research signifies many things to many people and that its essence is twofold: a commitment to some version of the naturalistic, interpretive approach to its subject matter and an on-going critique of the politics. Quantitative research emphasises the measurement and analysis of causal relationships between variables, not processes.

Independent research surveys were identified by using a questionnaire based survey methods. The questionnaires were administered by using an on-line survey. The questionnaires were validated and checked for content validity (entrepreneurship) and reliability. The questionnaires were validated and checked for validity and reliability by statistical analysis and a pilot study for each questionnaire. Personal interviews were conducted with Industry experts that formed part of the qualitative study. The research question and objective that were concluded in this chapter are:

- *RQ_7 – What are the components of a proposed model for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector?*
- *RO_7 - To propose a model for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector.*

The hypothesised model (Figure 6.7) identified the independent, intervening and dependent variables. The operationalisation of the aforementioned variables confirms that the dependent variable is contingent on the preceding variables. The dependent variable is repeatedly measured during the baseline and intervention phases. This allows the researcher to keep track of how well his/her intervention is proceeding and to evaluate success. The dependent variable is therefore the problem which must be worked on. In practice the independent variable is the intervention programme, the strategy and specific techniques and procedures the researcher will use to change the system. In the following chapter the results from the research studies will be presented and a discussion of the results will be included. The next chapter of this study will provide the interpretations of the results.

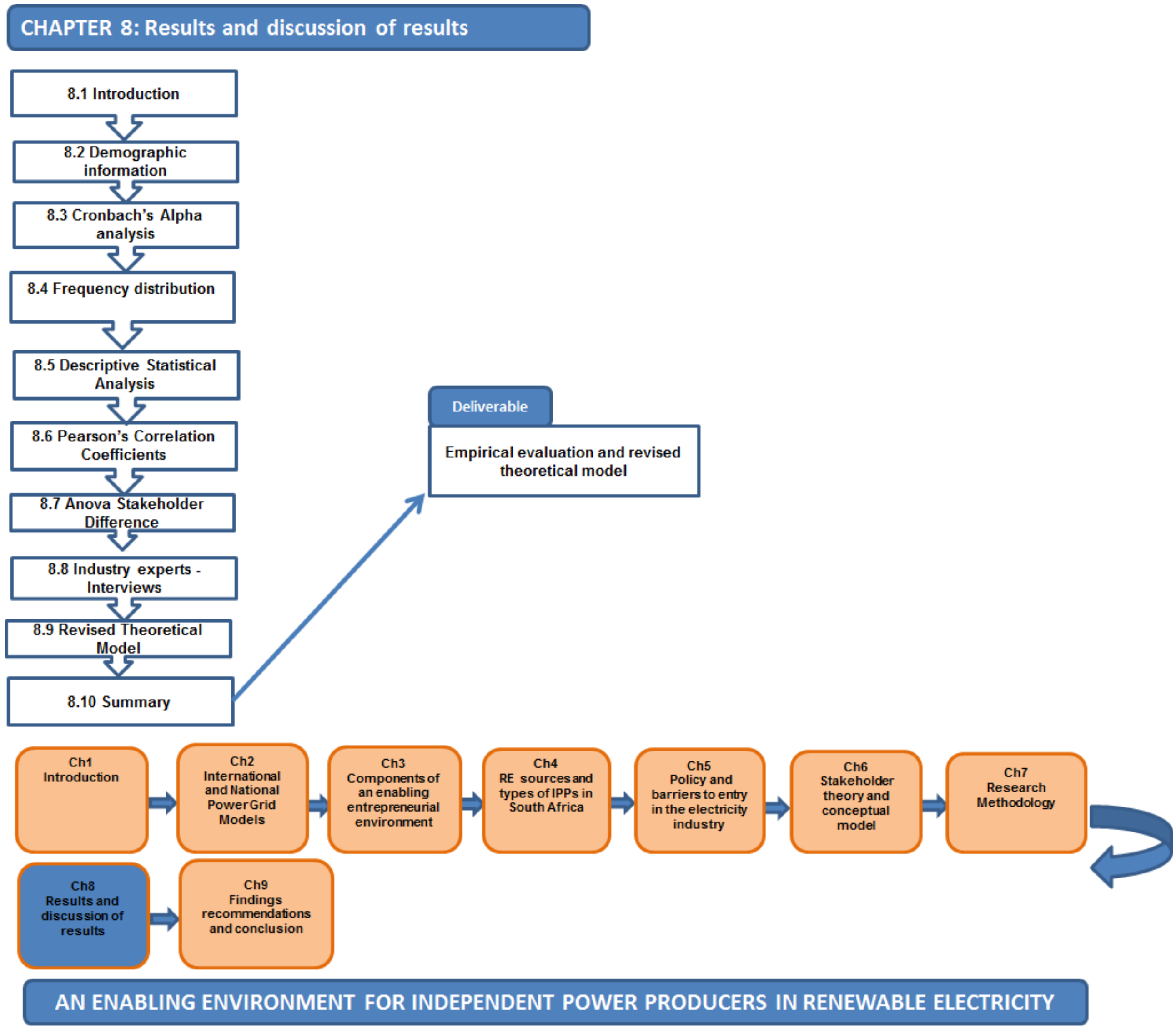


Figure 8.1: Outline of the chapter.

CHAPTER 8
RESULTS AND DISCUSSION OF RESULTS

8.1 INTRODUCTION

In the previous chapter, the methodology and research design that were used to analyse the collected data of the study under investigation were discussed. It comprised a description of the secondary and primary research used in this study, as well as a discussion of the data analysis techniques used in the research study. This chapter will elaborate on the empirical results as a result of the statistical analyses conducted. The aim of this chapter is to empirically test and analyse all the relationships depicted in the hypothesised model. This chapter is therefore addressing the research question $_{RQ8}$ and the research objective RO_8.

The aim of this chapter is to suggest recommendations to the electricity industry, managers and Eskom in particular, based on the findings of this The RQ and RO for this study are outlined below:

- *RQ_8. What are the results of an evaluation of the proposed enabling entrepreneurial model for IPP entrepreneurs in the RE sector of the electricity industry?*
- *RO_8. To evaluate the proposed enabling entrepreneurial model for IPP entrepreneurs in the RE sector.*

The research design was discussed in the previous chapter and the three questionnaires utilised in the study transversely in the electricity industry were explained. Each individual questionnaire was conducted as specified in Chapter 7 and the results statistically analysed. The results will be presented as indicated in the proposed IPP Model and are as follows:

- Eskom Management questionnaire (Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers);
- NERSA Management questionnaire (NERSA Managers);
- Approved and Non-Approved IPP questionnaire (IPP owners); and

- Industry expert interviews.

The results presented in this chapter will address each individual questionnaire. The statistical analysis of the data and a discussion of the results will be presented. Figure 8.1 outlines the chapter as follows: The chapter starts with a description of the sample of this study as given by means of a summary of the demographic information concerning the respondents (Section 8.2). Cronbach Alpha coefficients were calculated to assess the reliability of all the scales in the measuring instrument (Section 8.3). This is followed by a frequency distribution of the three questionnaires in Section 8.4. A discussion of the descriptive statistical analysis was then conducted in Section 8.5. Subsequently, the existence of relationships between variables investigated in this study was tested by the Pearson's correlation (Section 8.6). The next section of this chapter (Section 8.7) will deal with an analysis of the influence of demographic data of all the variables investigated in this study by means of ANOVA tests. Section 8.8 will deals with the Industry experts interviews. This was followed by a discussion of the revised theoretical model based on the results provided by the validity and reliability tests were done (Section 8.9). Lastly, a summary of the chapter will be given (Section 8.10).

8.2 DEMOGRAPHIC INFORMATION

Demographic information was obtained from the first section contained in each questionnaire (Eskom Management, NERSA Management and Approved and Non-Approved) and summarised. The reported data in Table 8.1 indicates that the demographic data represents the realised sample as well as the population identified for this study.

Table 8.1: Demographical information.

Gender

	Stakeholder							
	Eskom		IPPs		NERSA		Total	
Male	34	72%	51	82%	20	56%	105	72%
Female	13	28%	11	18%	16	44%	40	28%
Total	**47**	**100%**	**62**	**100%**	**36**	**100%**	**145**	**100%**

Race

	Stakeholder							
	Eskom		IPPs		NERSA		Total	
Asian	3	6%	4	6%	1	3%	8	6%
Black	15	32%	22	35%	26	72%	63	43%
Coloured	23	49%	5	8%	1	3%	29	20%
White	5	11%	30	48%	8	22%	43	30%
Other	1	2%	1	3%	0	0%	2	1%
Total	**47**	**100%**	**62**	**100%**	**36**	**100%**	**145**	**100%**

Position in organisation

	Stakeholder							
	Eskom		IPPs		NERSA		Total	
Manager	25	53%	48	77%	16	44%	89	61%
Advisor	12	26%	4	6%	6	17%	22	15%
Specialist	5	11%	6	10%	11	31%	22	15%
General staff	5	10%	4	7%	3	8%	12	9%
Total	**47**	**100%**	**62**	**100%**	**36**	**100%**	**145**	**100%**

Department

	Stakeholder							
	Eskom		IPPs		NERSA		Total	
Engineering	21	45%	28	45%	29	81%	78	54%
Customer Services	7	15%	0	0%	3	8%	10	7%
Strategy	6	13%	11	18%	1	3%	18	12%
Finance	6	13%	4	6%	2	6%	12	8%
Other	7	14%	19	31%	1	2%	27	19%
Total	**47**	**100%**	**62**	**100%**	**36**	**100%**	**145**	**100%**

Province where you are located

	Stakeholder							
	Eskom		IPPs		NERSA		Total	
Eastern Cape	8	17%	7	11%	0	0%	15	10%
Free State	24	51%	7	11%	2	6%	33	23%
Gauteng	4	9%	18	29%	34	94%	56	39%
KwaZulu Natal	0	0%	2	3%	0	0%	2	1%
Limpopo	2	4%	2	3%	0	0%	4	3%
Mpumalanga	0	0%	0	0%	0	0%	0	0%
North West	0	0%	0	0%	0	0%	0	0%
Northern Cape	3	6%	4	6%	0	0%	7	5%
Western Cape	6	13%	22	35%	0	0%	28	19%
Total	**47**	**100%**	**62**	**100%**	**36**	**100%**	**145**	**100%**

Age

	Stakeholder							
	Eskom		IPPs		NERSA		Total	
18 – 24	0	0%	1	2%	0	0%	1	1%
25 – 29	2	4%	2	3%	2	6%	6	4%
30 – 39	16	34%	18	29%	21	58%	55	38%
40 – 49	21	45%	28	45%	12	33%	61	42%
50 +	8	17%	13	21%	1	3%	22	15%
Total	**47**	**100%**	**62**	**100%**	**36**	**100%**	**145**	**100%**

Years of experience in the electricity industry

	Stakeholder							
	Eskom		IPPs		NERSA		Total	
Less than 2	0	0%	9	15%	1	3%	10	7%
2 – 4	2	4%	16	26%	4	11%	22	15%
5 – 9	13	28%	21	34%	20	56%	54	37%
10 – 19	21	45%	13	21%	10	28%	44	30%
20 +	11	23%	3	4%	1	2%	15	11%
Total	**47**	**100%**	**62**	**100%**	**36**	**100%**	**145**	**100%**

Highest Qualification

	Stakeholder							
	Eskom		IPPs		NERSA		Total	
Matric	1	2%	3	5%	0	0%	4	3%
Diploma	9	19%	4	6%	6	17%	19	13%
Degree	24	51%	31	50%	19	53%	74	51%
Post Grad	13	28%	24	39%	11	30%	48	33%
Total	**47**	**100%**	**62**	**100%**	**36**	**100%**	**145**	**100%**

From Table 8.1 it is evident that the electricity industry, with specific reference to the RE sector, is predominantly based on male occupancy. The majority of the finalised and usable questionnaires were completed by males, 72% for Eskom, 82% for IPPs and 56% for NERSA. The age group varied from 18 to over 50 years with the majority of the respondents represented between the ages 30 to 50 years. The age group 40-49 represented the highest figure of respondents at 42%. The results further reveal that 67% of the total respondent's years of experience ranged between 5 to 19 years in the electricity industry. This study specifically focuses on IPPs where 75% (15%, 26% and 34% respectively for IPPs) of the respondent's years of experience were between 0 and 9 years. This indicates the low business experience for IPPs (less than 2 years, 2 to 4 years and 5 to 9 years respectively) in the industry and the potential for new business ventures which may be brought into existence. Provinces where respondents were located included the Eastern Cape (10%), Free State (23%) and Gauteng (39%) in which the highest number of respondents was represented.

In terms of the questionnaires, some respondents occupied the position of manager with the following statistical indication: Eskom Management (53%), NERSA Management (77%) and Approved and Non-Approved IPPs (44%). The demographic data revealed that 54% of the respondents were from engineering departments, highlighting engineering expertise as a major driver in the electricity industry. In terms of years of experience in the electricity industry, the results revealed that 67% of the respondents had between 5 and 19 years service. Consequently it can be deduced that the questionnaire was administered to an experienced workforce.

The results of each questionnaire were statistically analysed and will be presented as indicated in the industry IPP Model as follows:

- Eskom Management questionnaire (Eskom Strategic Managers, Eskom Strategic Advisors, Eskom Managers);
- NERSA Management questionnaire (NERSA Managers); and
- Approved and Non-Approved IPP questionnaire (IPP owners).

8.3 CRONBACH ALPHA ANALYSIS

The reliability of the scores derived from the research instrument was tested by calculating Cronbach Alpha coefficients. For Cronbach Alpha coefficients greater than 0.70 (Table 8.2), the recommended minimum value for reliability was not observed. Most variable obtained values in the range of 0.60 to 0.69, an interval deemed acceptable in basic research. According to Nunally (1978), satisfactory levels of reliability depend on how a measure is being used. This study is deemed as new research hence, Nunally’s (1978) view on reliability will apply.

For the purpose of the study, the variable: Barriers to entry, was omitted as the Cronbach Alphas were not in range and deemed not to be significant. Variables deemed acceptable are listed in Table 8.2. Some questions to variables were left out to improve the Cronbach Alpha. Table 7.5 highlights these variables as follows:

- Variable: SA Smart Grid Model: Q4-7;
- Variable: Entrepreneurial Components and Access to Finance: Q5-10, Q5-3, Q5-1, Q5-5;
- Variable: Solar as a RE source: Q6-9; and
- Sub-variable: Other: Q9-12.

The acceptable Cronbach Alpha coefficient of 0.60 for the various variables suggests that the scores derived from the instrument used to measure this construct are reliable as displayed in Table 8.2. For the purpose of this study an enabling entrepreneurial environment refers to a conducive environment where harmonious and increased entrepreneurial activity can be experienced in the electricity industry of South Africa.

The Cronbach Alpha coefficients 0.60 (Table 8.2) indicate that the reliability of these variables are either poor or unacceptable. Only variables for the entrepreneurial components and the RE environment were observed as being poor. Though the results proved to be positive in terms of Cronbach Alpha coefficient, the results need to be treated with caution as a larger sample size could provide a higher reliance. The following (Table 8.2) depicts the results for Cronbach Alpha.

Table 8.2: Cronbach Alpha Analysis.

Unacceptable	**< 0.50**
Poor	**0.50 - 0.59**
Acceptable	**0.60 - 0.69**
Good	**0.70 - 0.79**
Excellent	**0.80 +**

	All	**Eskom**	**IPPs**	**NERSA**
Variable: Entrepreneurial Environment	0.70	0.57	0.67	-
Variable: SA Smart Grid	0.70	0.68	-	0.71
Variable: Entrepreneurial Components and Access to Finance	0.63	0.63	0.67	-
Variable: R & D transfer; Government facilitation and Business incubation	0.85	0.85	0.83	-
Variable: Entrepreneurial Components	0.54	0.51	0.56	-
Variable: RE environment	0.52	0.59	0.51	0.49
Variable: Solar as RE source	0.60	0.54	0.60	0.69
Variable: Wind as RE source	0.66	0.63	0.69	0.62
Variable: Hydro as RE source	0.74	0.53	0.83	0.80
Variable: SA Policy	0.77	0.80	0.77	0.75
Variable: Stakeholder Theory	0.80	0.77	0.79	0.80
Variable: Alternative generation	0.84	0.95	0.83	0.00
Variable: Finance	0.71	0.74	0.68	-
Variable: Government	0.82	0.83	0.82	-
Sub-Variable: Policy	0.84	0.81	0.88	0.82
Sub-Variable: SA Smart Grid	-	-	-	-
Sub-Variable: Stakeholder	0.65	0.61	0.59	0.26
Sub-Variable: Other	0.48	0.24	0.58	-

Table 8.2 depicts most Cronbach Alphas as being within range. This is deemed as acceptable with the exception of variables Entrepreneurial Components and RE environment. These Cronbach Alpha tests returned a result less than 0.60 which is below the accepted 0.60 reliability level. Consequently, the following variables will be omitted from the proposed IPP Model:

- Entrepreneurial components;
- RE environment; and
- Other (included items excluding the main variables).

Both Solar and Hydro yielded poor Cronbach Alphas at Eskom level (below 0.60) however much higher at IPPs level (0.60) and at NERSA level (0.69). The reluctance from Eskom to embrace RE alternatives is further confirmed with Eskom scoring relatively lower for variables such as wind (0.54) and hydro (0.63) respectively. Variable: Alternative generation indicated a strong positive notion towards alternative electricity generation in general with Eskom scoring (0.95) and IPPs (0.83).

Variables were widely accepted and should be considered in the IPPs industry model included: Variable: R & D transfer; Government facilitation and Business incubation, Variable: Stakeholder Theory, Variable: Government facilitation, Variable: SA Policy. The variables scored excellent Cronbach Alphas of above 0.80 indicating the respondent's acceptance of the variables. The most variables returned acceptable Cronbach Alpha coefficients of 0.60 (> 0.6) with the exception of Barriers to entry or enablers and therefore indicate that the instrument used to measure this construct is reliable.

8.4 FREQUENCY DISTRIBUTION

The frequency distribution for this statistical analysis will be discussed in the following sub-sections.

8.4.1 Eskom Management questionnaire

The study concentrated on Eskom's 9 provincial operating units in South Africa. A total of 50 questionnaires were distributed and a final number of 47 questionnaires were returned. In this study, nine provinces were targeted while seven provinces participated actively. Table 8.3 reflects the frequency distribution for Eskom.

Table 8.3: Frequency distribution for Entrepreneurial Environment – Eskom.

	Mean	S.D.	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
Enabling Entrepreneurial Environment												
Q3-5 Best practice policies have a positive effect on an Enabling Entrepreneurial Environment.	3.98	0.85	0	0%	4	9%	5	11%	26	55%	12	26%
Q3-3 Smart Grids accommodate alternative electricity provision sources in the electricity industry.	3.96	0.66	0	0%	2	4%	5	11%	33	70%	7	15%
Q3-1 I am satisfied with the entrepreneurial environment created for business in South Africa.	3.13	1.01	1	2%	16	34%	8	17%	20	43%	2	4%
SA Smart Grids												
Q4-3 Smart Grids are the future Grid models.	4.13	0.61	0	0%	1	2%	3	6%	32	68%	11	23%
Q4-4 Smart Grids embrace IPPs activity.	4.13	0.71	0	0%	2	4%	3	6%	29	62%	13	28%
Q3-6 Smart Grids enable entrepreneurship.	4.09	0.65	0	0%	0	0%	8	17%	27	57%	12	26%
Q4-3 Smart Grids are the future Grid models.	4.13	0.61	0	0%	1	2%	3	6%	32	68%	11	23%
Q4-4 Smart Grids embrace IPPs activity.	4.13	0.71	0	0%	2	4%	3	6%	29	62%	13	28%
Q4-5 Off-Grid forms an integral part of Smart-grids.	3.34	0.89	1	2%	9	19%	11	23%	25	53%	1	2%
Entrepreneurial components												
Q5-1 Entrepreneurship is critical to the development and well-being of society.	4.70	0.69	1	2%	0	0%	0	0%	10	21%	36	77%
Q5-8 Lack of access to finance is a barrier for entrepreneurial activity.	4.49	0.66	0	0%	1	2%	1	2%	19	40%	26	55%
Q5-10 To improve the entrepreneurial process, access to financial assistance needs to be prioritised.	4.34	0.70	0	0%	1	2%	3	6%	22	47%	21	45%
Q5-5 Early-stage finance is one of the biggest barriers for start-up entrepreneurs.	4.34	0.81	1	2%	1	2%	1	2%	22	47%	22	47%
Q5-9 Entrepreneurs deal with financial barriers in the industry effectively.	2.32	0.66	3	6%	28	60%	14	30%	2	4%	0	0%
RE environment												
Q6-1 There are growing concerns about electricity supply in South Africa.	4.77	0.56	0	0%	1	2%	0	0%	8	17%	38	81%

Q6-2 Climate change has heightened interest in harnessing RE sources.	4.53	0.55	0	0%	0	0%	1	2%	20	43%	26	55%
Q6-6 It is feasible to have a mix of solar, hydro and wind alternatives feeding the national grid.	4.43	0.58	0	0%	0	0%	2	4%	23	49%	22	47%
Q6-5 RE production aids lower carbon emission.	4.36	0.64	0	0%	0	0%	4	9%	22	47%	21	45%
Q6-1 There are growing concerns about electricity supply in South Africa.	4.77	0.56	0	0%	1	2%	0	0%	8	17%	38	81%
Q6-9 Solar generates sufficient electricity needed during times of peak electricity usage.	2.74	1.22	8	17%	15	32%	8	17%	13	28%	3	6%
SA Policy												
Q7-1 Policy is one of the main drivers in RE scenarios in the electricity industry.	4.26	0.74	0	0%	1	2%	5	11%	22	47%	19	40%
Q7-7 Policies motivated by climate change create greater environmental focus.	4.11	0.67	0	0%	1	2%	5	11%	29	62%	12	26%
Q7-11 Policies enable entrepreneurship.	3.96	0.98	0	0%	5	11%	8	17%	18	38%	16	34%
Q7-8 It is believed that policies are having an impact on liberalised electricity markets.	3.89	0.63	0	0%	1	2%	9	19%	31	66%	6	13%
Q7-3 Stakeholders are confident that the existing policies stay abreast with changes within the industry.	3.02	0.87	1	2%	14	30%	15	32%	17	36%	0	0%
Stakeholder Theory												
Q8-12 Government exerts power within the RE sector.	4.06	0.64	0	0%	1	2%	5	11%	31	66%	10	21%
Q8-8 Stakeholder Management serves as a managerial guide that can be followed within the electricity industry.	3.96	0.78	0	0%	3	6%	6	13%	28	60%	10	21%
Q8-14 NERSA exert power within the RE sector.	3.94	0.73	0	0%	3	6%	5	11%	31	66%	8	17%
Q8-3 Stakeholders contribute to corporate long-term efficiency of an Enabling Entrepreneurial Environment.	3.89	0.63	0	0%	1	2%	9	19%	31	66%	6	13%

Table 8.3: (Continued).

	Mean	S.D.	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
Q8-1 Stakeholders foster a healthy relationship with each other within the electricity industry.	3.36	0.87	0	0%	9	19%	15	32%	20	43%	3	6%

Table 8.3 indicates that respondents agreed (55% agree, 26% strongly agree) having best practice policies for an enabling entrepreneurial environment. A number of respondents (34%) were not satisfied with the entrepreneurial environment created for business in South Africa.

With regard to the variable SA Smart Grid Model, the respondents agreed with the statements measuring Smart Grids as an enabling variable for the entrepreneurial environment. All responses, when positively combined (agree and strongly agree) rated above 50%. Regarding the statement: "Smart Grids embrace IPP activity", 91% was the highest score. Respondents reacted well to the statement: "alternative electricity provision sources" (66% agreed and 15% strongly agreed). Only 15% of the respondents were neutral on this statement.

In terms of the stakeholder Eskom, entrepreneurial components for an enabling entrepreneurial environment remain imperative. Entrepreneurship is seen as critical to society as 21% agreed and 77% strongly agreed to this statement. A mean value of 4.70 was reported. Respondents indicated that the entrepreneurial environment does not deal well enough with financial barriers. A mean of 2.32 was reported with 60% of the respondents disagreeing with the statement: Entrepreneurs deal with financial barriers in the industry effectively.

Respondents reacted positively to RE sources, notably solar, wind and hydro to be utilised for electricity generation. This was confirmed by the response to the statement: "A sustainable energy mix for power utilities is encouraged in the RE sector" in which 62% agreed and 34% strongly agreed to this statement. The significance of climate change was accentuated as the statement pertaining to climate change and the harnessing of RE sources about which respondents were in unanimous agreement (43% agreeing and 55% strongly agreeing). A mean of 4.53 was confirmed for this statement. The ability of solar to generate sufficient output during peak electricity usage was split, as 30% of respondents disagreed, 32% neutral and only 36% agreed to this statement.

SA Policy and Stakeholder Theory received significant responses. Most respondents were of the opinion that policies motivated by climate change create greater environmental focus (62% agreed and 26% strongly agreed). Moreover, respondents indicated that policies are having an impact on liberalised electricity markets (66% agreed and 13% strongly agreed). No real confidence exists that existing electricity policy is aligned with climate mitigation (26% disagreed and 45% remained neutral). Stakeholder Management was seen to serve as a managerial guide that may be followed in the electricity industry (60% agreed, 21% strongly agreed and a mean of 3.96 was reported). Respondents indicated that an enabling entrepreneurial environment creates confident stakeholders that stay abreast with changes in the industry (66% agreed and 13% strongly agreed). A mean of 3.87 was reported for this statement.

8.4.2 NERSA Management questionnaire

This questionnaire concentrated on the regulatory aspect of electricity generation and its impact on RE generation within the electricity industry. A total of 100 questionnaires were distributed and a final number of 62 responses were returned. This study was conducted over the entire nine provinces with seven provinces actively participating. The frequency distribution for NERSA Management questionnaire reflected the following:

Table 8.4: Frequency distribution: NERSA.

	Mean	S.D.	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
SA Smart Grids												
Q3-1 Smart Grids enable entrepreneurship.	4.31	0.62	0	0%	0	0%	3	8%	19	53%	14	39%
Q3-6 Smart Grids embrace IPPs activity.	4.19	0.52	0	0%	0	0%	2	6%	25	69%	9	25%
Q3-10 Alternative electricity provision sources can be accommodated in the electricity industry in the form of Off-Grids.	4.14	0.42	0	0%	0	0%	1	3%	29	81%	6	17%
Q3-2 Mini-Grids form part of Smart Grids.	4.14	0.54	0	0%	1	3%	0	0%	28	78%	7	19%
Q3-9 Smart Grids find it challenging to accommodate new electricity generation in the form of Off-Grids.	3.47	0.77	0	0%	6	17%	7	19%	23	64%	0	0%
Entrepreneurial components												
Q4-1 There are growing concerns about electricity supply in South Africa.	4.67	0.48	0	0%	0	0%	0	0%	12	33%	24	67%
Q4-2 Climate change has heightened interest in harnessing RE sources.	4.47	0.65	0	0%	1	3%	0	0%	16	44%	19	53%
Q4-6 It is feasible to have a mix of solar, hydro and wind alternatives feeding the national grid.	4.14	0.54	0	0%	0	0%	3	8%	25	69%	8	22%
Q4-4 A sustainable energy mix for power utilities is encouraged in the RE sector.	4.11	0.62	0	0%	1	3%	2	6%	25	69%	8	22%
Q4-9 Solar generates sufficient electricity needed during times of peak electricity usage.	3.47	1.03	1	3%	7	19%	6	17%	18	50%	4	11%
SA Policy												
Q5-1 Policy is one of the main drivers in RE scenarios in the electricity industry.	4.78	0.48	0	0%	0	0%	1	3%	6	17%	29	81%
Q5-11 Policies enable entrepreneurship.	4.28	0.66	0	0%	0	0%	4	11%	18	50%	14	39%
Q5-8 It is believed that policies are having an impact on liberalised electricity markets.	4.03	0.51	0	0%	0	0%	4	11%	27	75%	5	14%
Q5-9 Market conditions are encouraging increasingly cost-effective investment in RE.	4.00	11%	0	0%	0	0%	5	14%	26	72%	5	14%
Q5-3 Stakeholders are confident that the existing policies stay abreast with changes within the industry.	2.78	0.99	1	3%	16	44%	12	33%	4	11%	3	8%
Stakeholder Theory												
Q6-10 The power of the stakeholder is to influence the RE sector.	4.06	0.53	0	0%	0	0%	4	11%	26	72%	6	17%
Q6-11 It is believed that	4.03	0.51	0	0%	0	0%	4	11%	27	75%	5	14%

stakeholders have power to influence the RE sector.												
Q6-12 Government exerts power within the RE sector.	4.03	0.56	0	0%	0	0%	5	14%	25	69%	6	17%
Q6-2 An Enabling Entrepreneurial Environment creates confident stakeholders that stay abreast with changes in the industry.	4.03	0.65	0	0%	0	0%	7	19%	21	58%	8	22%
Q6-1 Stakeholders foster a healthy relationship with each other within the electricity industry.	3.50	0.81	0	0%	3	8%	16	44%	13	36%	4	

Table 8.4 indicates that respondents agreed (53% agreed, 39% strongly agreed) to have best practice policies for an enabling entrepreneurial environment. A number of respondents were satisfied with the fact that alternative electricity provision sources can be accommodated in the electricity industry (81% agreed and 17% strongly agreed). A mean of 4.14 was observed for this statement. Respondents indicated that Smart Grid models find it challenging to accommodate new electricity generation in the form of Off-Grids, on Smart Grid models (64% agreed).

For the stakeholder NERSA, entrepreneurial components for an enabling entrepreneurial environment remain imperative. RE sources such as hydro are feasible options for increasing electricity diversity (67% agreed and 19% strongly agreed). A mean value of 4.06 was reported for this statement. Respondents regarded a mix of solar, hydro and wind RE alternatives feeding into the national grid as feasible. They reacted positively to this statement as 69% agreed and 22% strongly agreed that it will make a significant difference to electricity generation. A mean of 4.14 was reported.

Equally, respondents reacted optimistically to SA policy and Stakeholder Theory. Most respondents were of the opinion that policies motivated by climate change create greater environmental focus (86% agreed and 6% strongly agreed). Further, respondents indicated that policies are having an impact on liberalised electricity markets (75% agreed and 14% strongly agreed). Respondents are not confident that existing electricity policy is aligned with climate mitigation (19% disagreed, 39% agreed and 36% remained neutral). Stakeholder Management was seen to serve as a managerial guide that can be followed in the electricity industry (78% agreed, 8% strongly agreed and a mean of 3.94 was reported). Respondents indicated that an enabling entrepreneurial environment creates confident stakeholders who stay abreast with changes in the industry (58% agreed and 22% strongly agreed). A mean of 4.03 was reported for this statement.

8.4.3 Approved and Non- Approved IPPs questionnaire

In the following sub-section, the questionnaire concentrated on the entrepreneurial environment aspect of electricity generation and its impact on RE generation within the electricity industry. A total of 100 questionnaires were distributed and a final number of 62 questionnaires were returned. This study was conducted over the entire nine provinces. Seven provinces participated actively. The frequency distribution for IPPs questionnaire reflected the following:

Table 8.5: Frequency distribution: Approved and Non Approved IPPs.

	Mean	S.D.	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
Entrepreneurial Environment												
Q3-5 Best practice policies have a positive effect on an Enabling Entrepreneurial Environment.	3.48	1.14	5	8%	6	10%	16	26%	24	39%	11	18%
Q3-3 Smart Grids accommodate alternative electricity provision sources in the electricity industry.	3.39	1.14	5	8%	9	15%	13	21%	27	44%	8	13%
Q3-4 The grid model makes it easy to accommodate alternative electricity generation environments.	2.74	1.24	10	16%	23	37%	6	10%	19	31%	4	6%
Q3-1 I am satisfied with the entrepreneurial environment created for business in South Africa.	2.42	1.08	12	19%	27	44%	9	15%	13	21%	1	2%
Entrepreneurial components												
Q4-1 Entrepreneurship is critical to the development and well-being of society.	4.71	0.46	0	0%	0	0%	0	0%	18	29%	44	71%
Q4-10 To improve the entrepreneurial process, access to financial assistance needs to be prioritised.	4.31	0.67	0	0%	1	2%	4	6%	32	52%	25	40%
Q4-5 Early-stage finance is one of the biggest barriers for start-up entrepreneurs.	4.31	0.97	2	3%	2	3%	4	6%	21	34%	33	53%

Q4-8 Lack of access to finance is a barrier for entrepreneurial activity.	4.11	1.07	4	6%	2	3%	2	3%	29	47%	25	40%
Q4-9 Entrepreneurs deal with financial barriers in the industry effectively.	2.98	1.06	4	6%	20	32%	14	23%	21	34%	3	5%
Q4-7 In this industry, IPPs have no difficulty in obtaining access to start-up finance.	2.10	0.97	17	27%	31	50%	5	8%	9	15%	0	0%
RE environment												
Q5-1 There are growing concerns about electricity supply in South Africa.	4.81	0.47	0	0%	0	0%	2	3%	8	13%	52	84%
Q5-2 Climate change has heightened interest in harnessing RE sources.	4.68	0.54	0	0%	0	0%	2	3%	16	26%	44	71%
Q5-6 It is feasible to have a mix of solar, hydro and wind alternatives feeding the national grid.	4.50	0.65	0	0%	1	2%	2	3%	24	39%	35	56%
Q5-5 RE production aids lower carbon emission.	4.32	0.86	2	3%	0	0%	4	6%	26	42%	30	48%
Q5-9 Solar generates sufficient electricity needed during times of peak electricity usage.	3.10	1.16	6	10%	16	26%	10	16%	26	42%	4	6%
SA Policy												
Q6-1 Policy is one of the main drivers in RE scenarios in the electricity industry.	4.40	0.73	1	2%	0	0%	3	5%	27	44%	31	50%
Q6-7 Policies motivated by climate change create greater environmental focus.	4.21	0.63	0	0%	1	2%	4	6%	38	61%	19	31%
Q6-6 Policies are one of the main drivers in moderate and high renewable scenarios.	4.13	0.76	2	3%	0	0%	2	3%	42	68%	16	26%
Q6-8 It is believed that policies are having an impact on liberalised electricity markets.	4.02	0.78	1	2%	3	5%	3	5%	42	68%	13	21%
Q6-3 Stakeholders are confident that the existing policies stay abreast with changes within the industry.	2.87	0.95	3	5%	20	32%	24	39%	12	19%	3	5%

Table 8.5: (Continued).

	Mean	S.D.	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
Stakeholder Theory												
Q7-12 Government exerts power within the RE sector.	4.29	0.52	0	0%	0	0%	2	3%	40	65%	20	32%
Q7-13 Eskom exert power within the RE sector.	4.08	0.68	0	0%	2	3%	6	10%	39	63%	15	24%
Q7-2 An Enabling Entrepreneurial Environment creates confident stakeholders that stay abreast with changes in the industry.	3.89	0.70	0	0%	0	0%	19	31%	31	50%	12	19%
Q7-8 Stakeholder Management serves as a managerial guide that can be followed within the electricity industry.	3.73	0.79	1	2%	4	6%	12	19%	39	63%	6	10%
Q7-15 Stakeholder power is not misused in the electricity industry.	2.85	1.07	8	13%	15	24%	18	29%	20	32%	1	2%

Table 8.5 indicates that respondents agreed (39% agreed, 18% strongly agreed) with having best practice policies for an enabling entrepreneurial environment. A number of respondents (44% disagreed and 19% strongly disagreed) were not satisfied with the entrepreneurial environment created for business in the South African electricity industry. Only a small number (24% agreed and 3% strongly agreed) were satisfied with the status quo.

For the stakeholder Eskom, entrepreneurial components for an enabling entrepreneurial environment remain imperative and results indicated such. Entrepreneurship is seen as critical to society as 29% agreed and 71% strongly agreed to this statement. A mean value of 4.71 was reported for this statement. Respondents felt that the entrepreneurial environment does not deal well with financial barriers. A mean of 2.98 was reported while 32% of the respondents disagreed with to the statement: “Entrepreneurs deal with financial barriers in the industry effectively.” Only 34% of the respondents agreed with this statement. Respondents indicated that access to finance remains a challenge for IPPs in this sector as 50% disagreed and 27% strongly disagreed to the statement: “In this industry, IPPs have no difficulty in obtaining access to start-up finance”.

Respondents expressed positive sentiments regarding the use of RE sources such as solar, wind and hydro to be utilised for electricity generation. This was confirmed by the response to the statement: “a sustainable energy mix for power utilities is encouraged in the RE sector” with 56% agreeing and 23% strongly agreeing to this statement. The significance of climate change was accentuated as the statement pertaining to climate change and the harnessing of RE sources overwhelmingly agreed to this statement (26% agreed and 71% strongly agreed). A mean of 4.68 was confirmed for this statement. The ability of solar to generate sufficient output during peak electricity usage was split as 26% of respondents disagreed, 16% neutral and only 42% agreed to this statement. A mean of 3.10 was confirmed for this statement.

In terms of SA policy and Stakeholder Theory, respondents' feedback was undisputed. Most respondents were of the opinion that policies motivated by climate change, create greater environmental focus (61% agreed and 31% strongly agreed). Further, respondents indicated that policies are having an impact on liberalised electricity markets (68% agreed and 21% strongly agreed). They expressed doubt about the fact that existing policies stay abreast with changes within the industry (32% disagreed and 39% remained neutral). Stakeholder Management was seen to serve as a managerial guide that can be followed in the electricity industry (63% agreed, 10% strongly agreed and a mean of 3.73 was reported). Respondents indicated that an enabling entrepreneurial environment creates confident stakeholders that stay abreast of changes in the industry (50% agreed and 19% strongly agreed). A mean of 3.89 was reported for this statement.

Ottinger (2005) indicates that the use of renewable resources in emerging economies has grown markedly in the past decade. Many countries have significant RE sources instillations such as solar, wind and hydro with South Africa showing significant potential in solar and wind generation.

8.5 DESCRIPTIVE STATISTICAL ANALYSIS

Descriptive statistics were calculated with the aim of summarising and describing the sample data. These descriptive statistics comprise the means, standard deviation and frequency distribution. A 5-point Likert-type interval was used to assess the extent to which the respondents agreed with the statements. Table 8.6 depicts the frequency distribution responses, grouped under the following categories:

- Very Negative (0 to 1.8);
- Negative (1.8 to 2.6);
- Neutral (2.6 to 3.4);
- Positive (3.4 to 4.2); and

- Very Positive (4.2 to 5.0).

Tables 8.6 to Table 8.8 provide a summary of the various descriptive statistics and succeeding sections will discuss these results in more detail. For each category the numbers in brackets (Table 8.6) indicate a more representative frequency grouping for individual responses.

Table 8.6: Frequency Distributions: Variables: Entrepreneurial Environment to Stakeholder Theory – Eskom.

	Mean	S.D.	Very Negative (1.0 to 1.8)		Negative (1.8 to 2.6)		Neutral (2.6 to 3.4)		Positive (3.4 to 4.2)		Very Positive (4.2 to 5.0)	
Variable: Entrepreneurial Environment	3.51	0.59	0	0%	2	4%	18	38%	23	49%	4	9%
Variable: SA Smart Grid	3.86	0.44	0	0%	0	0%	7	15%	31	66%	9	19%
Variable: Entrepreneurial Components and Access to Finance	2.47	0.54	5	11%	22	47%	20	43%	0	0%	0	0%
Variable: R & D transfer; Government facilitation and Business incubation	3.54	0.46	0	0%	1	2%	16	34%	28	60%	2	4%
Variable: Entrepreneurial Components	3.01	0.41	0	0%	8	17%	33	70%	6	13%	0	0%
Variable: General RE environment	4.42	0.36	0	0%	0	0%	0	0%	16	34%	31	66%
Variable: Solar as RE source	3.78	0.54	0	0%	1	2%	10	21%	26	55%	10	21%
Variable: Wind as RE source	3.41	0.56	0	0%	3	6%	24	51%	17	36%	3	6%
Variable: Hydro as RE source	3.83	0.49	0	0%	0	0%	10	21%	30	64%	7	15%
Variable: SA Policy	3.65	0.50	0	0%	1	2%	13	28%	27	57%	6	13%
Variable: Stakeholder Theory	3.69	0.40	0	0%	1	2%	9	19%	34	72%	3	6%

Table 8.6 indicates that most variables' responses ranged between positive to very positive with the exception of Entrepreneurial components. Respondents took a neutral stance on this variable as little knowledge is shared on entrepreneurship in the electricity industry. Eskom is largely seen as a monopolistic organisation hence the appetite for entrepreneurial activity amongst the respondents was low.

A mean score of 4.42 was reported for RE environment. The majority of the respondents (100%) were positive. Further, 70% of the respondents were neutral regarding Entrepreneurial Components while 17% were negative. Variable for solar, wind and hydro reported mean scores of 3.78, 3.41 and 3.83 respectively. Most respondents were positive about to these variables with the exception of wind which had a 51% neutral feedback.

In terms of the variable, RE environment, respondents were positive (66%) about embracing RE as alternative electricity source. In addition, a further 19% of the respondents were very positive about this variable. Respondents were amenable to the idea of a Smart Grid and perceived it as the future grid model in the electricity industry. This validates Smart Grids as being a key contributor to the proposed IPPs model in creating an enabling entrepreneurial environment in the RE sector of the electricity industry. Respondents reacted negatively to the variables Entrepreneurial Components and Access to Finance (47% negative and 11% being very negative) with 43% being neutral. R & D transfer, Government facilitation and business incubation were variables respondents regarded as positive (60% positive).

Variables pertaining to the use of RE sources were affirmed as a 76% positive attitude to solar with 55% of the respondents being positive and 21% very positive in this regard. Hydro affirmed a positive result for Eskom as respondents indicated a 64% (positive) to 15% (very positive) split. In terms of SA Policy and Stakeholder Theory the results indicate that 70% and 78% of the respondents respectively, reacted positively.

Eskom respondents were also positive about the following Variables: These included Variables: Entrepreneurial Components and Access to Finance and Variable: Entrepreneurial Components.

Table 8.7: Frequency Distribution for Variables: Entrepreneurial Environment to Stakeholder Theory – NERSA.

	Mean	S.D.	Very Negative (1.0 to 1.8)		Negative (1.8 to 2.6)		Neutral (2.6 to 3.4]		Positive (3.4 to 4.2)		Very Positive (4.2 to 5.0)	
Variable: Entrepreneurial Environment	-	-	-	-	-	-	-	-	-	-	-	-
Variable: SA Smart Grid	4.06	0.31	0	0%	0	0%	1	3%	24	67%	11	31%
Variable: Entrepreneurial Components and Access to Finance	-	-	-	-	-	-	-	-	-	-	-	-
Variable: R & D transfer; Government facilitation and Business incubation	-	-	-	-	-	-	-	-	-	-	-	-
Variable: Entrepreneurial Components	-	-	-	-	-	-	-	-	-	-	-	-
Variable: General RE environment	4.22	0.32	0	0%	0	0%	0	0%	19	53%	17	47%
Variable: Solar as RE source	3.88	0.34	0	0%	0	0%	4	11%	29	81%	3	8%
Variable: Wind as RE source	3.73	0.43	0	0%	1	3%	7	19%	27	75%	1	3%
Variable: Hydro as RE source	3.78	0.49	0	0%	0	0%	9	25%	25	69%	2	6%
Variable: SA Policy	3.77	0.40	0	0%	0	0%	4	11%	28	78%	4	11%
Variable: Stakeholder Theory	3.88	0.31	0	0%	0	0%	2	6%	30	83%	4	11%

Table 8.7 indicates that the entrepreneurial environment variable was omitted from this section. The Smart Grid variable was positively viewed by NERSA. The general RE perception was positive as the response indicated 53% being positive and 47% being very positive about this variable. This indicates that respondents were generally amenable to

the introduction of RE in the electricity industry. Entrepreneurial components and access to finance were omitted. Variables pertaining to RE sources (solar, wind and hydro) were affirmed as 89% positive to solar with 81% of the respondents being positive and 8% very positive about this variable. A mean score of 3.88 was recorded for this variable. Respondents reacted positively (75%) and very positive (3%) to wind. Hydro affirmed a positive result for IPPs as respondents indicated a 69% (positive) to 6% (very positive) split. The SA Policy and Stakeholder Theory were positively accepted indicating an 89% and 94% overall positivity respectively. Overall IPPs respondents reacted positively to all variables.

Table 8.8: Frequency Distribution for Variables: Entrepreneurial Environment to Stakeholder Theory – IPPs.

	Mean	S.D.	Very Negative (1.0 to 1.8)		Negative (1.8 to 2.6)		Neutral (2.6 to 3.4)		Positive (3.4 to 4.2)		Very Positive (4.2 to 5.0)	
Variable: Entrepreneurial Environment	2.88	0.76	5	8%	14	23%	27	44%	15	24%	1	2%
Variable: SA Smart Grid	-	-	-	-	-	-	-	-	-	-	-	-
Variable: Entrepreneurial Components and Access to Finance	2.42	0.64	9	15%	27	44%	23	37%	3	5%	0	0%
Variables: R & D transfer; Government facilitation and Business incubation	3.24	0.52	0	0%	8	13%	27	44%	27	44%	0	0%
Variable: Entrepreneurial Components	2.83	0.48	2	3%	15	24%	37	60%	8	13%	0	0%
Variable: General RE environment	4.30	0.39	0	0%	0	0%	2	3%	23	37%	37	60%
Variable: Solar as RE source	4.06	0.50	0	0%	0	0%	6	10%	32	52%	24	39%
Variable: Wind as RE source	3.44	0.69	2	3%	3	5%	24	39%	29	47%	4	6%
Variable: Hydro as RE source	3.88	0.64	1	2%	2	3%	7	11%	42	68%	10	16%
Variable: SA Policy	3.71	0.49	1	2%	0	0%	9	15%	47	76%	5	8%
Variable: Stakeholder Theory	3.57	0.43	0	0%	3	5%	18	29%	38	61%	3	5%

The results in Table 8.8 reflect that 24% were positive and only 2% very positive about the creation of an entrepreneurial environment. A large number (44%) maintained a neutral stance toward this variable. The Smart Grid variable was omitted from the Approved and Non-Approved IPPs questionnaire. Negative reactions were recorded with entrepreneurial components and access to finance as most of the respondents were negative about this variable (44% negative and 15% being very negative) and 37% were neutral. A mean score of 2.42 was recorded for the variable R & D transfer, government facilitation and business incubation were variables that were generally accepted as positive (44% positive) and a large number of respondents (44%) maintained a neutral stance, while a small percentage adopted a negative stance (13%).

Variables pertaining to RE sources (solar, wind and hydro) were affirmed at 91% positive notion to solar with 52% of the respondents being positive and 39% very positive about these variables. Hydro affirmed a positive result for IPPs as respondents indicated a 68% (positive) to 16% (very positive) split. SA Policy and Stakeholder Theory were positively received, indicating positive a response rate of 84% and 66% respectively.

Eskom Managers expressed the opinion that business incubation should be used to establish IPP activity in the electricity industry. Respondents preferred solar and hydro as alternative RE sources as these sources are already incorporated into the electricity network on a limited scale, however they were not convinced about wind as a RE source. Research conducted in South Africa indicates that while wind technologies have grown at rates of around 30% over the past few years, they start from a low base (5 GW) in comparison to the total South African capacity of approximately 40 GW) (Winkler, 2006).

Results indicated that IPP respondents, except for a small number, were positive about most variables. The exceptions included Variable: Entrepreneurial Components and Access to Finance, Variable: Entrepreneurial Components and R & D transfer; Government facilitation and Business incubation, correlating directly with responses obtained from Eskom Managers. The results indicated that IPPs considered the RE sources of solar, wind and hydro as feasible alternatives.

The results from the NERSA Management questionnaire indicated an entrepreneurial appreciation predominantly for solar and wind as alternative electricity sources. The general perception in terms of RE as a viable electricity alternative was highly regarded. Finally these alternative RE sources were considered as vital components for Smart Grid networks. The Smart Grid Information Report (2011) concurs that diversity of supply changes how electricity is generated, such as alternative electricity generation in the form of RE. Some of the changes refer to substitutes to generation, such as demand response, energy storage and some of the changes refer to where the energy source is located, such as distributed generation and distributed resources (Smart Grid Information Report, 2011).

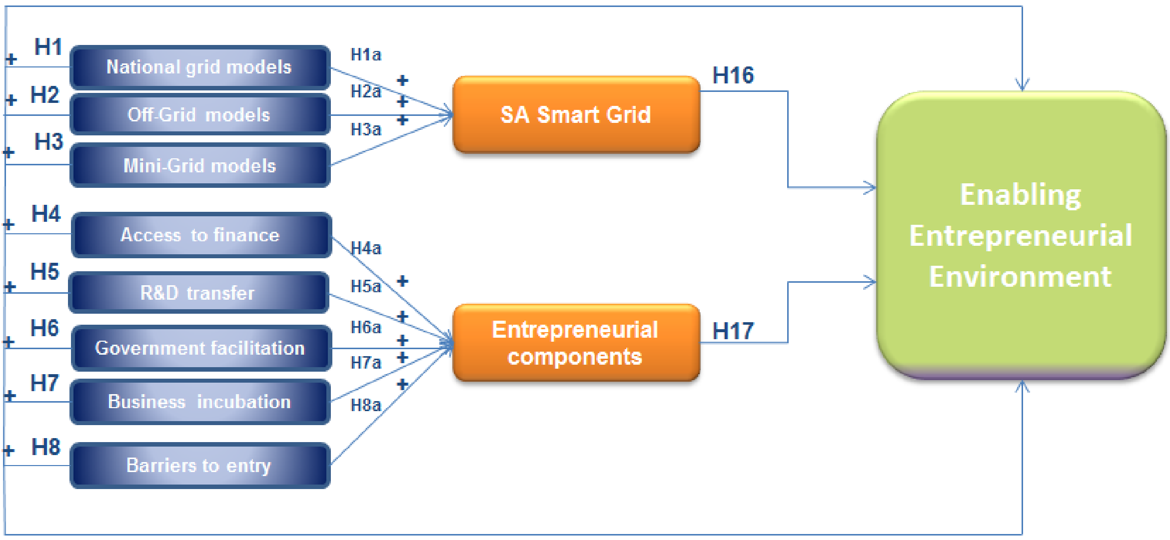
The results of this study confirm the findings by (Winkler, 2006) who indicated that RE sources such as solar, wind and hydro are deemed feasible RE alternatives in the electricity industry. The study also found that the projection for solar and wind technology takes over a much larger share of the supply of renewables in the future. The study further concluded that significant funds, both public and from Eskom, have been invested in the development of this technology. Costs decline with national production and initial investments in these alternatives already underline their potential.

8.6 PEARSON'S CORRELATION COEFFICIENTS

Hypothesis testing analysis was conducted to identify the potential underlying dimensions or variables in the data and to assess the discriminant validity of the instruments used to measure those variables. After the reliability of these constructs was confirmed by means of a Cronbach Alpha coefficient analysis, the theoretical model proposed in Chapter 7 was revised to reflect only those constructs that demonstrated sufficient discriminate validity and reliability. The relationships between these variables were presented in a path diagram and converted into a structural model for which the path coefficients of the relations were estimated. An assessment of the goodness-of-fit of the theoretical model to the empirical data will then be undertaken. The relationships between various input and process constructs was then assessed.

In this study, hypothesis testing was used to assess the discriminant validity of the measuring instrument. The first step was to assess the degree of reliability and validity in the data and this was done by performing correlation analysis. The results for the conceptual entrepreneurial model (Sub-model A) revealed that the following primary variables contributed towards the establishment of an enabling entrepreneurial environment: *Smart Grid, National Grid models, Off-Grid model, Mini Grid models; Entrepreneurial Components, Access to Finance, R & D transfer, Government facilitation, Business incubation and Barriers to entry.*

Figure 8.2: Conceptual Entrepreneurial model (Sub-model A).



Source: Own construction, 2014.

In the sections below, the measures of correlation will be reported for the sub-models. Subsequent variables are identified from the results. The variable structures for each sub-model will also be tabled. Two sub-models (Sub-model A and Sub-model B) were identified from correlation analysis and will be discussed in the next section. The Sub-models are represented in Figures 8.2 and 8.3 respectively.

Sub-model A: Eskom:

The correlations between the variables are reported in Appendix G. Correlations are:

- Statistically significant at 0.05 level for n = 47 if |r| >= .288
- Practically significant if |r| >= .300

The results revealed a statistically significant correlation between variables pertaining to an enabling entrepreneurial environment. A statistically significant positive correlation (0.843) between Entrepreneurial components (H17) and Access to finance (H4) was observed. Further, a statistically significant positive correlation (0.783) between entrepreneurial components (H17) and R & D transfer (H5); Government facilitation and Business incubation (H6) were evident. In addition, a statistically significant positive correlation exists between Smart Grids (H16) and the enabling entrepreneurial environment as the correlation value indicates 0.338. It was found that for the sub model, Entrepreneurial environment, RE sources (solar, wind and hydro), Entrepreneurial components proves essential to an enabling entrepreneurial environment.

Sub-model A: Approved and Non-Approved IPPs:

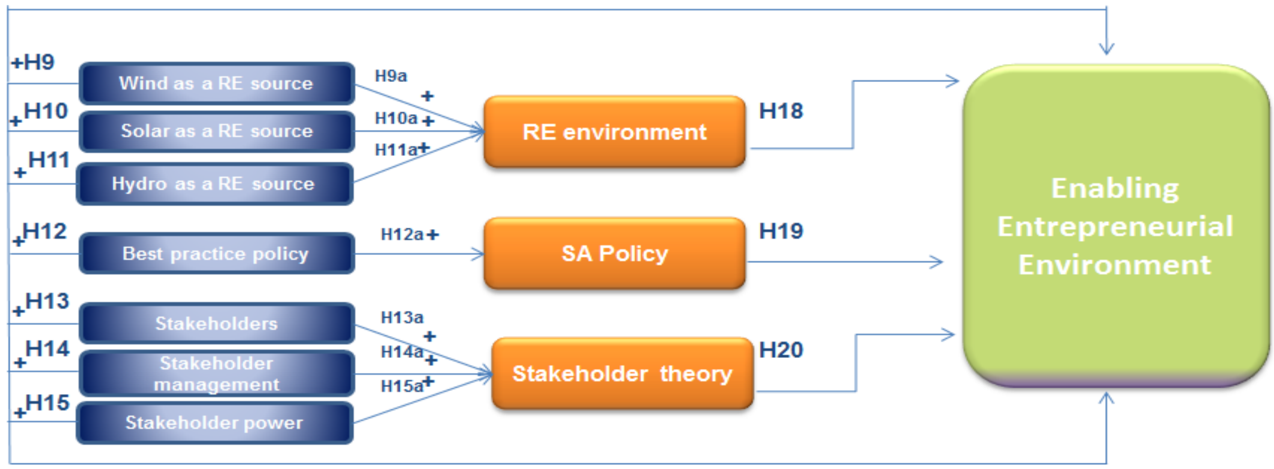
Statistically significant at 0.05 level for n = 62 if |r| >= .250
Practically significant if |r| >= .300
Thus significant (both statistically and practically) if |r| >= .300

A statistically significant correlation between an enabling entrepreneurial environment exists, with Entrepreneurial Components (H17) and Access to Finance (H4), R & D transfer (H5) (0.343); Government facilitation (H6) (0.540) and Business incubation (H7) (0.513) and Entrepreneurial Components. Further, a strong correlation exists between the Entrepreneurial Components - Access to Finance (H4), R & D transfer (H5); Government facilitation (H6) and Business incubation (H7) (0.402) and Entrepreneurial Components (H17) (0.873). R & D transfer; Government facilitation - Business incubation shares strong correlation with Entrepreneurial Components (0.797). Barriers to entry and enablers show a high correlation to an Enabling Entrepreneurial Environment (0.308) and Entrepreneurial components (0.567). A strong correlation (0.423) between barriers to entry (H8) and Entrepreneurial Components (H17) was evident.

Sub-model A: NERSA:
Statistically significant at 0.05 level for n = 36 if |r| >= .329
Practically significant if |r| >= .300
Thus significant (both statistically and practically) if |r| >= .329

Entrepreneurial environment, Entrepreneurial components and Smart Grids did not form part of the NERSA questionnaire and were therefore excluded as variables. The results of the conceptual entrepreneurial model (Sub model B) revealed that the following primary variables contributed towards the establishment of an enabling entrepreneurial environment: RE environment, Wind as a RE source, Solar as a RE source and Hydro as a RE source; SA Policy, Best practice policy; Stakeholder Theory, Stakeholders, Stakeholder Management and Stakeholder power. This indicated the potential of the abovementioned variables to contribute positively to an enabling entrepreneurial environment.

Figure 8.3: Conceptual Entrepreneurial model (Sub-model B).



Source: Own construction, 2014.

Sub-model B: Eskom

Statistically and practically significant if results are:

Statistically significant at 0.05 level for n = 47 if |r| >= .288

Practically significant if |r| >= .300

The data revealed a statistically and practically significant correlation between the RE environment (H18) and an enabling entrepreneurial environment by heeding 0.367 as depicted in Appendix G. A statistically significant correlation (0.429) between an enabling entrepreneurial environment and hydro (H11) was observed. There was a statistically and practically significant relationship between SA Policy (H19) and an enabling entrepreneurial environment, Entrepreneurial components exist. The results reflected as: 0.508, 0.517 and 0.398 for the Entrepreneurial component. This indicated that SA policy was well-regarded as a contributing variable to an enabling entrepreneurial environment.

Sub-model B: IPPs

Statistically significant at 0.05 level for n = 62 if |r| >= .250

Practically significant if |r| >= .300

Thus significant (both statistically and practically) if |r| >= .300

The data revealed a statistically and practically significant correlation between RE environment (H18) and Solar (H10) by heeding 0.268 as depicted in Appendix G. Equally, a statistically and practically significant correlation between solar (H10) and wind (H9) was found 0.388.

A correlation (0.298) was observed between RE environment (H18) and solar (H10) (0.415) wind (H9) (0.512) and hydro (H11) (0.343) for IPPs. Stakeholders (H13) showed a statistically and practically significant correlation with Stakeholder Theory 0.360. Business incubation shared a correlation between, Stakeholder Theory (0.642), Access to finance (0.438) and Government facilitation (0.464). This indicated the potential of the abovementioned variables to contribute positively to an enabling entrepreneurial environment.

Sub-model B: NERSA

In this section, low correlations were observed for NERSA, with only a statistically and practically significant correlation between Stakeholder Management (H14) and Stakeholder Theory (0.324) (H20) observed. No further significant correlations were observed for this stakeholder under this sub model. Entrepreneurial environment and entrepreneurial components did not form part of the NERSA Management questionnaire and were therefore excluded as variables.

8.7 ANOVA TEST- STAKEHOLDER DIFFERENCE

For the variable Stakeholder, a high significant difference ($p = 0.005$) exists between respondents. Scheffe's test indicates the direction of difference at the < 0.0005 significance level. Cohen's d was found to be large between Eskom and IPPs, small between Eskom and NERSA and large between IPPs and NERSA. This indicated that IPP responses differed largely from the responses yielded by Eskom and NERSA.

Table 8.9: Variable: RE environment.

ANOVA - Variable: RE environment					
Source of Variation	***SS***	***df***	***MS***	***F***	***p*-value**
Between Groups	0.849	2	0.424	3.141	.046
Within Groups	19.188	142	0.135		
Total	20.036	144			
Variable: RE environment					
Stakeholder 1	**Stakeholder 2**	**Diff. M_1-M_2**	**Scheffé p**	**Cohen's d**	
Variable: RE environment					
Stakeholder 1	**Stakeholder 2**	**Diff. M_1-M_2**	**Scheffé p**	**Cohen's d**	
Eskom	IPPs	0.12	.254	0.31	Small
Eskom	NERSA	0.20	.052	0.58	Medium
IPPs	NERSA	0.08	.572	0.22	Small

The variable RE environment (Table 8.9) yielded that a high significance difference (p 0.046) exists between respondents. Scheffe's test indicates the direction of difference at 0.254 (between Eskom and IPPs), 0.052 (between Eskom and NERSA) and 0.572 (between IPPs and NERSA). Less difference (0.20) exists between Eskom and NERSA. Cohen's d was found to be small between Eskom and IPPs, medium between Eskom and NERSA and small between IPPs and NERSA. Meaning that Eskom Management revealed more variation in terms of response to questions posed. Less difference exists between Eskom and NERSA (0.52), indicating that less variation in terms of response to questions was experienced.

Table 8.10: Variable: Solar as RE source

ANOVA - Variable: Solar as RE source					
Source of Variation	***SS***	***df***	***MS***	***F***	***p*-value**
Between Groups	2.262	2	1.131	4.897	.009
Within Groups	32.802	142	0.231		
Total	35.065	144			
Variable: Solar					
Stakeholder 1	**Stakeholder 2**	**Diff. M_1-M_2**	**Scheffé p**	**Cohen's d**	
Eskom	IPPs	-0.28	.011	0.55	Medium
Eskom	NERSA	-0.10	.653	0.21	Small
IPPs	NERSA	0.19	.187	0.41	Small

Table 8.10 reflects that a significant positive (p = 0.009) relationship was reported between the groups. Cohen's d was found to be medium between Eskom and IPPs, small between Eskom and NERSA and small between IPPs and NERSA. Scheffe's test indicated the direction of difference at 0.011, 0653 and 0.187 were recorded. Less difference exists between Eskom and IPPs (0.11), indicating that less variation in terms of response to questions was experienced.

Table 8.11: Variable: Wind as RE source

ANOVA - Variable: Wind as RE source					
Source of Variation	***SS***	***df***	***MS***	***F***	***p*-value**
Between Groups	2.433	2	1.216	3.456	.034
Within Groups	49.976	142	0.352		
Total	52.408	144			
Variable: Wind					
Stakeholder 1	**Stakeholder 2**	**Diff. M_1-M_2**	**Scheffé p**	**Cohen's d**	
Eskom	IPPs	-0.03	.968	0.05	Not sig.
Eskom	NERSA	-0.32	.060	0.63	Medium
IPPs	NERSA	-0.29	.075	0.47	Small

Based on the ANOVA test (Table 8.11), a significant positive (p = 0.034) relationship was reported between the groups. Cohen's d reflected no significance between Eskom and IPPs, medium between Eskom and NERSA and small between IPPs and NERSA. Scheffe's test indicated the direction of difference at 0.968 (between Eskom and IPP), 060 (Eskom and NERSA) and 0.075 (IPPs and NERSA). Less difference exists between Eskom and NERSA and IPPs and NERSA. Less difference existed between Eskom and NERSA (0.60), indicating that less variation in terms of response to questions was experienced. The results indicated that Eskom and NERSA regarded wind (as RE source) as crucial to the RE sector.

Table 8.12: Variable: SA Policy.

ANOVA - Variable: SA Policy					
Source of Variation	***SS***	***df***	***MS***	***F***	***p*-value**
Between Groups	0.321	2	0.161	0.723	.487
Within Groups	31.563	142	0.222		
Total	31.885	144			

Based on the ANOVA test (Table 8.12), a significant positive (p = 0.487) relationship was reported between the groups. The F value was reported at .723 for this Sub-Variable. The table indicates a strong relationship between stakeholders.

Table 8.13: Variable: Stakeholder Theory.

ANOVA - Variable: Stakeholder Theory					
Source of Variation	***SS***	***df***	***MS***	***F***	***p*-value**
Between Groups	2.228	2	1.114	7.102	.001
Within Groups	22.268	142	0.157		
Total	24.495	144			
ANOVA - Variable: Stakeholder Theory					
Stakeholder 1	**Stakeholder 2**	**Diff. M_1-M_2**	**Scheffé p**	**Cohen's d**	
Eskom	IPPs	0.12	.293	0.29	Small
Eskom	NERSA	-0.19	.094	0.53	Medium
IPPs	NERSA	-0.31	.001	0.79	Medium

Table 8.13 reflects, that a significant positive (p = 0.01) relationship was reported between the groups. Cohen’s d was found to be small between Eskom and IPPs and both medium between Eskom and NERSA and IPPs and NERSA. Scheffe’s test indicated the direction of difference at 0.293, 094 and 0.001 was recorded. Less difference exists between IPPs and NERSA, indicating that less variation in terms of response to questions was experienced. This indicated that for Stakeholder Theory, NERSA Management revealed more variation in terms of responses to questions posed.

Table 8.14: Variable: Alternative generation.

ANOVA - Variable: Alternative generation					
Source of Variation	***SS***	***df***	***MS***	***F***	***p*-value**
Between Groups	0.166	2	0.083	1.441	.240
Within Groups	8.189	142	0.058		
Total	8.356	144			

In Table 8.14 the ANOVA test indicated, a negative (p = 0.240) relationship between the groups. The F value was reported at 1.441 for this variable. Table 8.14 indicates poor relationship between stakeholders.

Table 8.15: Sub-Variable: Government facilitation

ANOVA - Variable: Government facilitation					
Source of Variation	***SS***	***df***	***MS***	***F***	***p*-value**
Between Groups	3.820	2	1.910	6.509	.002
Within Groups	41.668	142	0.293		
Total	45.488	144			
ANOVA - Sub-Variable: Government					
Stakeholder 1	**Stakeholder 2**	**Diff. M_1-M_2**	**Scheffé p**	**Cohen's d**	
Eskom	IPPs	-0.03	.961	0.05	Not sig.
Eskom	NERSA	-0.39	.006	0.72	Medium
IPPs	NERSA	-0.36	.007	0.72	Medium

The Variable Government facilitation (Table 8.15) indicated a highly significant difference (p = 0.002) existed between stakeholders. Scheffe's test indicated the direction of difference between (Eskom and IPPs - 0.961), (Eskom and IPPs - 00.006) and (IPPs and NERSA - 0.007). Less difference existed between Eskom - NERSA and IPPs - NERSA. In terms of Cohen's d, there was no significance between Eskom and IPPs, medium significance between Eskom and NERSA and likewise for IPPs and NERSA. This indicated that for Government facilitation, NERSA Management revealed more variation in terms of responses to questions posed.

Table 8.16: Variable: SA Policy.

ANOVA - Sub-Variable: SA Policy					
Source of Variation	***SS***	***df***	***MS***	***F***	***p*-value**
Between Groups	0.390	2	0.195	0.520	.595
Within Groups	53.237	142	0.375		
Total	53.627	144			

Low significance differences (p = 0.595) for the variable SA Policy exist between stakeholders. The F value is indicated at 0.520. The F value for this Sub-Variable was reported at 0.520 as reflected in Table 8.16. The results indicated that there is no relationship between the groups on the variable: SA policy.

Table 8.17: Sub-Variable: Stakeholder.

ANOVA - Sub-Variable: Stakeholder					
Source of Variation	***SS***	***df***	***MS***	***F***	***p*-value**
Between Groups	6.973	2	3.486	23.332	.005
Within Groups	21.218	142	0.149		
Total	28.191	144			
Sub-Variable: Stakeholder					
Stakeholder 1	**Stakeholder 2**	**Diff. M_1-M_2**	**Scheffé p**	**Cohen's d**	
Eskom	IPPs	0.42	<.0005	0.97	Large
Eskom	NERSA	-0.06	.791	0.20	Small
IPPs	NERSA	-0.47	<.0005	1.17	Large

The Variable Stakeholder (Table 8.17) indicated a high significance difference (p = 0.005) between stakeholders. Scheffe's test indicated the direction of difference at the < 0.0005 significance level. Less difference existed between Eskom - IPPs and IPPs - NERSA. Cohen's d was found to be large (0.97) between Eskom and IPPs, small between Eskom and NERSA (0.20) and large between IPPs and NERSA (1.17). The Sub-Variable Stakeholder therefore indicated that responses were closely related with Eskom and NERSA but differed significantly between Eskom and IPPs and IPPs and NERSA.

8.8 INDUSTRY EXPERTS - INTERVIEWS

Interviews were conducted with Industry experts that specialise in the RE sector of the electricity industry. The targeted population was 25, however only 5 responded to the invitation to participate in the study. In this research study, personal interviews were conducted by informally interviewing 2 senior academics from the Nelson Mandela Metropolitan University (NMMU), 2 electricity industry consultants and a retired senior engineer. The following questions were posed:

- In your opinion why is Eskom facing electricity demand problems?
- How can alternative electricity generation assist in the current electricity supply crisis?
- What form of alternative electricity source is feasible in the South African context and why?
- What will constitute an optimal electricity-source mix for the South African electricity industry?

- How can entrepreneurship play a positive role in making a contribution to the electricity industry?
- How can alternative electricity sources be accommodated in the electricity industry?
- How can policy influence the RE sector?
- What kind of barriers exists for IPPs?

The themes for the industry experts' interviews are outlined in table 8.18. The researcher provides feedback based on the responses obtained in the interviews relating to each of the themes and sub-themes which are indicated. Responses from all the participants in the personal interview namely two senior academics from the Nelson Mandela Metropolitan University (NMMU), two electricity industry consultants and a retired senior engineer are presented.

Table 8.18: Thematic analysis of the qualitative data

THEMES	SUB-CATEGORIES
Theme 1: Alternative forms of electricity generation	• Solar generation • Wind generation • Hydro generation
Theme 2: Pressure on the electricity network	• High electricity demand
Theme 3: Enabling entrepreneurial environment	• IPPs as entrepreneurs
Theme 4: RE policy	• Importance of RE policy • Role of RE policy
Theme 5: Stakeholder management	• Stakeholder importance • Stakeholder's expectations

The Industry experts generally indicated that Eskom introduced alternative forms of electricity generation too late, hence the supply constraints that South Africa is experiencing. They advised that more policy needs to be written to ensure that alternative electricity generation is embraced and RE targets are pursued and met. Solar was viewed as the most feasible option for RE generation in South Africa as the climate suits such generation. They indicated that IPPs would not provide total solutions for the current electricity crisis however IPP entrepreneurs would alleviate pressure on the network.

Industry experts are of the opinion that RE policy is imperative to establish an enabling entrepreneurial environment. Some indicated that existing policy does not accommodate the entrepreneurial expertise IPPs bring to the electricity industry. The general indication was that IPP administration processes are cumbersome and slow. Recommendations were to have improved facilitation initiatives from government and other stakeholders such as Eskom and NERSA. Respondents felt that these stakeholders need to work together in trying to establish an enabling entrepreneurial environment for these IPPs in the RE sector. Industry experts were of the opinion that current policy is restrictive and seen as a barrier to entry for IPPs. They further indicated that the South African resource pool accommodates most forms of alternative electricity in the form of solar, wind and hydro. This is indicative of efforts towards the establishment of solar plants and wind farms which are RE initiatives, focused on increasing entrepreneurial activity within the electricity industry.

The general view was that entrepreneurship in the RE sector of the electricity industry is in its infancy stage and needs to be embraced by stakeholders. IPP entrepreneurs through increased entrepreneurial activity can make a valuable contribution to the RE sector and the overall economy, but need support in the form of increased entrepreneurial activity through:

- Smart Grid establishment;
- Improved IPP administration;
- Improved RE policy; and
- Improved stakeholder management.

8.9 REVISED THEORETICAL MODEL

In this study, hypotheses were tested and conclusions were drawn. For the purpose of the study, a revised theoretical model was formulated after the relevant hypotheses were considered for inclusion. Table 8.19 summarises the accepted hypotheses.

Table 8.19: Summary of accepted hypotheses.

Hypothesis	Wording	Status
H_1	There is a positive relationship between National Grid models and South African Smart Grid.	Accepted
H_2	There is a positive relationship between Mini-Grid models and South African Smart Grid model.	Accepted
H_3	There is a positive relationship between access to finance for entrepreneurs and essential components of entrepreneurship.	Accepted
H_4	There is a positive relationship between R & D transfer and essential components of entrepreneurship.	Accepted
H_5	There is a positive relationship between government facilitation and essential components of entrepreneurship.	Accepted
H_6	There is a positive relationship between business incubation and essential components of entrepreneurship.	Accepted
H_7	There is a positive relationship between wind as an RE source and the RE environment.	Accepted
H_8	There is a positive relationship between solar as an RE source and the RE environment.	Accepted
H_9	There is a positive relationship between best practice policy and the RE sector.	Accepted
H_{10}	There is a positive relationship between stakeholder management and the stakeholder theory.	Accepted
H_{11}	There is a positive relationship between stakeholder power and the stakeholder theory.	Accepted
H_{12}	There is a positive relationship between Smart Grid and an enabling entrepreneurial environment in the electricity sector.	Accepted
H_{13}	There is a positive relationship between Entrepreneurial components and an enabling entrepreneurial environment in the electricity sector.	Accepted
H_{14}	There is a positive relationship between RE environment and an enabling entrepreneurial environment in the electricity sector.	Accepted
H_{15}	There is a positive relationship between SA Policy and an enabling entrepreneurial environment in the electricity sector.	Accepted
H_{16}	There is a positive relationship between Stakeholder and an enabling entrepreneurial environment in the electricity sector.	Accepted

Based on all the information gathered (qualitative and quantitative) a revised theoretical model is proposed. The proposed theoretical model was presented in Figure 6.7 as established from the literature. The analysis resulted in the revision of the original theoretical model depicted in Figure 6.7 (Chapter 6). The revised theoretical model is presented in Figure 8.4. This revised theoretical model and subsequent hypotheses are the result of all variables considered for correlation. By using correlation, the variables determined through hypothesis testing, proved to have significant correlation and Cronbach Alpha scores. The following variables need to be included in the final theoretical model:

Table 8.20: Overall analysis of variables.

	Correlation	Cronbach Alpha
Smart Grids - *Eskom*	0.338	0.68
- *NERSA*	0.632	0.71
- *IPP*	-	-
Entrepreneurial components - *Eskom*	0.373	0.63
- *NERSA*	-	-
- *IPP*	0.513	0.67
RE environment - *Eskom*	0.367	0.57
- *NERSA*	-	-
- *IPP*	0.235	0.67
SA Policy - *Eskom*	0.486	0.80
- *NERSA (Solar)*	0.407	0.77
- *IPP*	0.446	0.75
Stakeholder - *Eskom*	0.321	0.77
Stakeholder - *NERSA (Smart Grids)*	0.311	0.79
Stakeholder - *IPP*	0.508	0.80

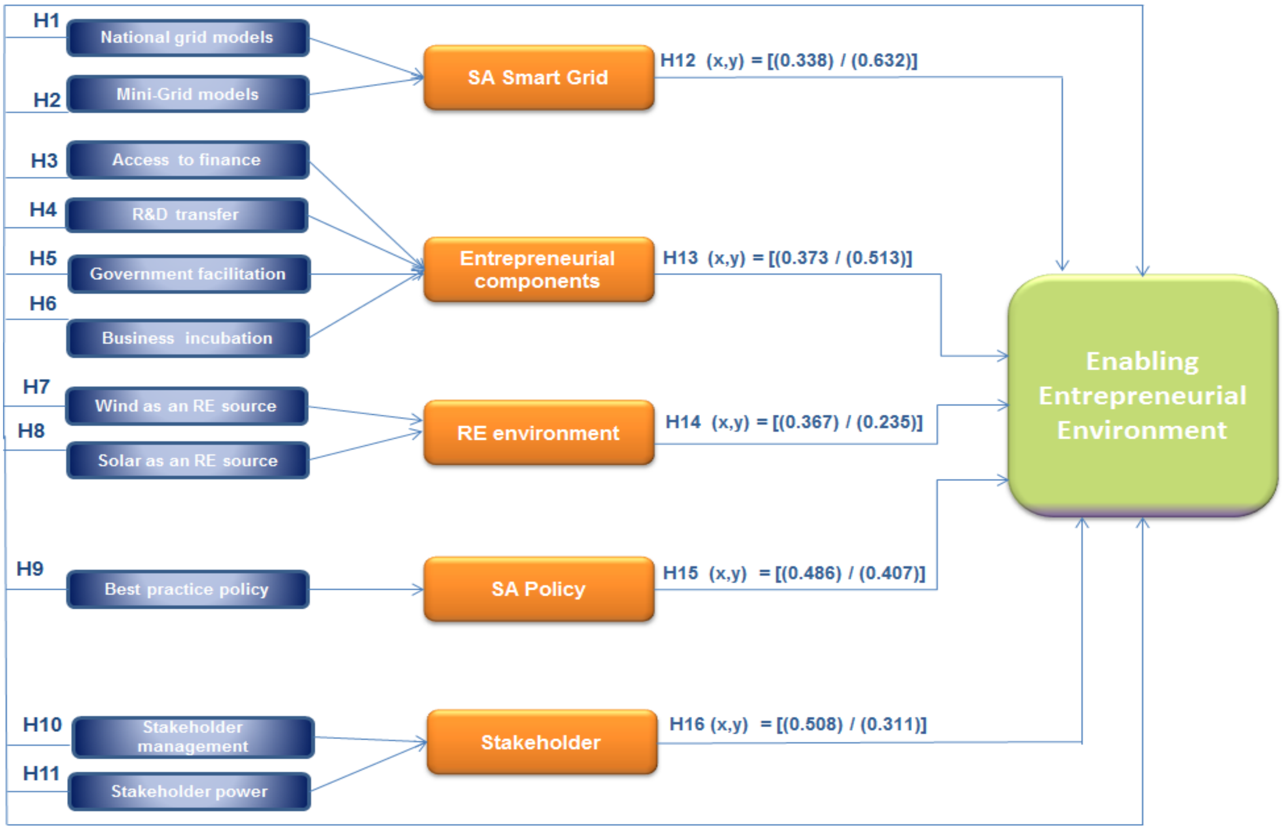
Table 8.20 indicates the variables considered for the final theoretical model. From this table it can be deduced that the above variables best suit the proposed IPP entrepreneurial model ensure an enabling entrepreneurial environment for increased entrepreneurial activity in the RE sector of the electricity industry.

For both Eskom and NERSA, Smart Grids have shown positive correlation to an enabling entrepreneurial environment, with correlation and Cronbach Alpha statistics measuring 0.338 and 0.632 respectively. The Entrepreneurial component variable has been omitted for NERSA while this variable has been positively viewed by Eskom and IPPs (0.373 and 0.513). Cronbach Alpha was measured at 0.63 and 0.67 respectively.

RE environment is a key variable within the RE sector, thus stakeholder perception was viewed as of vital importance to determine which RE sources are feasible in the electricity industry. Both Eskom and IPPs indicated a positive response in this variable (Cronbach Alpha of 0.57 and 0.67) while correlation figures indicated 0.367 and 0.235 respectively.

All stakeholders responded positively towards the variable SA Policy. In the RE sector, policy will be instrumental in ensuring that the framework is set for controlled entrepreneurial activity that would include administration, operations and process. High correlation and Cronbach Alpha measures were observed. Equally, stakeholders viewed Stakeholder Theory as positive and the results supported the fact. Winkler, et al. (2010) state that the adoption of a clear policy with regard to the electricity industry remains paramount. In the South African context, with specific emphasis on RE, a clear policy signal is required to drive efficiency and then switch to greater proportions of renewable energy. Thus, when all variables are considered this forms the basis for the revised theoretical model as proposed (Figure 8.4).

Figure 8.4: Revised theoretical model.



Source: Own construction, 2014.

8.10 SUMMARY

The aim of this chapter was to present the empirical results of the study. A summary of the demographic information concerning the respondents and the length of time they had been working in the electricity industry was given. With regard to the validity and reliability of the items, five variables were identified as contributing to an enabling entrepreneurial environment in the RE sector of the electricity industry. These variables were *Smart Grid, Entrepreneurial Components, RE environment, SA Policy and Stakeholder* provided enough evidence of reliability. The operational definitions of the variables were reformulated and the model revised based on these results.

In order to summarise the gathered data, numerous descriptive statistics (means, frequency distribution and standard deviations) were calculated. Cronbach Alpha and Pearson's correlation coefficients were calculated to assess the relationships between the different variables. Finally, an analysis of the variance (ANOVA) was conducted in order to evaluate the influence of various demographic variables on all the variables investigated in this study.

Chapter 9, the last chapter of this study will provide interpretations of the results as well as a brief summary of the study. Recommendations to the RE sector of the electricity industry will be provided based on the implications of the empirical results. Lastly, the contribution of the study, its limitation and recommendations for future studies will be delivered.

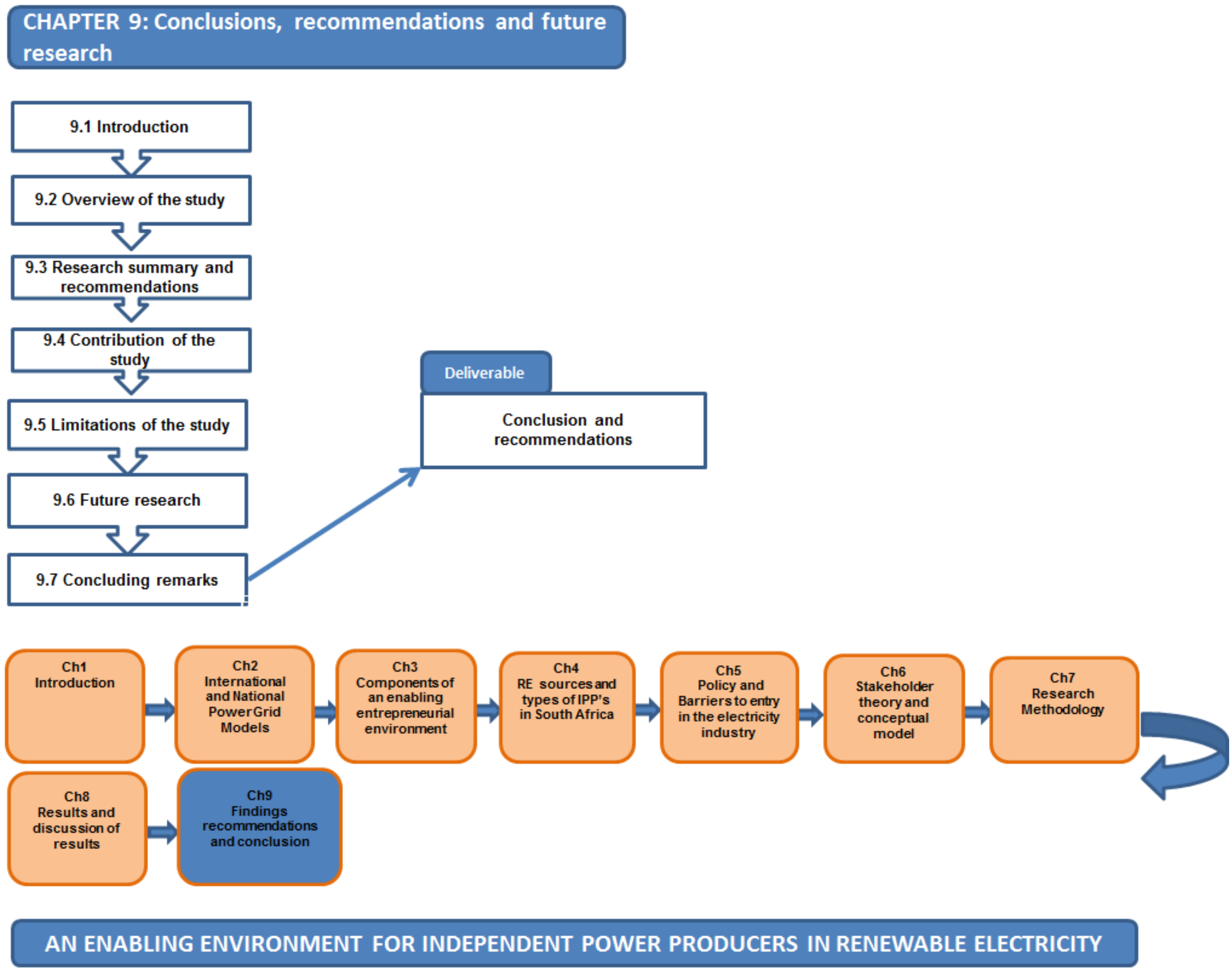


Figure 9.1: Outline of the chapter.

CHAPTER 9

CONCLUSIONS, RECOMMENDATIONS AND FUTURE RESEARCH

9.1 INTRODUCTION

Challenges experienced in the electricity industry and the subsequent impact on social and economic development globally and in South Africa necessitate reform in the industry. These sentiments are echoed by Heller and Victor (2004) who reiterate that the electricity industry is the growth engine of modern industrial and emerging economies while the centralised characteristics of power systems conceptually make them a pivotal public utility. Hence, the lessons learnt from experience about reforms in the electricity industry matter and can serve as essential economic and political tests for governments when undertaking the reforms which prove to be crucial to emerging economies.

Sen and Jamasb (2012) highlight the necessity to revisit the experience of the process and impact of such market-driven reform trends and draw on lessons learnt in the electricity industry. Therefore, electricity industry reforms, if successful, should enhance the efficiency of the industry, improve electricity access and reliability, improve service quality, reduce the price-cost gap through cost-reflective pricing and increase investments by taking into consideration more than 20 years of reform period in reforming economies (Sen and Jamasb, 2012). Diversification of the electricity generation in South Africa by means of alternative electricity sources is imminent and should be considered. Such diversification of the electricity industry can be achieved through the mobilisation of IPPs where key efforts should be devoted to RE generation.

Notwithstanding, the role of the electricity industry in climate change mitigation in South Africa is important. It is anticipated that with emissions to 2050 will continue to be dominated by energy sources which are increasing at a far more rapid rate than emissions from non-energy sectors (Tyler, 2009). The country has undergone an electricity supply crisis, which has prompted an urgent reassessment of certain aspects of the electricity industry, including energy institutions, regulation and policy. Areas of synergy and conflict with the country’s climate change mitigation objectives are explored and mitigated. Such projects where the roll out of RE programmes through IPPs is considered but the aim should be to establish greater policy alignment and the establishment of an enabling entrepreneurial environment for IPPs in the same process (Tyler, 2009).

Chapter 9 is the concluding chapter of this study. The main aim of this chapter is to suggest recommendations to the electricity industry and managers, based on the findings of this study. Hence this chapter is addressing the final research question and objective RQ_m and RO_m.

> *RQ_m What components need to be included in a model to promote an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector?*
>
> *RO_m: To propose a model for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector.*

This chapter will deliver an overview (Section 9.2) of the study and will summarise the most significant results (Section 9.3). Based on the findings and interpretations, recommendations to the electricity industry and managers will be provided (Section 9.3). Subsequently, the contribution of this study will be discussed (Section 9.4) and the various limitations of the study will be highlighted in Section 9.5. This is followed by future research (Section 9.6). This study will end with concluding remarks (Section 9.7).

Based on the purpose of the research and the research objectives, the main Research Question (RQ_m) may be formulated as follows: *What components need to be included in a model to promote an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector?*

9.2 OVERVIEW OF THE STUDY

The primary objective of this study was to propose a model for an enabling, entrepreneurial environment for IPP entrepreneurs in the RE sector and in particular, to create an enabling entrepreneurial environment for IPP entrepreneurs in the electricity industry (Winkler, 2006). This was prompted by the limited published research on the utilisation of RE in the electricity industry. In order to address the primary objective of this study, subsequent secondary objectives were developed:

Sub-research questions:

- RQ_1 – What type of Grid models exist in the RE sector?
- RQ_2 – What are the components of an enabling entrepreneurial environment?
- RQ_3 – What RE sources are available that IPP entrepreneurs can utilise in the RE sector?
- RQ_4 – What type of IPPs are required in the South African electricity sector?
- RQ_5 – What are best practice policies that the South African RE sector could consider?
- RQ_6 – How do stakeholder theory and stakeholder management influence the South African RE sector?
- RQ_7 – What are the components of a proposed model for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector?
- RQ_8 – What are the electricity's industry results of an evaluation of the proposed enabling entrepreneurial model for IPP entrepreneurs in the RE sector?

In Chapters 2, 3, 4, 5 and 6, a literature review was conducted, thus addressing the secondary research objectives 1-6 of this study. In the following paragraphs, a brief overview of these chapters is presented.

The research question RQ_8: What are the electricity's industry results of an evaluation of the proposed enabling entrepreneurial model for IPP entrepreneurs in the RE sector? is directly linked to the thesis statement: *An enabling entrepreneurial environment for IPPs in the RE sector that will allow all stakeholders to contribute positively to the electricity industry as a whole.*

Chapter 2 addressed the first research objective of this study $RO_{1.}$ This chapter focused on international and national Grid models. The discussion started by conceptualising electrical Grid models. The concept was proven to have various definitions but for the purposes of this study, the term electrical grid model is described as an interconnected network for delivering electricity from suppliers to consumers. Chapter 2 further discussed the importance of securing reliable electricity delivery and emphasised that the scale and nature of the access gap and locations involved need to be addressed. This implies that electricity will need to be provided through both centralised and decentralised energy technologies and systems. In order to ensure the efficient functioning of the electricity industry, a combination of four general power grid models, namely, the Grid extension model, Mini-Grid access model, Off-Grid access model and Smart Grid model were proposed. The mentioned models are important to the industry as innovation is sought after in the electricity generation process. To this end, the importance of grid-connected models, commonly known in the electricity sector as IPPs, was highlighted as becoming an increasingly important predictor of success in RE advancement world-wide. The important role of RE in global economic development and its dependence on the availability of accommodative RE models for IPP participation, was discussed. In terms of international Grid models, the general consensus amongst countries is that existing electricity grids are not sufficient in terms of capacity, efficiency, reliability, security and environmental impact to supply the electrical power needs of modern societies.

Chapter 3 addressed the second research objective RO_2. This chapter provided an outline of entrepreneurship and its components in an attempt to identify an enabling environment for IPP entrepreneurs in the RE sector. In particular, this chapter focused on the components of an enabling entrepreneurial environment. Several definitions of entrepreneurship were presented, however, for the purpose of this study, entrepreneurship refers to the process of perceiving and attempting to exploit new business opportunities as an essential part of an organisation’s ability to succeed in an ever-changing and increasingly competitive global marketplace. The importance of the IPP as ecopreneur of the electricity industry who are able to spot latent opportunities and contribute toward lowering carbon emissions of conventional electricity production and producing cleaner electricity in the form of RE, was discussed.

It was found that in a number of key areas in South Africa’s performance, entrepreneurial activity has weakened considerably since 2002. Numerous literature sources were consulted to identify the proposed components of an enabling entrepreneurial environment, namely, access to finance, barriers to entry for entrepreneurs, government facilitation, research and development transfer and need for business incubation. This enabling entrepreneurial environment is fashioned by providing essential components needed to seize opportunities and advance the economy of a country. The chapter highlights that the key to achieving an enabling entrepreneurial environment lies in overcoming barriers to the efficient functioning of markets for environmental resources. The process will thus provide entrepreneurs with an enabling environment at the start-up stage of the development of an organisation, to help reduce the cost of launching the enterprise, increase the capacity of the entrepreneur and link the entrepreneur to the resources required to start a competitive enterprise.

Chapter 4 investigated the RE sources and types of IPPs in South Africa. Sources of RE and the types of IPPs complementing the relevant sources were identified. The importance of a mix of solar, hydro and wind alternatives which must be added to the grid as new RE technology unfolds was discussed.

The literature revealed that the theoretical potential for RE in countries such as South Africa is significant, therefore exploring renewable forms of electricity sources is important in making a contribution to the welfare of the environment. It was found that an optimal mix of RE and conventional electricity is of vital importance to the electricity grid. Finally it was demonstrated that RE can contribute towards a more sustainable electricity industry through the introduction of IPPs to the grid. This chapter attained the research objectives four and five (RO_3 and RO_4).

The next secondary objective (RO_5) was achieved in Chapter 5 (Policy and best practice in the electricity industry). This chapter started with a focus on the current global RE situation. Next, barriers and incentives for IPPs in the RE sector were discussed. The importance of policy as one of the main drivers in moderate and high-renewable scenarios in the electricity industry was discussed. Further, the alignment of existing and emerging energy and related policy areas with RE aspirations were highlighted. It was found that there is inadequate institutional capacity to support energy efficiency as well as RE responses to climate change mitigation. Where these are attempted, they are thwarted by lack of co-ordination, or more sinisterly, by well-established institutions with vested interests in maintaining the status quo. The establishment of a single, overarching, co-ordinating energy policy institution is identified as a pre-requisite to any chance of alignment. Despite misalignment and delays at the policy level, stakeholders such as Eskom, NERSA and Government have achieved some success in attaining a certain level of change. Central to the success of the electricity industry in the long-term is how the South African RE sector can accommodate IPP entrepreneurs on the power grid.

Chapter 6 addressed the sixth secondary research objective (RO_6). This chapter introduced the academic theory on which the research was based and the components for an enabling entrepreneurial environment within the RE sector of the South African electricity industry. Various definitions of stakeholder theory and stakeholders are identified. In this study, stakeholders signify any group or individuals who may affect or be affected by the attainment of an organisation's goals. In particular, Government, Eskom, NERSA, IPPs and the public are identified as stakeholders. The chapter highlights the fact that NERSA and Government act as the decision contributors in the RE sector. Eskom power utility is given the opportunity to influence decision making within the electricity industry at large (Ferrari, 2008). The public and IPPs are being given an opportunity to be heard prior to decision making. The role of each stakeholder proves to be an important component for key decision making and the influence they have needs to be valued. Thus each stakeholder has power to impose its will on the organisation, especially through the control of resource.

The literature further indicates that the management of stakeholders plays an integral role in organisations as it too has a stake in the modern business environment. Further, the theory does not give primacy to one stakeholder group over another, though there will surely be times when one group will benefit at the expense of others. It was found that needs of each stakeholder group has to be considered. Managing these stakeholders is critical to ensure they promote participation and increased entrepreneurial activity within the RE environment. Thus, protecting the interests of each stakeholder group empirically ensures best practice to support the prevailing stockholder-centred system within the RE sector.

The seventh secondary research objective (RO_7) was addressed in Chapter 7. In this chapter, the research methodology and design were elaborated on. The population as well as the sampling method were described. With regard to the data collection procedure, three questionnaires were designed, targeted at Eskom Management, NERSA Management and Approved and Non-Approved IPPs and interviews were conducted with Industry experts. The process for collecting the primary data was also explained. The method used to evaluate the validity and reliability of the questionnaire was explained. In order to assess the reliability of the measuring instrument, Cronbach Alfa coefficients were calculated. Finally the statistical techniques adopted to analyse the data were described.

The final secondary research objective (RO_8) was addressed in Chapter 8. This chapter presented the results of the statistical analyses. The validity of the dependent and intervening variables were assessed by means of a pilot study conducted for the three questionnaires. An Analysis of Variance (ANOVA) was undertaken in order to obtain an understanding of the relation between respondent groups.

9.3 RESEARCH SUMMARY AND RECOMMENDATIONS

The research study utilised three questionnaires across the electricity industry. The research results indicated that at organisational level Eskom Managers were supportive of structures for the electricity industry that are considered necessary to accommodate IPPs in the RE sector. Respondents agreed that the implementation of electricity policies is imperative in the electricity industry towards improved IPP entrepreneurial participation. SA policy in turn was seen to be instrumental in assisting Government and Eskom to facilitate the IPP process and feeding the RE generation into the network. Respondents were predominantly positive about the role of Smart Grids in future electricity generation and its contribution towards an enabling entrepreneurial environment (Table 9.1)

The need for early access to finance for IPP entrepreneurs was accentuated by the respondents. The literature has shown the need for finance in the early years of business as most businesses fail within the first few years of existence. The electricity industry proved no different as the years of experience of IPPs indicated that they are young in the industry, hence the emphasis on access to finance. A high stakeholder emphasis proved imperative for this group (IPPs) with results indicating stakeholder management as a key variable contributing to an enabling entrepreneurial environment.

The research results indicated that at legislative level, NERSA managers are of the opinion that not all RE policies have been equally effective and are contributing towards creating an enabling entrepreneurial environment for IPP entrepreneurs. Respondents indicated that through policy, greater emphasis can be placed on climate change and environmental challenges.

The South African Government and stakeholder (Eskom and including NERSA) facilitation proved essential for these groups, as the success of IPP entrepreneurs depends on a well-constructed and executed facilitation process. Sound policies led by NERSA are essential in ensuring key objectives for both environmental challenges and increased IPP activity in the RE sector. Consequently, government, NERSA and Eskom should continue to update and revise policies.

The research results indicated that at entrepreneurial level, Approved and Non-Approved IPPs are facing challenges pertaining to access to finance for start-up business ventures. This continues as additional access to finance and aspects of operations in this capital-intensive industry remain a challenge. Results highlighted a gap in administrative and finance related support to entrepreneurs as respondents felt that limited to no support is given to aspiring IPP entrepreneurs within the first two years of operation. IPPs stressed that the opportunities within the RE sector with particular preference to solar and wind are feasible electricity generation alternatives. The importance of increased entrepreneurial activity was stressed by IPPs and the results indicated their confidence in large-scale PV (photovoltaic) systems being able to feed into most electricity grids. Further, it was observed that solar systems are declining in cost, improving in efficiency and steadily increasing in sales. From the results it is believed that IPPs are confident that if new policies for RE match existing South African policies for electricity generation, increased entrepreneurial activity can be experienced.

This research study highlighted the rapid change in the electricity industry with specific focus on the RE sector introducing electricity generating alternatives such as wind, solar and hydro. Results reveal that it is imperative that power utilities such as Eskom need to stay abreast of electricity generation technologies in the quest to alleviate electricity supply shortages while lowering carbon emissions. Successful intervention relies on substantial involvement of government, Eskom and other relevant stakeholders. The author identifies key areas for collaboration and recognises the diversity of South Africa and its needs. These measures will help to accelerate RE deployment, liberating local innovation and industry, while bringing clean electricity generation to the country.

The unique contribution of this research is a proposed model for an enabling entrepreneurial environment for IPPs in the RE sector that can be utilised to ensure increased entrepreneurial activity within the electricity industry. The establishing of such an enabling environment would contribute positively to the alleviation of the electricity demand crisis, lower carbon emissions and create a sustainable, more diverse electricity generation mix. The proposed IPP industry model for an enabling entrepreneurial environment has addressed the problems experienced at different levels of the electricity industry, utilising three questionnaire methods. The research study further provides suggestions and proposes interventions at all levels of the electricity industry with specific focus on the RE sector.

The Industry IPP Model (Figure 1.2) was proposed and utilised in two important ways. Firstly, the model presented the three major levels in the electricity industry, indicating how RE fits into electricity industry and further addresses the electricity and energy mix in South Africa. To this end, the study employs three questionnaires to address the three problems at the different levels of the electricity industry. Secondly, in addressing the problems in the electricity industry, results from the questionnaires reveal suggestions at the organisational, legislative and entrepreneurial level which contribute to the creation of an enabling entrepreneurial environment for IPP entrepreneurs.

The unique contribution of this research is a proposed industry IPP Model for the creation of an enabling entrepreneurial environment model for IPP entrepreneurs. Thus, having such an environment will reach higher levels of success for IPP entrepreneurs and in the process will aid power utilities such as Eskom to deal with rapid electricity demand hikes which are a challenge to contend with. The model can be utilised to increase entrepreneurial activity in the RE sector of the electricity industry in South Africa at different levels by using the three survey methods. The research study further provides suggestions and proposes interventions at all levels in the RE sector of the electricity industry.

The main research question, addressed by this research study, was formulated as follows:

What components need to be included in a model to promote an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector?

The recommendations outlined in Sections 9.3.1 – 9.3.3 are provided to address the problems experienced at organisational level, legislative level and entrepreneurial level.

9.3.1 Organisational level

Identified problems at this level:

- Existing structures of the electricity industry do not accommodate IPPs in the RE sector;
- There is no alignment of IPP initiatives with organisational imperatives;
- There is no integration of RE entrepreneurship into Eskom's existing strategy; and
- Electricity policies are not aligned to RE generation.

Although the South African Government supports increased entrepreneurial activity within the electricity industry, IPPs are provided with limited support and the government endorsed the integrated resource plan which promoted the involvement of IPPs; power utility Eskom and the electricity industry at large. This is a national effort to promote entrepreneurial activity in the industry while simultaneously providing alternative electricity solutions to a struggling electricity network. Therefore, there is still opportunity to consider better generation location strategies in the longer term. The diversification of the electricity generation industry is largely dependent on the RE sector where IPPs seem to be the vehicle for successful implementation.

Another generation strategy that can provide advantages in terms of a diverse generation mix is to consider alternative RE sources of generation. These would be smaller-sized plants in the form of IPPs which can be integrated into generation networks utilising existing grid infrastructure (Pickering, 2010). Options such as regional hydro and photovoltaic generation that can fulfil the requirements and the expectations of the electricity household demand should be a primary consideration for IPP entrepreneurs feeding the grid (Pickering, 2010).

The potential for RE in countries such as South Africa is enormous in the RE sector of the electricity industry. Moreover, exploring renewable forms of electricity sources is of utmost importance in making a contribution to the environment. Thus, investment in RE and energy efficiency becomes critical to reduce the negative economic, social and environmental impacts of electricity production and consumption (Nathwani and Chen, 2012). Thus, IPP entrepreneur participation in the electricity industry (in the form of IPPs) can contribute to expanded supply, provided there is access to the grid for independent power production in the form of IPP entrepreneurs (Clark, et al., 2005).

Núñez-Luna (2005) argues that a strong need exists to authorise private sector participation in certain sectors of the industry that “do not constitute public service”, but which ultimately means that private projects cannot sell electricity directly to end-users. Taking this into consideration, private IPP entrepreneurs can participate in the following subsectors: self-generation, co-generation, independent production and import-export of electricity liberally. Each of these sub-sectors can be utilised as key initiatives in the RE sector by serving as a driving force behind green initiatives (Nathwani and Chen, 2012). This is also the case in emerging countries where IPP generation receives key focus. Initiatives can contribute greatly to:

- Significant reduction of carbon emissions;
- Increased accessibility to electricity services;
- Promoting energy diversity thus securing an optimal energy mix; and
- Providing innovative ways dealing with climate change (Ojha, 2009).

Recommendations at the Organisational level

- The electricity industry (Eskom and Government) structures should accommodate IPPs;
- Utility Eskom’s organisational imperatives should align with IPP initiatives which both government and Eskom envisage to implement;
- Both government and Eskom’s business strategy should allow for RE integration in the form of RE sources (wind, hydro and solar);
- Entrepreneurial efforts aligned with these initiatives should be supported by stakeholders (Eskom, Government and NERSA);
- Build partnerships and national networks to support IPP development; and
- Accreditation process for IPPs should be accelerated and become more streamlined.

9.3.2 Legislative level

Identified problems at this level include:

- Restrictive legislation that does not aid entrepreneurial activity;
- A lack of operational objectives governing IPP activity;
- RE policy creating barriers to entry; and
- Inappropriate policy geared more towards coal generation than RE.

RE can contribute towards a more sustainable electricity industry through the introduction of IPPs to the grid. Therefore, an enabling entrepreneurial environment needs to be created to reap both economic and environmental benefits for any country (Ma, et al., 2008). Such an enabling entrepreneurial environment will therefore necessitate meticulous regulation aided by impeccable policy particularly, in South Africa where RE is still in its infancy stage (Ma, et al., 2008).

However, not all RE policies have been equally effective and success has often rested on detailed design and implementation. Consequently, governments continue to update and revise policies in response to challenges to design and implementation and in response to advances in technologies and market changes. These policies will continue to exert a strong influence on national markets in the years and decades ahead. It is clear therefore that in the future, national policymakers will confront a wide range of choices and considerations in continuing, updating and retiring existing policies to ensure a more enabling legislative system governing IPP activity (REN 21, 2013).

As renewables become more integrated with existing infrastructure, legislators will confront the need for new policies and policy cycles to achieve these various forms of integration (REN 21, 2013). Governments, academics and the professional legislative organisations that form the peer networks of bureaucrats and politicians have described the policy cycle as a process that starts with a need and ends with an evaluation of policy impact (IRENA, 2012). In particular, the prescribed policies revolve around eliminating economic barriers (barriers to investment related to insufficient revenue, access to finance or excessive start-up cost). By levelling the playing field of renewables vis-à-vis fossil fuels as well as by implementing support mechanisms that compensate for high costs, limited access to finance and insufficient demand policies can aid entrepreneurs in this regard (Garcia, 2013).

The following recommendations emanated from this study:

Recommendations at the Legislative level

- Policies should be written to accommodate entrepreneurial activity in the electricity industry;
- Utility Eskom's organisational imperatives should align with IPP initiatives government wants to implement;
- The government and Eskom's business strategy should allow for RE integration with the support of legislation;
- Government facilitation of key legislative processes;
- Build partnerships and national networks to support IPP development;
- Policy should remove, or compensate for barriers;
- Removing restrictive policy will ensure competitive renewable technologies;
- Policy to support RE generation; and
- Best practice in policymaking and legislative processes for the deployment of grid-connected RE.

9.3.3 Recommendations at the Entrepreneurial level

Identified problems at this level include:

- Limited industry and governmental facilitation for IPPs in gaining access to the grid;
- Unrealistic industry requirements for entrepreneurial activity;
- Start-up finance for IPP entrepreneurs; and
- Poor stakeholder facilitation.

Whilst established corporations are realising the importance of being environmentally friendly, it is believed that they are executing push strategies, whereby government's regulatory agencies, stakeholders and lobby-groups impel policy and guiding principles to act in an environmentally conscious manner (Bell, 2012). As entrepreneurship is an activity that is action-oriented, the individuals who innovate take risks and create value in the form of new products and services and this creates an opportunity for entrepreneurs to enter the market (Mokaya, et al., 2012).

As in any industry, entrepreneurship in the electricity industry stems from the actions of individuals and organisations seeking new business opportunities. National investments into education and research transfer into businesses only when there are sufficient incentives to gather complementary assets for business development (Juha-Pekka and Hokkanen, 2009).

Essential ingredients for entrepreneurial success include the willingness to take calculated risks in terms of time equity, or career. The ability to formulate an effective venture team to marshal, needed resources, the fundamental skill of building a solid business plan and the vision to recognise opportunity where others see chaos, contradiction and confusion add to entrepreneurial success (Kuratko and Hodgetts, 2007).

The current pressure on power utilities to lower carbon emissions of conventional electricity production and produce cleaner electricity in the form RE creates an opportunity for entrepreneurs to exploit (Gibbs, 2009). For the electricity industry, the IPP plays a key role as entrepreneur of the RE sector. These entrepreneurs who are able to spot latent opportunities, commercialise them and direct the growth of a new industry are well-positioned to capture very large economic gains for their firms and for the society (Valliere and Hrelja, 2011).

IPPs are therefore the vehicle for entrepreneurship in the electricity industry by ensuring that a government attains its goals; attracts private capital, encourages the introduction of new technology and catalyses a better managed and more competitive electricity market (Woo, 2005). To date, the thrust of the reforms in the electricity industry worldwide was to increase private sector participation in order to reap the benefits from increased competition and efficiency in power generation (Woo, 2005).

Incorporating IPPs into the electricity industry depends on a series of interlocking changes elsewhere in government that are essential to impose market discipline on the industry. For example, state budget reforms have been essential to imposing hard budget constraints on State Owned Enterprises (SOEs) such as Eskom. The imposition of independent corporate governance has been essential in creating truly competitive and accountable new private enterprises (Woodhouse, 2005a).

It is crucial that the private sector plays a role in addressing the future electricity needs of South Africa. This will reduce the burden of funding on the government, relieve the borrowing requirements of Eskom and introduce electricity generation technologies that Eskom may not consider as part of its core function. These however may play a vital role in future electricity supply options, in particular Off-Grid, distributed generation, Smart Grids and small-scale renewable projects. Similarly, Ozigbo (2014) contends that, in South Africa and through this innovative practice, entrepreneurs will be able to create new, competitive markets and businesses which lead to job creation and have a multiplying effect on the economy.

The importance of IPP entrepreneurs in the electricity industry cannot be discounted. Modern electricity networks need alternative forms of electricity generation, therefore IPPs form an integral part of future electricity networks in RE sector. Thus, to address these challenges, the recommendations below are proposed.

Recommendations at the Entrepreneurial level

- Governmental facilitation for the entire IPP process (registration – generation);
- Create business incubation units to develop young entrepreneurs;
- Government facilitation of access barriers;
- Improved access to start-up finance;
- Availability of financial capital and access to finance;
- Awareness and network building;
- Research and development transfer;
- Entrepreneurial education and skills;
- A culture that is tolerant of failure; and
- A stable regulatory environment.

9.4 CONTRIBUTION OF THE STUDY

This study has made a contribution to research in the electricity industry by proposing a model for an enabling environment for IPP entrepreneurs in the RE sector. There are limited studies addressing the entrepreneurial activity in the electricity industry and more specifically in the RE sector. This study has made a contribution by developing three questionnaires that were appropriate for identifying and assessing the components of an enabling entrepreneurial environment in the RE sector of the electricity industry. The items contained in these questionnaires could be used to develop other measuring instruments for future studies.

An important contribution has been made towards Stakeholder Theory as it proves to be instrumental within the RE sector of the electricity industry in South Africa at large as the mentioned role players have a reciprocal role to play. Managing these stakeholders is thus critical to ensure the effective participation and integration for increased entrepreneurial activity. Thus, protecting the interests of each stakeholder group empirically ensures that best practice within the RE sector of the electricity industry is upheld.

As a result, the study presents recommendations to ensure that stakeholder management is used as a tool in the quest for improved relations between industry stakeholders (Eskom, NERSA, IPPs and the public) in order to create an enabling entrepreneurial environment.

9.5 LIMITATIONS OF THE STUDY

The study focused on power utility Eskom and NERSA and its relevant departments in South Africa. In addition, Approved and Non-Approved IPPs provided insight into entrepreneurship in the RE sector of the electricity industry. However, a few limitations have been acknowledged. Based on these limitations, recommendations will be made on how to overcome these difficulties in future research:

- The research under investigation was based on purposive sampling. The sample was also limited in its size. Future studies can be based on sampling that is more representative. In addition, a larger sample should be obtained for future studies.
- This study only focuses on selected variables and does not consider the various other variables influencing an enabling entrepreneurial environment for IPP entrepreneurs in the electricity industry. Future studies could present a broader

view on the subject by investigating variables such as economic variables (public private partnerships and foreign investment) as well.

- The small sample size of this study led to the use of item analysis. Future research should have large enough to conduct broader analysis.
- The qualitative study of the research study should be broader that will allow for a more in-depth qualitative analysis.
- Only 150 usable questionnaires out of 225 sent were returned after the two-month period allowed for the collection of data. This demonstrated that the time period allocated for the respondents to return the questionnaires was too short. Future studies should set more time aside for the collection of data.
- A final limitation to the research study is that extensive research on interventions at the organisational level with regard to an enabling entrepreneurial environment in the electricity industry was not included in this study.

9.6 FUTURE RESEARCH

The study has provided the foundation for the promotion of increased entrepreneurial activity within the electricity industry with specific focus on RE. A significant finding is that most IPPs participating in this questionnaire indicated that the current South African entrepreneurial environment is not conducive for IPPs. Industry barriers such as access to finance and support from government for business incubation and RE policy implementation need to be focus areas.

This study has highlighted the importance of promoting an enabling entrepreneurial environment in the electricity industry. Problems at different levels have been identified and recommendations provided. Comparing the South African electricity industry with other electricity industries such as China, Finland and India proved that the South African electricity model lacks focus and needs to provide additional interventions in terms of an entrepreneurial environment for IPPs. Additional research needs to be conducted at the legislative level to provide the necessary high level strategies to combat the barriers created by policy and legislative restrictions in South Africa. The study further focussed on the importance of government facilitation as well as the importance of stakeholder support in the RE sector of the electricity industry.

The focus if the problem experienced in the RE sector to promote entrepreneurial activity is that IPPs are not considering venturing into newer areas such as hydro and wind generation. The fact that power utility Eskom and the government are not encouraging IPPs to pursue business opportunities in these key areas hampers industry growth and possible solutions to a struggling electricity industry. In this study, statistical results from the entrepreneurial level (Approved and Non-Approved IPP Questionnaire) indicated that the questionnaire needs to be redesigned to address a wider range of RE source alternatives. The redesign of Approved and Non-Approved IPP questionnaires is of utmost importance and requires urgent future research so as to provide insight into the possibilities of other alternatives such as biomass and gas.

9.7 CONCLUDING REMARKS

This research study highlighted the need for reform in the electricity industry and the introduction of RE alternative electricity generation through the establishment of a proposed model for an enabling entrepreneurial environment for IPP entrepreneurs. The investigation into a proposed model for an enabling entrepreneurial environment in an attempt to promote increased entrepreneurial activity in the electricity industry is of particular significance. The link between IPPs and an enabling entrepreneurial environment with a firm policy to support RE initiatives has been empirically documented in this research study.

Dean and McMullen (2007) state that the key to achieving an enabling entrepreneurial environment lies in overcoming barriers to the efficient functioning of markets for environmental resources. Subsequently, the unique characteristics of many environmental resources do not tend to be easily amenable to market allocation. Entrepreneurs thus create and improve markets for such resources through entrepreneurial action that results in the development of economic institutions, the reduction of transaction costs, dissemination of information and the motivation of government action (Dean and McMullen, 2007). The principle challenge to the electricity industry is therefore to establish an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector.

In reporting on the findings, this study concluded that:

- Access to finance is experienced as a barrier for RE development;
- Greater Government facilitation assisting IPPs is needed;
- Embracing Smart Grids will encourage RE activity;
- Stakeholder Management was found to be central to the operation in the industry; and
- Policy is one of the main drivers for RE expansion.

The aforementioned findings proved to be critical for an enabling entrepreneurial environment whilst addressing the main research objective (ROm): To propose a model for an enabling entrepreneurial environment for IPP entrepreneurs in the RE sector.

For IPP entrepreneurs, it is evident that the electricity industry will benefit in promoting entrepreneurial activity in the industry. This can be done by establishing an enabling entrepreneurial environment for increased entrepreneurial activity through the effective entrepreneurial components, feasible RE sources, effective policy implementation and effective stakeholder management in the industry. Although managing each area comes with its own challenges as seen in the results presented in the study, to eradicate barriers in the quest of such an enabling entrepreneurial environment is not an insurmountable task. Through the establishment of such an enabling environment, the RE sector of the electricity industry can benefit greatly with regard to more optimal electricity generation and ultimately increased economic benefits at large.

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APPENDIX A: Form E – Ethics

Nelson Mandela Metropolitan University

for tomorrow

FORM E

ETHICS CLEARANCE FOR TREATISES/DISSERTATIONS/THESES

Please type or complete in black ink

FACULTY: BUSINESS AND ECONOMIC SCIENCE____________________

SCHOOL/DEPARTMENT:__BUSINESS SCHOOL__________________

I, (surname and initials of supervisor and co- supervisor) ___CULLEN,M.D.M. and CALITZ,A.P.

the supervisors for (surname and initials of candidate)_____V.P PALMER__

(student number) __**207081175**_______________________

a candidate for the degree of

________DBA_______________________________________

with a treatise/dissertation/thesis entitled (full title of treatise/dissertation/thesis):

____

____

considered the following ethics criteria *(please tick the appropriate block):*

	YES	NO
1. Is there any risk of harm, embarrassment of offence, however slight or temporary, to the participant, third parties or to the communities at large?		X
2. Is the study based on a research population defined as 'vulnerable' in terms of age, physical characteristics and/or disease status?		X
2.1 Are subjects/participants/respondents of your study:		X
(a) Children under the age of 18?		X
(b) NMMU staff?		X
(c) NMMU students?		X
(d) The elderly/persons over the age of 60?		X

(e) A sample from an institution (e.g. hospital/school)?		X
(f) Handicapped (e.g. mentally or physically)?		X
3. Does the data that will be collected require consent of an institutional authority for this study? (An institutional authority refers to an organisation that is established by government to protect vulnerable people)		X
3.1 Are you intending to access participant data from an existing, stored repository (e.g. school, institutional or university records)?		X
4. Will the participant's privacy, anonymity or confidentiality be compromised?		X
4.1 Are you administering a questionnaire/survey that:		X
(a) Collects sensitive/identifiable data from participants?		X
(b) Does not guarantee the anonymity of the participant?		X
(c) Does not guarantee the confidentiality of the participant and the data?		X
(d) Will offer an incentive to respondents to participate, i.e. a lucky draw or any other prize?		X
(e) Will create doubt whether sample control measures are in place?		X
(f) Will be distributed electronically via email (and requesting an email response)? Note: • If your questionnaire **DOES NOT** request respondents' identification, is distributed electronically and you request respondents to return it *manually* (print out and deliver/mail); **AND** respondent anonymity can be guaranteed, your answer will be NO. • If your questionnaire **DOES NOT** request respondents' identification, is *distributed via an email link and works through a web response system (e.g. the university survey system); **AND*** respondent anonymity can be guaranteed, your answer will be NO.		

Please note that if ANY of the questions above have been answered in the affirmative (YES) the student will need to complete the full ethics clearance form (REC-H application) and submit it with the relevant documentation to the Faculty RECH (Ethics) representative.

and hereby certify that the student has given his/her research ethical consideration and full ethics approval is not required.

15/12/2014

SUPERVISOR(S) **DATE**

15/12/14

HEAD OF DEPARTMENT **DATE**

STUDENT(S) **DATE**

APPENDIX B: Approval to conduct research – Eskom

Date:
20 August 2014
Enquiries:
Mr Len Turner
Telephone:
+27 11 800-5184

To: The Registrar
Nelson Mandela Metropolitan University

ETHICS CLEARANCE: CONFIRMATION OF ESKOM INTELLECTUAL PROPERTY RIGHTS AND SECURITY CLEARANCE FOR DOCTORATE RESEARCH – Vivian Palmer

This memorandum serves as an ethics clearance; confirmation of Eskom intellectual property rights and security clearance for the continuation of (Doctorate Business Administration) level research and write-up by Mr. Vivian Julian Palmer. The research topic is ***"An enabling environment for Independent Power Producers in renewable electricity."***

Mr. Vivian Julian Palmer has followed due internal processes in terms of gaining permission for this research.

It must be noted that this general clearance is for a limited period only, which will be for the rest of the financial year 2014 till end 2016, and in no way waives Eskom's Intellectual Property Rights.

Yours sincerely

Len Turner
Senior Consultant
Talent and Skills Management

APPENDIX C: Approval to conduct research – NERSA

Date:
20 August 2014
Enquiries:
Ms P Mahlangu
Telephone:
+27 11 800-5184

To: The Registrar
Nelson Mandela Metropolitan University

ETHICS CLEARANCE: CONFIRMATION OF NERSA INTELLECTUAL PROPERTY RIGHTS AND SECURITY CLEARANCE FOR DOCTORATE RESEARCH – Vivian Palmer

This memorandum serves as an ethics clearance; confirmation of NERSA intellectual property rights and security clearance for the continuation of (Doctorate Business Administration) level research and write-up by Mr. Vivian Julian Palmer. The research topic is ***"An enabling environment for Independent Power Producers in renewable electricity."***

Mr. Vivian Julian Palmer has followed due internal processes in terms of gaining permission for this research.

It must be noted that this general clearance is for a limited period only, which will be for the rest of the financial year 2014 till end 2016, and in no way waives NERSA's Intellectual Property Rights.

Yours sincerely

Poppy Mahlangu
Senior Consultant
Communications

APPENDIX D: Eskom Management Questionnaire

ESKOM MANAGEMENT QUESTIONNAIRE
AN ENABLING ENVIRONMENT FOR INDEPENDENT POWER PRODUCERS IN RENEWABLE ELECTRICITY

INSTRUCTIONS

1. *Please mark your answers with an X in the appropriate block.*
2. *Questions are ranked from 1 – 5, 1 indicating Strongly Disagree and 5 indicating Strongly Agree.*

For the purpose of the study, the following definitions are utilised:

Grid: *A grid is an electricity network.*

IPP: *An IPP is an independent electricity generation utility feeding into the existing electricity network.*

Mini-Grid: *A tailored approach in electricity which can provide centralised electricity generation at the local level using a village-wide distribution network.*

Smart Grid: *an automated, widely distributed energy delivery network characterised by a two-way flow of electricity and information, capable of monitoring and responding to changes in everything from power plants to customer preferences to individual appliances.*

SECTION A: BIOGRAPHIC INFORMATION

1. Gender	Male	Female

2. Race	Asian	Black	Coloured	White	Other

2.1 If "Other" specify	

3. Position in organisation	Manager	Advisor	Specialist	General staff

4. Department	Engineering	Customer Services	Strategy	Finance	Other

4.1 If "Other" specify	

5. Province you are located	Eastern Cape	Free State	Gauteng	Kwazulu Natal	Limpopo
	Mpumalanga	North West	Northern Cape	Western Cape	

6. Age	18 - 24	25 - 29	30 - 39	40 - 49	50 +

7. Years experience in electricity industry	Less than 2	2 - 4	5-9	10-19	

8. Highest Qualification	Matric	Diploma	Degree	Post Grad

9. E- mail address, if feedback is required	

SECTION B: ENTREPRENEURIAL ENVIRONMENT

*With regard to the **Entrepreneurial Environment** in respect of South Africa, to what extent do you agree with the following statements?*		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
B1	I am satisfied with the entrepreneurial environment created for business in South Africa.	1	2	3	4	5
B2	Few barriers exists that hamper entrepreneurial activity in South Africa.	1	2	3	4	5
B3	Smart Grids accommodate alternative electricity provision sources in the electricity industry.	1	2	3	4	5
B4	The grid model makes it easy to accommodate alternative electricity generation environments.	1	2	3	4	5
B5	Best practice policies have a positive effect on an enabling entrepreneurial environment.	1	2	3	4	5
B6	Smart Grids enable entrepreneurship.	1	2	3	4	5

SECTION C: SMART GRID

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
SA Smart Grid						
C1	Mini-grids form part of Smart Grids	1	2	3	4	5
C2	Mini-grids enable Smart Grids.	1	2	3	4	5
C3	Smart grids are future grid models.	1	2	3	4	5

C4	The Smart Grids embrace IPP activity.	1	2	3	4	5
C5	Off-grid models form an integral part of Smart Grids.	1	2	3	4	5
C6	Off-grids can operate independently from the Smart Grids.	1	2	3	4	5
C7	Smart Grids find it challenging to accommodate new electricity generation in the form of Off-grids.	1	2	3	4	5
C8	Alternative electricity provision sources can be accommodated in the electricity industry in the form of Off-grids.	1	2	3	4	5
C9	Off-grid electrification projects have cost benefit ratios that may exceed those of grid extension.	1	2	3	4	5

SECTION D: ENTREPRENEURIAL COMPONENTS

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Entrepreneurial components and access to finance						
D1	Entrepreneurship is critical to the development and well-being of society.	1	2	3	4	5
D2	Significant entrepreneurial activity in the electricity industry is evident.	1	2	3	4	5
D3	IPPs drive entrepreneurship in the electricity industry.	1	2	3	4	5
D4	IPPs cope effectively with barriers in the industry.	1	2	3	4	5
D5	Early-stage finance is one of the biggest barriers for start-up entrepreneurs.	1	2	3	4	5
D6	IPPs have no difficulty in obtaining access to start-up finance.	1	2	3	4	5
D7	RE start-up businesses enjoy financial support.	1	2	3	4	5
D8	Lack of access to finance is a barrier for entrepreneurial activity.	1	2	3	4	5
D9	Entrepreneurs deal with financial barriers in the industry effectively.	1	2	3	4	5
D10	To improve the entrepreneurial process, access to financial assistance needs to be prioritised.	1	2	3	4	5
R & D transfer, Government facilitation and Business incubation						
D11	Investment in research and development with specific focus on RE is on the increase.	1	2	3	4	5

D13	Research and development is a high priority in the RE environment.	1	2	3	4	5
D14	IPPs can rely on the support of policies and regulation for RE.	1	2	3	4	5
D15	Competition is encouraged through research and development in the RE environment.	1	2	3	4	5
D16	Enforcement of health, safety and environment regulations is encouraged through research and development in the RE environment.	1	2	3	4	5
D17	IPPs are satisfied with the extent to which government facilitates start-up processes for entrepreneurs for this industry.	1	2	3	4	5
D18	Government facilitation ensures monitoring the impact of new IPP agreements.	1	2	3	4	5
D19	Current government facilitation encourages RE participation.	1	2	3	4	5
D20	IPPs believe that the government has some significant policies to assist them as industry entrepreneurs.	1	2	3	4	5
D21	IPPs believe government facilitation is contributing to creating an enabling environment for entrepreneurial activity.	1	2	3	4	5
D22	Start-up entrepreneurs enjoy the support of business incubation.	1	2	3	4	5
D23	Business incubation further develops the entrepreneur to face challenges in the RE industry.	1	2	3	4	5
D24	IPPs find that the process of business incubation is a critical organisational support mechanism for fledgling entrepreneurs in the initial stage in this industry.	1	2	3	4	5
D25	IPPs agree that to maximise the chances of success in the industry, business incubation is essential.	1	2	3	4	5
D26	The process of starting a business has been made easier with the implementation of business incubation.	1	2	3	4	5

SECTION E: RENEWABLE ELECTRICITY SOURCES		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Renewable electricity sources						
E1	There are growing concerns about electricity supply in South Africa.	1	2	3	4	5
E2	Climate change has heightened interest in harnessing RE sources.	1	2	3	4	5
E3	Integration of RE in power generation is welcomed by the electricity industry.	1	2	3	4	5
E4	A sustainable energy mix for power utilities is encouraged in the RE sector.	1	2	3	4	5
E5	RE production aids lower carbon emission.	1	2	3	4	5
E6	It is feasible to have a mix of solar, hydro and wind alternatives feeding the national grid.	1	2	3	4	5
Solar, Wind and Hydro						
E7	IPPs claim that the most popular RE source is solar power.	1	2	3	4	5
E8	IPPs are confident that large-scale PV (photovoltaic) systems can feed into most electricity grids.	1	2	3	4	5
E9	Solar generates sufficient electricity needed during times of peak electricity usage.	1	2	3	4	5
E10	IPPs are confident that the potential of solar sources in the electricity industry are significant.	1	2	3	4	5
E11	Solar systems are declining in cost, improving in efficiency and increasing rapidly in sales.	1	2	3	4	5
E12	Wind energy makes a valuable contribution to the national grid.	1	2	3	4	5
E13	There is a growing confidence that sufficiently powerful winds exist to sustain an electricity network.	1	2	3	4	5
E14	Enough transmission is built to transmit the peak power capacity of an intermittent power source such as wind.	1	2	3	4	5
E15	There is sufficient public and private sector participation in the form of IPPs, to achieve equitable distribution of wind generated electricity.	1	2	3	4	5

E16	Wind is a promising alternative for the national electricity grid.	1	2	3	4	5
E17	RE sources such as hydro is another feasible option for increasing electricity diversity.	1	2	3	4	5
E18	In the promotion of electricity diversity, hydro secures an optimal electricity mix.	1	2	3	4	5
E19	It is believed that with hydro as an energy source intermittency poses no challenge.	1	2	3	4	5
E20	Hydro generation can make a difference of several thousand megawatts on the electricity grid.	1	2	3	4	5
E21	Hydro generation in the form of pumped storage is an asset to the network.	1	2	3	4	5

SECTION F: SA POLICIES						
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
SA Policies and best practice						
F1	Policy is one of the main drivers in RE scenarios in the electricity industry.	1	2	3	4	5
F2	It is believed that new policies for RE match existing South African policies for electricity.	1	2	3	4	5
F3	Stakeholders are confident that the existing policies stay abreast with changes within the industry.	1	2	3	4	5
F4	Enabling structures exist for good policy making.	1	2	3	4	5
F5	Existing electricity policy is aligned with climate mitigation.	1	2	3	4	5
F6	Policies are one of the main drivers in moderate and high renewable scenarios.	1	2	3	4	5
F7	Policies motivated by climate change create greater environmental focus.	1	2	3	4	5
F8	It is believed that policies are having an impact on liberalised electricity markets.	1	2	3	4	5
F9	Market conditions are encouraging increasingly cost-effective investment in RE.	1	2	3	4	5
F10	A well-grounded global RE policy exists for countries to model.	1	2	3	4	5
F11	Policies enable entrepreneurship.	1	2	3	4	5

SECTION G: STAKEHOLDER THEORY		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Stakeholders, Stakeholder Management and Stakeholder power						
G1	Stakeholders foster a healthy relationship with each other within the electricity industry.	1	2	3	4	5
G2	An enabling entrepreneurial environment creates confident stakeholders that stay abreast with changes in the industry.	1	2	3	4	5
G3	Stakeholders contribute to corporate long term efficiency of an enabling entrepreneurial environment.	1	2	3	4	5
G4	It is believed that the electricity industry serves the interests of its various stakeholders.	1	2	3	4	5
G5	The interests of the various stakeholders are taken into account in arriving at key decisions within the RE sector.	1	2	3	4	5
G6	It is believed that the identification of key stakeholders is done through stakeholder management.	1	2	3	4	5
G7	Through stakeholder management, stakeholder interest is found to be central to the operation in the industry.	1	2	3	4	5
G8	Stakeholder management serves as a managerial guide that can be followed within the electricity industry.	1	2	3	4	5
G9	A strong power for stakeholder groups to exert control in the electricity industry exists.	1	2	3	4	5
G10	The power of the stakeholder is to influence the RE sector.	1	2	3	4	5
G11	It is believed that stakeholders have power to influence the RE sector.	1	2	3	4	5
G12	Government exerts power within the RE sector.	1	2	3	4	5
G13	Eskom exerts power within the RE sector.	1	2	3	4	5
G14	NERSA exerts power within the RE sector.	1	2	3	4	5
G15	Stakeholder power is not misused in the electricity industry.	1	2	3	4	5

SECTION H: INSTRUCTIONS

1. *Please mark your answers with an X in the appropriate block.*
2. *Questions are ranked from 1 – 3, 1 indicating Barrier and 3 indicating Enabler.*
3. *Please choose only one answer.*

SECTION H: INDUSTRY BARRIERS OR ENABLERS				
To what extent do you regard the following statements as barriers or enablers to an enabling entrepreneurial environment in the RE sector?		**Barrier**	**Neutral**	**Enabler**
H1	Smart Grids enable entrepreneurial RE activity.	1	2	3
H2	A Smart Grid as a future electricity network.	1	2	3
H3	Competition in the RE sector.	1	2	3
H4	Access to finance for start-up IPPs.	1	2	3
H5	Access to additional funding after start-up.	1	2	3
H6	Research and development in the RE sector.	1	2	3
H7	Business incubation for young IPPs (< 2 years).	1	2	3
H8	Support from government for business incubation.	1	2	3
H9	Government facilitation of the business incubation process.	1	2	3
H10	Government facilitation of policy.	1	2	3
H11	Government facilitation of IPP agreements.	1	2	3
H12	Government facilitation of access to finance.	1	2	3
H13	Eskom administration of the IPP agreements.	1	2	3
H14	Inclusion of solar as an energy source for electricity generation.	1	2	3
H15	Inclusion of wind as an energy source for electricity generation.	1	2	3
H16	Inclusion of hydro as an energy source for electricity generation.	1	2	3
H17	Policy pertaining to feeding into the network.	1	2	3
H18	Policy pertaining IPP access to the network.	1	2	3
H19	Policy pertaining RE (solar, wind, hydro).	1	2	3
H20	Policy implementation by stakeholders.	1	2	3
H21	Stakeholder support in the RE sector.	1	2	3
H22	Stakeholder groups in the RE sector.	1	2	3

H23	Eskom's stakeholder power in the RE sector.	1	2	3
H24	NERSA's stakeholder power in the RE sector.	1	2	3
H25	Government's stakeholder power in the RE sector.	1	2	3

Thank you for participating in this important survey. The results will be made available to all divisions.

APPENDIX E: NERSA Management Questionnaire

NERSA MANAGEMENT QUESTIONNAIRE
AN ENABLING ENVIRONMENT FOR INDEPENDENT POWER PRODUCERS IN RENEWABLE ELECTRICITY

INSTRUCTIONS

3. *Please mark your answers with an X in the appropriate block.*
4. *Questions are ranked from 1 – 5, 1 indicating Strongly Disagree and 5 indicating Strongly Agree.*

For the purpose of the study, the following definitions are utilised:

Grid: *A grid is an electricity network.*

IPP: *An IPP is an independent electricity generation utility feeding into the existing electricity network.*

Mini-Grid: *A tailored approach in electricity which can provide centralised electricity generation at the local level using a village-wide distribution network.*

Smart Grid: *an automated, widely distributed energy delivery network characterised by a two-way flow of electricity and information, capable of monitoring and responding to changes in everything from power plants to customer preferences to individual appliances.*

SECTION A: BIOGRAPHIC INFORMATION

1. Gender	Male	Female

2. Race	Asian	Black	Coloured	White	Other

2.1 If "Other" specify	

3. Position in organisation	Manager	Advisor	Specialist	General staff

4. Department	Engineering	Customer Services	Strategy	Finance	Other

4.1 If "Other" specify	

5. Province you are located	Eastern Cape	Free State	Gauteng	Kwazulu Natal	Limpopo
	Mpumalanga	North West	Northern Cape	Western Cape	

6. Age	18 - 24	25 - 29	30 - 39	40 - 49	50 +

7. Years experience in electricity industry	Less than 2	2 - 4	5-9	10-19

8. Highest Qualification	Matric	Diploma	Degree	Post Grad

9. E- mail address, if feedback is required	

SECTION B: SMART GRID						
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
SA Smart Grid						
B1	Smart Grids enable entrepreneurship.	1	2	3	4	5
B2	Mini-Grids form part of Smart Grids.	1	2	3	4	5
B3	Smart Grids accommodate alternative electricity provision sources in the electricity industry.	1	2	3	4	5
B4	Mini-Grids enable Smart Grids.	1	2	3	4	5
B5	Smart Grids are the future grids.	1	2	3	4	5
B6	The Smart Grids embrace IPP activity.	1	2	3	4	5
B7	In this industry, Off-Grids form an integral part of Smart Grids.	1	2	3	4	5
B8	Off-Grids can operate independently from the Smart Grids.	1	2	3	4	5
B9	Smart Grids find it challenging to accommodate new electricity generation in the form of Off-Grids.	1	2	3	4	5
B10	Alternative electricity provision sources can be accommodated in the electricity industry in the form of Off-Grids.	1	2	3	4	5
B11	Off-Grid electrification projects have cost benefit ratios that may exceed those of grid extension.	1	2	3	4	5

SECTION C: RENEWABLE ELECTRICITY SOURCES

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Renewable electricity sources						
C1	There are growing concerns about electricity supply in South Africa.	1	2	3	4	5
C2	Climate change has heightened interest in harnessing RE sources.	1	2	3	4	5
C3	Integration of RE in power generation is welcomed by the electricity industry.	1	2	3	4	5
C4	A sustainable energy mix for power utilities is encouraged in the RE sector.	1	2	3	4	5
C5	RE production aids lower carbon emission.	1	2	3	4	5
C6	It is feasible to have a mix of solar, hydro and wind alternatives feeding the national grid.	1	2	3	4	5
Solar, Wind and Hydro						
C7	IPPs claim that the most popular RE source is solar power.	1	2	3	4	5
C8	IPPs are confident that large-scale PV (photovoltaic) systems can feed into most electricity grids.	1	2	3	4	5
C9	Solar generates sufficient electricity needed during times of peak electricity usage.	1	2	3	4	5
C10	IPPs are confident that the potential of solar sources in the electricity industry are significant.	1	2	3	4	5
C11	Solar systems are declining in cost, improving in efficiency and increasing rapidly in sales.	1	2	3	4	5
C12	Wind energy makes a valuable contribution to the national grid.	1	2	3	4	5
C13	There is growing confidence that sufficiently powerful winds exists to sustain an electricity network.	1	2	3	4	5
C14	Enough transmission is built to transmit the peak power capacity of an intermittent power source such as wind.	1	2	3	4	5
C15	There is sufficient public and private sector participation in the form of IPPs to achieve equitable distribution of wind generated electricity.	1	2	3	4	5
C16	Wind is a promising alternative for the national electricity grid.	1	2	3	4	5
C17	RE sources such as hydro is another feasible option for increasing electricity diversity.	1	2	3	4	5

C18	In the promotion of electricity diversity, hydro secures an optimal electricity mix.	1	2	3	4	5
C19	It is believed that with hydro as an energy source intermittency poses no challenge.	1	2	3	4	5
C20	Hydro generation can make a difference of several thousand megawatts on the electricity grid.	1	2	3	4	5
C21	Hydro generation in the form of pumped storage is an asset to the network.	1	2	3	4	5

SECTION D: SA POLICIES						
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
SA Policies and best practice						
D1	Policy is one of the main drivers in RE scenarios in the electricity industry.	1	2	3	4	5
D2	It is believed that new policies for RE match existing South African policies for electricity.	1	2	3	4	5
D3	Stakeholders are confident that the existing policies stay abreast with changes within the industry.	1	2	3	4	5
D4	Enabling structures exist for good policy making.	1	2	3	4	5
D5	Existing electricity policy is aligned with climate mitigation.	1	2	3	4	5
D6	Policies are one of the main drivers in moderate and high renewable scenarios.	1	2	3	4	5
D7	Policies motivated by climate change create greater environmental focus.	1	2	3	4	5
D8	It is believed that policies are having an impact on liberalised electricity markets.	1	2	3	4	5
D9	Market conditions are encouraging increasingly cost-effective investment in renewable electricity.	1	2	3	4	5
D10	A well-grounded global RE policy exists for countries to model on.	1	2	3	4	5
D11	Policies enable entrepreneurship.	1	2	3	4	5

SECTION E: STAKEHOLDER THEORY

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Stakeholders, Stakeholder Management and Stakeholder power						
E1	Stakeholders foster a healthy relationship with each other within the electricity industry.	1	2	3	4	5
E2	An enabling entrepreneurial environment creates confident stakeholders that stay abreast with changes in the industry.	1	2	3	4	5
E3	Stakeholders contribute to corporate, long term efficiency of an enabling entrepreneurial environment.	1	2	3	4	5
E4	It is believed that the electricity industry serves the interests of its various stakeholders.	1	2	3	4	5
E5	The interests of the various stakeholders are taken into account in arriving at key decisions within the RE sector.	1	2	3	4	5
E6	It is believed that the identification of key stakeholders is done through stakeholder management.	1	2	3	4	5
E7	Through Stakeholder Management, stakeholder interest is found to be central to the operation in the industry.	1	2	3	4	5
E8	Stakeholder Management serves as a managerial guide that can be followed within the electricity industry.	1	2	3	4	5
E9	A strong power for stakeholder groups to exert control in the electricity industry, exists.	1	2	3	4	5
E10	The power of the stakeholder is to influence the RE sector.	1	2	3	4	5
E11	It is believed that stakeholders have power to influence the RE sector.	1	2	3	4	5
E12	Government exerts power within the RE sector.	1	2	3	4	5
E13	Eskom exerts power within the RE sector.	1	2	3	4	5
E14	NERSA exerts power within the RE sector.	1	2	3	4	5
E15	Stakeholder power is not misused in the electricity industry.	1	2	3	4	5

SECTION F: INSTRUCTIONS

4. *Please mark your answers with an X in the appropriate block.*

5. *Questions are ranked from 1 – 3, 1 indicating Barrier and 3 indicating Enabler.*

6. *Please choose only one answer.*

SECTION F: INDUSTRY BARRIERS OR ENABLERS				
To what extent do you regard the following statements as barriers or enablers to an enabling entrepreneurial environment in the RE sector?		**Barrier**	**Neutral**	**Enabler**
F1	Competition in the RE sector.	1	2	3
F2	Government facilitation of policy.	1	2	3
F3	Government facilitation of IPP agreements.	1	2	3
F4	Eskom administration of the IPP agreements.	1	2	3
F5	Inclusion of solar as an energy source for electricity generation.	1	2	3
F6	Inclusion of wind as an energy source for electricity generation.	1	2	3
F7	Inclusion of hydro as an energy source for electricity generation.	1	2	3
F8	Policy pertaining feeding into the network.	1	2	3
F9	Policy pertaining IPP access to the network.	1	2	3
F10	Policy pertaining RE (Solar, Wind, Hydro).	1	2	3
F11	Policy implementation by stakeholders.	1	2	3
F12	Stakeholder support in the RE sector.	1	2	3
F13	Stakeholder groups in the RE sector.	1	2	3
F14	Eskom's stakeholder power in the RE sector.	1	2	3
F15	NERSA's stakeholder power in the RE sector.	1	2	3
F16	Government's stakeholder power in the RE sector.	1	2	3

Thank you for participating in this important survey. The results will be made available to all divisions.

APPENDIX F: Approved and Non-Approved IPP Questionnaire

APPROVED AND NON-APPROVED IPP QUESTIONNAIRE
AN ENABLING ENVIRONMENT FOR INDEPENDENT POWER PRODUCERS IN RENEWABLE ELECTRICITY

INSTRUCTIONS

5. *Please mark your answers with an X in the appropriate block.*
6. *Questions are ranked from 1 – 5, 1 indicating Strongly Disagree and 5 indicating Strongly Agree.*

For the purpose of the study, the following definitions are utilised:

Grid: *A grid is an electricity network.*

IPP: *An IPP is an independent electricity generation utility feeding into the existing electricity network.*

Mini-Grid: *A tailored approach in electricity which can provide centralised electricity generation at the local level using a village-wide distribution network.*

Smart Grid: *an automated, widely distributed energy delivery network characterised by a two-way flow of electricity and information, capable of monitoring and responding to changes in everything from power plants to customer preferences to individual appliances.*

SECTION A: BIOGRAPHIC INFORMATION

1. Gender	Male	Female

2. Race	Asian	Black	Coloured	White	Other

3. Position in organisation	Manager	Advisor	Specialist	General staff

4. Department	Engineering	Customer Services	Strategy	Finance	Other: ....

5. Province that you are located in	Eastern Cape	Free State	Gauteng	Kwazulu Natal	Limpopo
	Mpumalanga	North West	Northern Cape	Western Cape	

6. Age	18 - 24	25 - 29	30 - 39	40 - 49	50 +

7. Years experience in the electricity industry	Less than 2	2 - 4	5-9	10-19	20+

8. Highest Qualification	Matric	Diploma	Degree	Post Grad

SECTION B: ENTREPRENEURIAL ENVIRONMENT						
*With regard to the **Entrepreneurial Environment** in respect of South Africa, to what extent do you agree with the following statements?*		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
An Enabling Entrepreneurial Environment						
B1	I am satisfied with the entrepreneurial environment created for business in South Africa.	1	2	3	4	5
B2	No barriers exist that hamper entrepreneurial activity in South Africa.	1	2	3	4	5
B3	Smart Grids accommodate alternative electricity provision sources in the electricity industry.	1	2	3	4	5
B4	The grid model makes it easy to accommodate alternative electricity generation environments.	1	2	3	4	5
B5	Best practice policies have a positive effect on an enabling entrepreneurial environment.	1	2	3	4	5

SECTION C: ENTREPRENEURIAL COMPONENTS						
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Entrepreneurial components and access to finance						
C1	Entrepreneurship is critical to the development and well-being of society.	1	2	3	4	5
C2	Significant entrepreneurial activity in the electricity industry is evident in South Africa.	1	2	3	4	5
C3	IPPs drive entrepreneurship in the electricity industry.	1	2	3	4	5
C4	Few entrepreneurial barriers exist in this industry.	1	2	3	4	5
C5	IPPs cope effectively with barriers in the industry.	1	2	3	4	5
C6	Early-stage finance is one of the biggest barriers for start-up entrepreneurs.	1	2	3	4	5
C7	In this industry, IPPs have no difficulty in obtaining access to start-up finance.	1	2	3	4	5
C8	Renewable electricity start-up businesses	1	2	3	4	5

	enjoy financial support.					
C9	Lack of access to finance is a barrier for entrepreneurial activity.	1	2	3	4	5
C10	Entrepreneurs deal with financial barriers in the industry effectively.	1	2	3	4	5
C11	To improve the entrepreneurial process, access to financial assistance needs to be prioritised.	1	2	3	4	5
R & D transfer, Government facilitation and Business incubation						
C12	Investment in research and development with specific focus on RE is on the increase.	1	2	3	4	5
C13	Research and development is a high priority in the RE environment.	1	2	3	4	5
C14	IPPs enjoy good support and can focus on policies and regulation for RE.	1	2	3	4	5
C15	Competition is encouraged through research and development in the RE environment.	1	2	3	4	5
C16	Enforcement of health, safety and environment regulations is encouraged through research and development in the RE environment.	1	2	3	4	5
C17	IPPs are satisfied with the extent to which government facilitates start-up processes for entrepreneurs for this industry.	1	2	3	4	5
C18	Government facilitation ensures monitoring the impact of new IPP agreements.	1	2	3	4	5
C19	Current government facilitation encourages RE participation.	1	2	3	4	5
C20	IPPs believe that the government has some significant policies to assist them as industry entrepreneurs.	1	2	3	4	5
C21	IPPs believe government facilitation is contributing to creating an enabling environment for entrepreneurial activity.	1	2	3	4	5
C22	Start-up entrepreneurs enjoy the support of business incubation.	1	2	3	4	5
C23	Business incubation further develops the entrepreneur to face challenges in the RE industry.	1	2	3	4	5
C24	IPPs find that the process of Business Incubation is a critical organisational support mechanism for fledgling entrepreneurs in the initial stage in this industry.	1	2	3	4	5
C25	IPPs agree that to maximise the chances of success in the industry business incubation is essential.	1	2	3	4	5

C26	The process of starting a business has been made easier with the implementation of business incubation.	1	2	3	4	5

SECTION D: RENEWABLE ELECTRICITY SOURCES						
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Renewable electricity sources						
D1	There are growing concerns about electricity supply in South Africa.	1	2	3	4	5
D2	Climate change has heightened interest in harnessing RE sources.	1	2	3	4	5
D3	Integration of RE in power generation is welcomed by the electricity industry.	1	2	3	4	5
D4	A sustainable energy mix for power utilities is encouraged in the RE sector.	1	2	3	4	5
D5	RE production aids lower carbon emission.	1	2	3	4	5
D6	It is feasible to have a mix of solar, hydro and wind alternatives feeding the national grid.	1	2	3	4	5
Solar, Wind and Hydro						
D7	IPPs claim that the most popular RE source is solar power.	1	2	3	4	5
D8	IPPs are confident large-scale PV (photovoltaic) systems can feed into most electricity grids.	1	2	3	4	5
D9	Solar generates sufficient electricity needed during times of peak electricity usage.	1	2	3	4	5
D10	IPPs are confident that the potential of solar sources in the electricity industry are significant.	1	2	3	4	5
D11	Solar systems are declining in cost, improving in efficiency and increasing rapidly in sales.	1	2	3	4	5
D12	Wind energy makes a valuable contribution to the national grid.	1	2	3	4	5
D13	There is a growing confidence that sufficiently powerful winds exist to sustain an electricity network.	1	2	3	4	5
D14	Enough transmission is built to transmit the peak power capacity of an intermittent power source such as wind.	1	2	3	4	5

D15	There is sufficient public and private sector participation in the form of IPPs, to achieve equitable distribution of wind generated electricity.	1	2	3	4	5
D16	Wind is a promising alternative for the national electricity grid.	1	2	3	4	5
D17	RE sources such as hydro is another feasible option for increasing electricity diversity.	1	2	3	4	5
D18	In the promotion of electricity diversity, hydro secures an optimal electricity mix.	1	2	3	4	5
D19	It is believed that with hydro as an energy source intermittency poses no challenge.	1	2	3	4	5
D20	Hydro generation can make a difference of several thousand megawatts on the electricity grid.	1	2	3	4	5
D21	Hydro generation in the form of pumped storage is an asset to the network.	1	2	3	4	5

SECTION E: SA POLICIES

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
SA Policies and best practice						
E1	Policy is one of the main drivers in RE scenarios in the electricity industry.	1	2	3	4	5
E2	It is believed that new policies for RE match existing South African policies for electricity.	1	2	3	4	5
E3	Stakeholders are confident that the existing policies stay abreast with changes within the industry.	1	2	3	4	5
E4	Enabling structures exist for policy making.	1	2	3	4	5
E5	Existing electricity policy is aligned with climate mitigation.	1	2	3	4	5
E6	Policies are one of the main drivers in moderate and high renewable scenarios.	1	2	3	4	5
E7	Policies motivated by climate change create greater environmental focus.	1	2	3	4	5
E8	It is believed that policies are having an impact on liberalised electricity markets.	1	2	3	4	5
E9	Market conditions are encouraging increasingly cost-effective investment in RE.	1	2	3	4	5
E10	A well-grounded global RE policy exists for countries to model.	1	2	3	4	5

E11	Policies enable entrepreneurship.	1	2	3	4	5

SECTION F: STAKEHOLDER THEORY						
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
Stakeholders, Stakeholder Management and Stakeholder power						
F1	Stakeholders foster a healthy relationship with each other within the electricity industry.	1	2	3	4	5
F2	An enabling entrepreneurial environment creates confident stakeholders that stay abreast with changes in the industry.	1	2	3	4	5
F3	Stakeholders contribute to corporate long term efficiency of an enabling entrepreneurial environment.	1	2	3	4	5
F4	It is believed that the electricity industry serves the interests of its various stakeholders.	1	2	3	4	5
F5	The interests of the various stakeholders are taken into account in arriving at key decisions within the RE sector.	1	2	3	4	5
F6	It is believed that the identification of key stakeholders is done through stakeholder management.	1	2	3	4	5
F7	Through stakeholder management, stakeholder interest is found to be central to the operation in the industry.	1	2	3	4	5
F8	Stakeholder Management serves as a managerial guide that can be followed within the electricity industry.	1	2	3	4	5
F9	A strong power for stakeholder groups to exert control in the electricity industry, exists.	1	2	3	4	5
F10	The power of the stakeholder is to influence the RE sector.	1	2	3	4	5
F11	It is believed that stakeholders have power to influence the RE sector.	1	2	3	4	5
F12	Government exerts power within the RE sector.	1	2	3	4	5
F13	Eskom exerts power within the RE sector.	1	2	3	4	5
F14	NERSA exerts power within the RE sector.	1	2	3	4	5
F15	Stakeholder power is not misused in the electricity industry.	1	2	3	4	5

SECTION G: INSTRUCTIONS

7. *Please mark your answers with an X in the appropriate block.*
8. *Questions are ranked from 1 – 3, 1 indicating Barrier and 3 indicating Enabler.*
9. *Please choose only one answer.*

SECTION G: INDUSTRY BARRIERS OR ENABLERS				
To what extent do you regard the following statements as barriers or enablers to an enabling entrepreneurial environment in the RE sector?		**Barrier**	**Neutral**	**Enabler**
G1	Competition in the RE sector.	1	2	3
G2	Access to finance for start-up IPPs.	1	2	3
G3	Access to additional funding after start-up.	1	2	3
G4	Research and development in the RE sector.	1	2	3
G5	Business incubation for young IPPs (< 2 years).	1	2	3
G6	Support from government for business incubation.	1	2	3
G7	Government facilitation of business incubation process.	1	2	3
G8	Government facilitation of policy.	1	2	3
G9	Government facilitation of IPP agreements.	1	2	3
G10	Government facilitation of access to finance.	1	2	3
G11	Eskom administration of the IPP agreements.	1	2	3
G12	Inclusion of solar as an energy source for electricity generation.	1	2	3
G13	Inclusion of wind as an energy source for electricity generation.	1	2	3
G14	Inclusion of hydro as an energy source for electricity generation.	1	2	3
G15	Policy pertaining to feeding into the network.	1	2	3
G16	Policy pertaining to IPP access to the network.	1	2	3
G17	Policy pertaining to RE (solar, wind, hydro).	1	2	3
G18	Policy implementation by stakeholders.	1	2	3
G19	Stakeholder support in the RE sector.	1	2	3
G20	Stakeholder groups in the RE sector.	1	2	3

G21	Eskom's stakeholder power in the RE sector.	1	2	3
G22	NERSA's stakeholder power in the RE sector.	1	2	3
G23	Government's stakeholder power in the RE sector.	1	2	3

Thank you for participating in this important survey. The results will be made available to all divisions.

APPENDIX G: Correlations

Appendix G: Correlations-Eskom

	Variable: Entrepreneurial Environment	Variable: Smart Grid	Variable: Entrepreneurial Components and Access to Finance	Variable: Research and development; Government facilitation and Business incubation	Variable: Entrepreneurial Components	Variable: General RE Perceptions	Variable: Solar	Variable: Wind	Variable: Hydro	Variable: SA Policies
Variable: Entrepreneurial Environment	-	.338	.219	.408	.373	.367	.092	.096	.429	.334
Variable: Smart Grid	.338	-	-.256	.308	.006	.130	.288	.139	.452	.259
Variable: Entrepreneurial Components and Access to Finance	.219	-.256	-	.346	.849	.215	.012	-.084	-.044	.222
Variable: Research and development; Government facilitation and Business incubation	.408	.308	.346	-	.789	.405	.349	.231	.380	.604
Variable: Entrepreneurial Components	.373	.006	.849	.789	-	.368	.204	.075	.185	.486
Variable: General RE Perceptions	.367	.130	.215	.405	.368	-	.135	.001	.353	.376

Appendix G: Correlations-Eskom

Variable: Solar	.092	.288	.012	.349	.204	.135	-	.241	.293	.290
Variable: Wind	.096	.139	-.084	.231	.075	.001	.241	-	.117	.119
Variable: Hydro	.429	.452	-.044	.380	.185	.353	.293	.117	-	.151
Variable: SA Policies	.334	.259	.222	.604	.486	.376	.290	.119	.151	-
Variable: Stakeholder Theory	.321	.253	.040	.484	.299	.342	.469	.044	.185	.621
Variable: Alternative generation	.114	.418	-.134	-.006	-.091	.153	.058	.135	.162	.058
Variable: Finance	-.083	.109	.004	.060	.036	-.147	.043	-.045	.131	.146
Variable: Government	.031	-.222	.092	.074	.102	.057	-.113	.158	-.290	.110
Variable: Policy	.060	.186	-.169	.155	-.023	.132	.230	.144	.141	.121
Variable: Smart-grid	-.123	.293	-.008	.088	.044	-.238	.145	.057	.009	.030
Variable: Stakeholder	.135	-.094	-.199	-.268	-.281	.021	-.284	.215	-.219	-.266

Appendix G: Correlations-Eskom

Variable: Other	-.062	.185	.161	.270	.257	.212	.025	-.140	.051	.333
Variable: Industry Barriers Or Enablers	.026	.137	-.046	.146	.052	.100	.020	.130	-.009	.220
	Variable: Stakeholder Theory	**Variable: Alternative generation**	**Variable: Finance**	**Variable: Government**	**Variable: Policy**	**Variable: Smart-grid**	**Variable: Stakeholder**	**Variable: Other**	**Variable: Industry Barriers Or Enablers**	**-**
Variable: Entrepreneurial Environment	.321	.114	-.083	.031	.060	-.123	.135	-.062	.026	-
Variable: Smart Grid	.253	.418	.109	-.222	.186	.293	-.094	.185	.137	-
Variable: Entrepreneurial Components and Access to Finance	.040	-.134	.004	.092	-.169	-.008	-.199	.161	-.046	-
Variable: Research and development; Government facilitation and Business incubation	.484	-.006	.060	.074	.155	.088	-.268	.270	.146	-
Variable: Entrepreneurial Components	.299	-.091	.036	.102	-.023	.044	-.281	.257	.052	-

Appendix G: Correlations-Eskom

Variable: General RE Perceptions	.342	.153	-.147	.057	.132	-.238	.021	.212	.100	-
Variable: Solar	.469	.058	.043	-.113	.230	.145	-.284	.025	.020	-
Variable: Wind	.044	.135	-.045	.158	.144	.057	.215	-.140	.130	-
Variable: Hydro	.185	.162	.131	-.290	.141	.009	-.219	.051	-.009	-
Variable: SA Policies	.621	.058	.146	.110	.121	.030	-.266	.333	.220	-
Variable: Stakeholder Theory	-	-.056	.111	.291	.087	.033	.004	.107	.239	-
Variable: Alternative generation	-.056	-	.152	-.028	.428	-.038	.029	.358	.510	-
Variable: Finance	.111	.152	-	-.106	.026	.104	-.224	.359	.543	-
Variable: Government	.291	-.028	-.106	-	.137	-.136	.384	-.156	.459	-
Variable: Policy	.087	.428	.026	.137	-	-.103	.105	.081	.599	-
Variable: Smart-grid	.033	-.038	.104	-.136	-.103	-	-.064	-.075	-.093	-
Variable: Stakeholder	.004	.029	-.224	.384	.105	-.064	-	-.155	.282	-
Variable: Other	.107	.358	.359	-.156	.081	-.075	-.155	-	.477	-
Variable: Industry Barriers Or Enablers	.239	.510	.543	.459	.599	-.093	.282	.477	-	-