

**DIVERSIFYING SOUTH AFRICA'S RENEWABLE ENERGY MIX THROUGH
POLICY**

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ABSTRACT

South Africa is one of the most energy-intensive economies in the world, with around 90 per cent of its electricity generated using coal as a primary resource. As such, the South African energy system remains on a highly unsustainable path, and the potential for long-term growth and prosperity of the economy is thwarted. The alternative to conventional energy, renewable energy, has unfortunately been relatively slow to take off in the South Africa market. This is disappointing considering the country's wealth of natural resources required for renewable energy generation.

The potential of renewable energy to contribute to the South African energy mix is thus significant. The transition to a green economy, and subsequently a more sustainable energy future, is therefore achievable and realistic. However, national policies aimed at promoting the deployment of renewable energy have been thwarted by inconsistencies, lack of coordination, and proved relatively ineffective at increasing the country's renewable energy capacity to its full potential. The recent policy changes from a feed-in tariff to a competitive tender approach dented investor confidence in the South African renewable energy industry significantly. Nevertheless, renewable energy policy in South Africa is still in its infancy, and valuable lessons are still to be learnt and incorporated into future policies going forward.

A critical analysis of the current policy identifies the need for amendment to the structure of the policy landscape. The current policy strongly favours larger, more established and mature renewable technologies, whilst completely neglecting smaller and less mature ones. This not only results in a highly undiversified renewable energy mix, which has considerable negatives in itself, but also reduces the ability of the policy to capture a host of significant opportunities and advantages associated with small-scale renewable energy projects. The importance of diversifying South Africa's renewable energy mix was therefore one of the principal stances of this study, and intervention that ensured diversification within the industry was therefore vital.

This study fundamentally designs and proposes a revised policy system that makes use of both competitive tenders and feed-in tariffs within the policy framework. In essence, this would allow for greater diversification within the renewable energy industry. The competitive tender component should be used for larger, more established technologies and

projects, while the feed-in tariff should be used to drastically stimulate investment in smaller technologies and projects. By making use of a dual-mechanism system, the benefits associated with small-scale renewable energy projects can be realized without any noteworthy opportunity costs foregone. These benefits include diversification of the renewable energy mix; stimulation of smaller technologies; increased job creation; and stabilisation of supply volatility.

This study recommends that the current renewable energy policy in South Africa be reassessed for both its relevancy within the South African context as well as its ability to effectively promote the deployment of alternative energy technologies. In an ever-changing and globalising world, where exogenous influences on national policies are stronger than ever, it becomes necessary and of utmost importance that policies are evaluated constantly in order to ensure their effectiveness is at optimal level.

OPSOMMING

Die Suid-Afrikaanse ekonomie is een van die energie-intensiefstes ter wêreld, met steenkool as hoofbron vir sowat 90 persent van die land se kragopwekking. Die Suid-Afrikaanse energiestelsel as sulks bly dus op 'n onstabiele pad, en die potensiaal vir langdurige ekonomiese groei en welvaart word geknel. As teenvoeter vir konvensionele krag het hernubare energie steeds stadig veld gewen in die plaaslike mark – wat teleurstellend is as die land se rykdom aan natuurlike bronne vir hernubare energie-opwekking in ag geneem word.

Hernubare energie het dus 'n aansienlike potensiaal om tot die Suid-Afrikaanse energiemengsel by te dra. Die oorgang na 'n groen ekonomie, en gevolglik na 'n volhoubaarder energie-toekoms, is daarom bereikbaar en realisties. Nasionale beleide oor hoe die uitrol van hernubare energie bevorder word, is egter tot dusver gestrem deur ongereeldhede en 'n gebrek aan koördinasie, en was gevolglik relatief ondoeltreffend om die land se hernubare energiekapasiteit ten volle te verhoog. Die onlangse beleidsveranderinge vanaf 'n toevoertarief na 'n mededingende tenderbenadering het beleggersvertroue aansienlik geskaad. Suid-Afrika se hernubare energiebeleid is nietemin nog in sy kinderskoene, met kosbare lesse wat geleer kan word en vir die pad vorentoe in toekomsplanne ingewerk kan word.

'n Kritiese ontleding van die huidige beleid wys hoe nodig 'n aangepaste struktuur vir die beleidsraamwerk is. Die huidige beleid begunstig groter, meer gevestigde en ontwikkelde tegnologieë terwyl kleiner en minder ontwikkeldes heeltemal afgeskeep word. Dit het tot gevolg nie net 'n hoogs ongediversifiseerde mengsel van hernubare energie nie, wat op sigself 'n aantal nadele inhou, maar boonop verminder dit die beleid se vermoë om vele betekenisvolle geleenthede en voordele aan te gryp wat gepaard gaan met kleinskaalse projekte vir hernubare energie. Dat die diversifisering van Suid-Afrika se hernubare energiesamestelling belangrik is, was dus een van dié studie se hoofbenaderings, asook dat ingryping ter wille van diversifisering binne die bedryf onontbeerlik is.

Hierdie studie bied 'n ingrypende ontwerp en voorstel vir 'n hersiene beleidstelsel, met mededingende tenders asook toevoertariëwe binne die beleidsraamwerk. Dit sal in wese ruimte laat vir groter diversifikasie binne die hernubare energiebedryf. Die mededingende tendergedeelte behoort vir groter, meer gevestigde tegnologieë en projekte gebruik te word, terwyl die toevoertariëwe kan dien om belegging in kleiner tegnologieë en projekte te

stimuleer. Deur 'n stelsel van tweeledige meganismes kan die voordele van kleinskaalse hernubare energieprojekte realiseer sonder die inboet van noemenswaardige geleentheidskoste. Dié voordele sluit in, om enkeles te noem, die diversifikasie van die hernubare energie-toneel; die stimuleer van kleiner tegnologieë met gepaardgaande groter werkskepping; en toenemende plaaslike produkvervaardiging.

Met dié studie word aanbeveel dat Suid-Afrika se huidige beleid oor hernubare energie heroorweeg word, rakende die relevansie daarvan binne die landskonteks asook die beleid se vermoë om die ontplooiing van alternatiewe energietegnologieë doeltreffend te bevorder. In 'n voortdurend veranderende en globaliserende wêreld, met buite-invloede op nasionale beleidsrigtings sterker as ooit, word dit noodsaaklik en uiters belangrik dat beleide voortdurend heroorweeg word om die doeltreffendheid daarvan op die gunstigste vlak te verseker.

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ABBREVIATIONS

CAC	Command and Control
CC	Climate Change
CO ₂	Carbon Dioxide
CSP	Concentrated Solar Power
DME	Department of Minerals and Energy
DoE	Department of Energy
EU	European Union
FIT	Feed-In Tariff
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GW	Gigawatt
GWh	Gigawatt-hour
IEA	International Energy Agency
IPCC	International Panel on Climate Change
IPP	Independent Power Producers
KW	Kilowatt
KWh	Kilowatt-hour
LCOE	Localised Cost of Electricity
LTMS	Long-Term Mitigation Scenarios
MBI	Market-Based Instrument
MC	Marginal Cost
MEC	Minerals – Energy- Complex
MW	Megawatt
MWh	Megawatt-hour
NETL	National Energy Technology Laboratory
NERSA	National Energy Regulator of South Africa
OECD	Organisation of Economic Cooperation and Development
O&M	Operations and Maintenance
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
PV	Photovoltaic
RE	Renewable Energy

REFIT	Renewable Energy Feed-in Tariff
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
REPA	Renewable Energy Purchasing Agency
RETs	Renewable Energy Technology(s)
RPS	Renewable Portfolio Standard
SBO	Single Buyers Office
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNFCCC	United Nations Framework Convention on Climate Change
W	Watt
WEC	World Energy Council
ZAR	South African Rand

CLARIFICATION OF CONCEPTS

i. Energy

Energy is defined, according to its scientific meaning, as the ability to do work (Mokheseng, 2010; Swanepoel, 2008). Energy is based on the concept of work developed from Newton's first and second law of motion, which states that 'work done by any force is the product of the force and the distance moved in the direction of the force (Aubrecht, 2006). For the purpose of this thesis, energy is defined in terms of power and, therefore, according to the unit of watt (W). According to Aubrecht (2007), power is defined as the '*work done divided by the time needed to do the work*'. Energy is governed by the Law of Conservation, which postulates that energy can never be created nor destroyed; rather, it can only be converted (Smit, 2009). Consequently, the amount of energy in the universe is constant. According to Smit (2009), we are actually incorrect when we say that energy is 'consumed' or 'used'. For simplicity reasons, energy 'use' or 'consumption' from hereon in is solely for convenience of understanding.

ii. Energy system

According to Jaccard (2006), an energy system is the '*combined processes of acquiring and using energy in a given society or economy*'. The use of the term 'combined processes' illustrates that it involves a number of components including exploration, extraction, production, consumption and transportation of the energy (Valenti, 2013a). Therefore, an energy system is the total interactions between all elements in the system.

iii. Conventional energy

Conventional energy refers to the dominant energy sources that currently generate electricity. These dominant sources are classified as fossil fuels and widely considered non-renewable. The three main forms of fossil fuels include coal, gas and oil. For the remainder of this thesis, the term conventional energy will refer to any form of energy generated using coal, gas and oil.

iv. Renewable energy

Renewable energy is commonly understood to be energy from on-going, natural processes (Macdonald, 2009). Renewable sources are unlimited, and our consumption of them does not reduce the available amount – they are inexhaustible. According to Smit (2009), renewable

energy sources are considered inexhaustible because ‘*all renewable energy originates from the electromagnetic radiation created via fusion inside the sun, a process that is expected to survive for countless years*’. This solar energy is then converted into other renewable form of energy including solar, wind, hydro and geothermal, to name a few.

v. Renewable energy sources

Renewable energy sources refers to sun, wind, biomass, water (hydro), waves, tides, ocean currents, geothermal, and any other natural phenomena that are cyclical and non-depletable (Department of Minerals and Energy (DME), 2003: v).

vi. Renewable energy technology

Renewable energy technology is any type of technology that has the ability to convert a primary renewable source of energy or energy resource to the desired form of energy service. Technology is a way or ways of carrying through any economic purpose and may exist as pure method or pure information or it may be embodied in physical products or processes (Schilling, 1998).

vii. Electricity

Electricity is the cleanest form of energy at the point of use (McDaid, 2009), and is a form of energy resulting from the existence of charged particles, either statically as an accumulation of charge or dynamically as a current. An electrical current is generated when electrons flow in an atom. This electrical current passes between atoms to create electricity. While the sources used to create electricity can be renewable or non-renewable, electricity in itself is neither renewable nor non-renewable. Electricity is measured in watts; one watt-hour is the amount of electricity expended by one-watt load drawing power for one hour. For example, a 50-watt light bulb will consume 500 watt-hours of electricity if left on for 10 hours. Electricity measurements are as follows:

- i. 1 kWh = 1 000 W
- ii. 1 MWh = 1 000 KWh
- iii. 1 GWh = 1 000 MWh
- iv. 1 TWh = 1000 GWh

viii. Climate change

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as *'a change of climate which is attributed directly or indirectly to human activity that alters the composition of global atmospheric and which is in addition to natural climate variability observed over comparable time periods'*. Climate change is a naturally occurring phenomenon that has occurred throughout history. However, it has recently been associated with the induced effect of anthropogenic activities that have increased levels of greenhouse gases in the earth's atmosphere, stimulating an enhanced greenhouse effect, known as global warming (Mokheseng, 2009). The global consensus is that human activities on earth have greater than realised the influence on global climate (Intergovernmental Panel on Climate Change (IPCC), 2013). Over the last century, the average global temperature has risen by 0.7 degrees Celsius (Seifred & Witzel, 2010).

ix. Greenhouse gas

According to the IPCC (2013: 22), greenhouse gases (GHGs) are *'those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere and the clouds'*. Increases in global GHGs give rise to the greenhouse effect: the process in which the absorption of infrared radiation by the atmosphere warms the Earth (IPCC, 2013). GHGs include Water Vapor (H₂O); Carbon Dioxide (CO₂); Nitrous Oxide (N₂O); Methane (CH₄); and Ozone (O₃).

x. Fossil fuels

McDaid (2009: 65) defines fossil fuels as *'millions of years' worth of deposited organic matter, transformed over hundreds of thousands more years by high pressure and temperature within the earth. These fossil fuels contain energy taken up from the sun over thousands of millennia, accumulated and transformed as the earth rebuilds itself on the geological time-scale'*. Fossil fuels are considered non-renewable: the rate at which humans consume them exceeds their natural regenerative capacity. In addition, the use of fossil fuels raises serious environmental concerns. According to the Swilling and Annecke (2012), the burning of fossil fuels produces roughly 21.3 billion tonnes of CO₂ per year; only half of this is naturally absorbed by the atmosphere. The three most consumed fossil fuels include: coal, oil and natural gas – all of which are deeply embedded within the global energy system.

CHAPTER 1: SETTING THE SCENE

1.1. INTRODUCTION

‘South Africa has not yet joined the global renewable energy transition. Virtually all moves in this direction have been thwarted by policies lacking follow-up action strategies, contradictory regulations from different government agencies, and a failure to actually commission significant renewable energy production. A number of recent legislative, regulatory and planning process developments have been formulated and implemented into the South African market; however, less than 10 per cent of the targeted new renewable energy capacity has been achieved to date. Unless the challenges are faced now, with clear vision and active leadership, South Africa could miss another decade of the global transition to renewable energy’.

(Stiftung, 2014)

Energy is well recognised to be the lifeline of all human activities and the world we live in today has undoubtedly been shaped by the global energy system. However, the very energy system that humanity has become so dependent on is increasingly becoming less sustainable as the demand for energy continues to grow at exponential rates. There is no question that the future requires change – through the development and adaption of new supply of technologies, through a successful search for new, less resource – intensive paths of economic development, and through adoption of more efficient ways to use energy, including effective policies that can achieve this (Taylor, Govindarajalu, Leven, Meyer & Ward, 2008).

The intention of this study is to contribute to the existing academic knowledge associated with energy systems by proposing an alternative renewable energy (RE) policy framework specifically aligned with South African context that could increase the effectiveness of the policy to promote RE investment. The quote from Stiftung (2014) above illustrates that the South African RE landscape is not prepared for the transition to a sustainable energy system.

Before discussing the research aims and objectives of this study, it is important to first contextualize the study. As Barrientos (2007) argues, policy-based research involves a wide range of literature sources that will ‘*contain a number of different times periods, institutional sources, theoretical approaches, and ideological perspectives, and each are reflected in different paradigms or policy agendas*’. Barrientos (2007) further argues that none of these sources of literature were written in a vacuum, and extensively examining the overall context of the study can provide important insights into a better understanding of it. The extent to how deeply one needs to discuss the context of a study is partly dictated by the type of topic they are researching. Due to increases in globalization, and the rise of exogenous influences in the global RE system on national RE sectors, it is important for this study to extensively focus on not only the South African energy context, but the global energy system too.

1.2. FRAMING THE RESEARCH PROBLEM AND STUDY

1.2.1. Global energy context

The global energy system is by its very nature is a highly complex and multi-dimensional system. While there are many domains and characteristics in the global energy system, this section assesses the global energy system specifically in terms of electricity, and primarily focus on three considerations. Firstly, the composition of the global energy system in terms of energy sources for electricity production; secondly, the environmental consequences of the sources used to generate electricity globally; and finally, the exponential increases in world population. All three of these characteristics are all central to the composition of the global energy system, and are all playing a large influence on the sustainability of the system.

The global energy system is currently dominated by fossil fuels. The three leading global fossil fuel sources are coal, oil and gas – all of which are classified as non-renewable. Fossil fuels are concentrated material forms of energy that can be stored and transported relatively easily until their energy is required. This explains why they have predominantly been the dominant energy source since the industrial revolution. Fossil fuels provide highly concentrated energy that is extremely convenient, and have been the primary driver of industrialization, economic growth and more recently globalization (McDaid, 2009). Haw and Hughes (2007) argue that the most

used primary energy sources have been those that are nearest and easiest to consume, which is why humans have historically relied on fossil fuels as the primary source of energy. Figure 1.1 represents global electricity generation by fuel type.

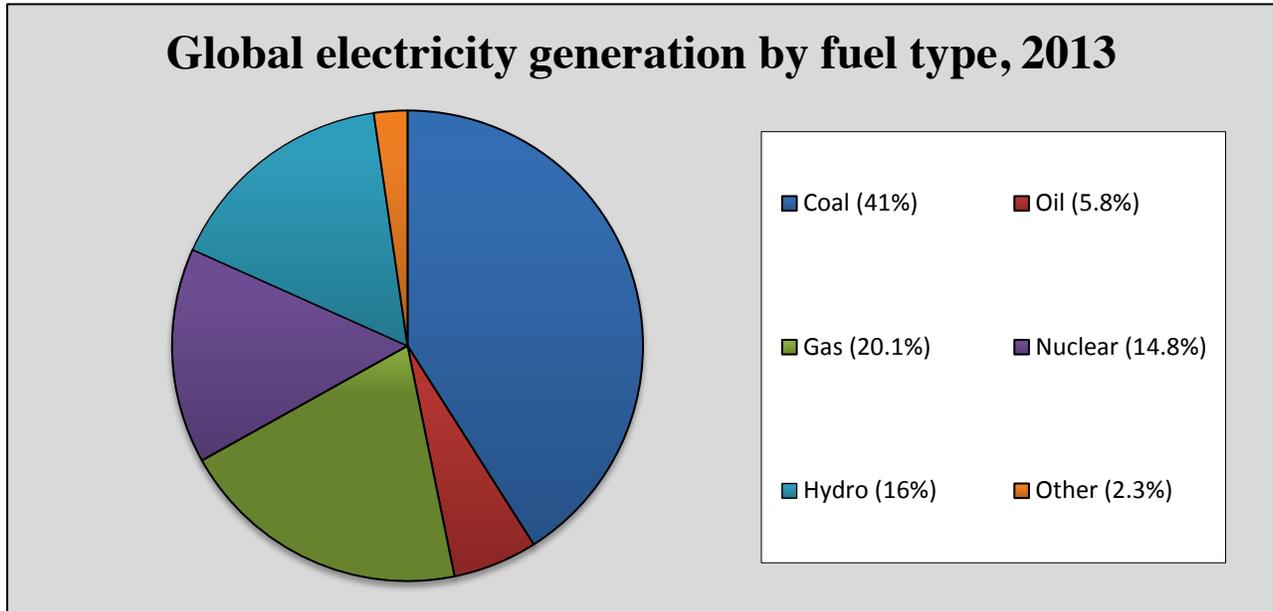


Figure 1.1: Electricity generation by fuel, 2013

Source: Redesigned from IEA (2013)

Coal is the dominant global source for current global electricity generation with a 41 per cent contribution. Following coal is gas (20.1%), hydro (16.0%), nuclear (14.8%), oil (5.8%) and other (2.3%). Fossil fuels contribute approximately 65 per cent towards global electricity production. Figure 1.1 reflects the historical trend in which fossil fuels significantly supply the majority of the world's energy needs.

While the combustion of fossil fuels was essential to the development of today's modern societies, their use for electricity generation has been known to have significant adverse effects on the environment. More than ever before, there is an emerging global consensus that the unsustainable use of conventional energy sources is detrimental to the natural environment and now pose a major health risk for both humans and non-humans (Mokheseng), 2010 While all

processes in fossil fuel consumption are detrimental to the environment, the process that has the worst environmental effects is the combustion stage of the energy sources.

Fossil fuels contain the environmentally harmful gas Carbon Dioxide (CO₂). When fossil fuels are combusted, they release gases, as their energy is transferred through heat. These gases are then absorbed by the Earth's atmosphere, a process commonly known as the 'greenhouse effect'. While the greenhouse effect is essential for life on Earth, exceeding the capacity of the atmosphere's ability to absorb the CO₂ has serious implications. The biggest consequence of this 'unnatural' greenhouse effect caused from human activity is that it essentially 'warms' the planet – effectively giving rise to the notions of Climate Change and Global Warming.

Global warming is real, and has the potential to affect all of world society (Rowlands, 1998). While climate change and global warming are essentially naturally occurring processes (Seifred & Witzel, 2010), there is evidence that the global temperature increases are due to an increase in concentrations of GHGs in the atmosphere caused by human activities (IPCC, 2013). Since the pre-industrial age, the concentration of CO₂ has risen from roughly 280 parts per million (ppm) to the current level of 430 ppm (Stern, 2006); exceedingly close to the global limit of 450 – 550 ppm. Stern (2006) further suggests that the Earth's atmosphere has a critical Carbon Dioxide threshold, and although this exact level is unknown, it is within the capacity of human activity. Figure 1.2 illustrates the increases in global CO₂ emissions since the industrial revolution in the 18th century.

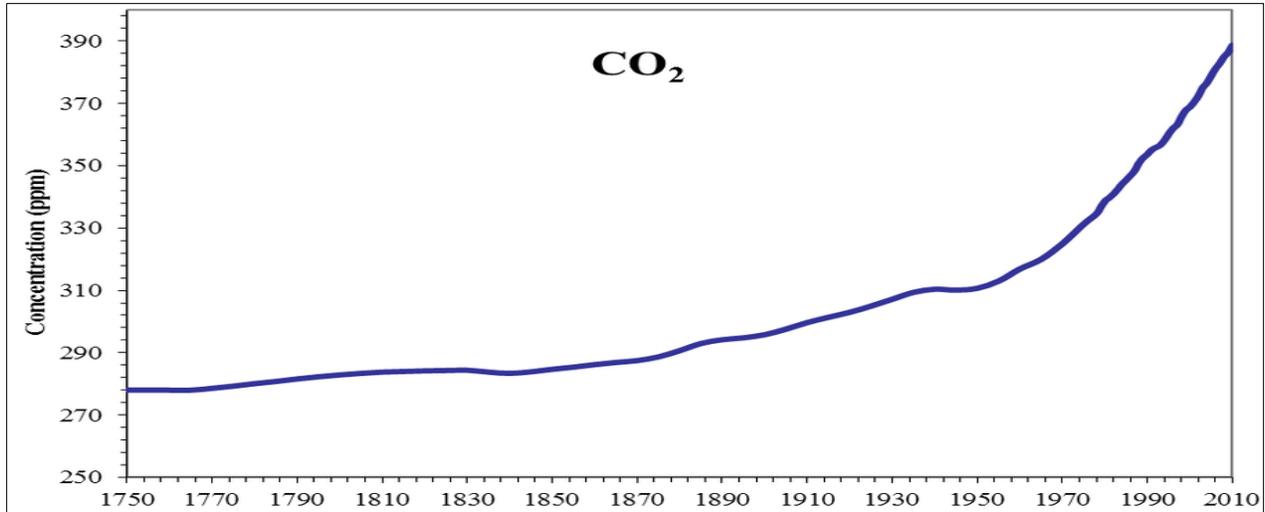


Figure 1.2: Global CO₂ emissions, 1750 – 2010

Source: EIA (2013)

The increases in CO₂ levels in the atmosphere have already resulted in a 0.7 degree temperature increase over the past century (Seifred & Witzel, 2010). Future projections suggest that if we do not act quickly to build low-carbon economies, temperatures could rise by an additional 2 degrees (Swilling & Annecke, 2012). The increase in global temperature has already, to a certain extent, had significant influences on global climate patterns, and will increasingly have catastrophic consequences, ranging from increased sea levels, to tempestuous weather events, to increased desertification, only to name a few.

The third consideration that has immense consequences on the global energy system is the increases in global population. Worldwide, more than 1.3 billion people already lack access to electricity, making it harder for them to overcome poverty and to benefit from basic communications, healthcare, and educational services (EIA, 2013). Global human population has increased almost threefold between 1950 and 2008 (United National Department of Economic and Social Affairs (UNDESA), 2008) which has led to new scarcities being created, especially in water, land and energy supplies. *The World Population Prospects, The 2008 Revision* (UNDESA, 2008) predicts that the current population of 6.7 billion will increase to 9.8 billion by 2050. According to the World Energy Council (WEC, 2013), the global primary energy demand has increased by more than 50 per cent since the 1980's, and this demand is set to continue at an

annual average rate of 2 per cent between 2008 and 2050. Figure 1.3 illustrates predicted energy consumption and world population growth.

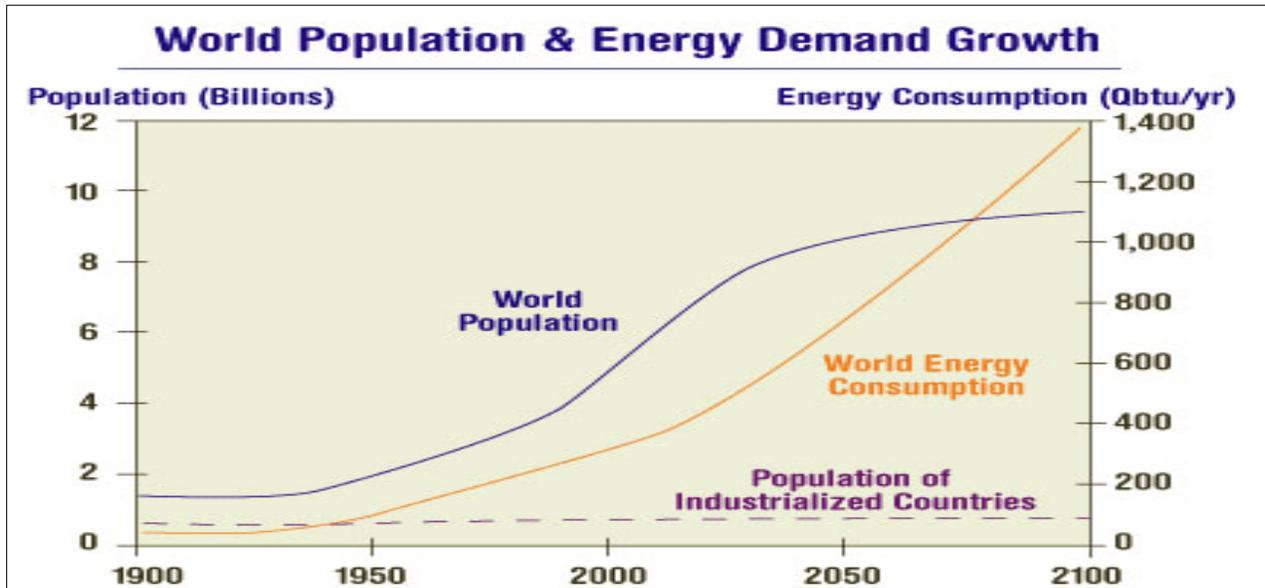


Figure 1.3: World population and energy demand growth, 1900-2100

Source: UNDESA (2008)

Figure 1.3 illustrates an important trend with global population. Note how the overwhelming majority of population increases will come from developing countries; industrialized countries population will remain relatively constant. This trend has already had, and will continue to have, many negative effects on land, water and energy as the demand for such services has increased dramatically in order to compliment the growth. The additional global energy required to support this population growth has placed immense stress on the global energy systems, as energy is critical for human development – to such an extent that modern living would cease to exist if we did no ‘unplug’ ourselves (Smit, 2009).

Exponential population growth in developing nations is quickly becoming an area for concern, as developing countries are required to generate additional electricity to meet the needs of the increased population. Valenti (2013a) argues that there are three reasons energy consumption will increase in developing countries. Firstly, political independence and the subsequent economic growth that follows; secondly, entry into the global economy due to globalization; and

thirdly, increased knowledge and information regarding fossil fuels and their extraction. Unfortunately, with such rapid population growth expected in developing countries, energy is likely to be sourced from the most accessible sources, namely fossil fuels.

In summary, there is sufficient evidence to suggest that the global energy system is currently on a highly unsustainable path. Energy sources in the forms of fossil fuels dominate the global energy system, and look likely to continue dominating on a global level in the foreseeable future. These fossil fuels are known to have numerous harmful environmental impacts associated throughout all stages of their consumption, particularly during their combustion stage. Among many, the most concerning environmental issue is, however, the harmful CO₂ that fossil fuels release when combusted. The scientifically-proven increase in CO₂ levels in the atmosphere has already directly resulted in global temperature increases –generating terms such as ‘Climate Change’ and ‘Global Warming’. However, if the situation is not bad enough as it is, predictions indicate that without major intervention, it will continue on a highly unsustainable path, as the number of human inhabitants on Earth is predicted to drastically increase over the next decades – the majority of increases being found in developing countries. Increased global growth will require additional energy supplies – supplies that are already becoming more and more difficult – at least costly – to exploit.

1.2.2. Global renewable energy context

The global energy context described above clearly shows that fossil fuels still dominate the system. Fossil fuels contribute 77.9 per cent to the global energy system, with RE contributing 22.1 per cent (Renewable Energy Policy Network (REN 21, 2014). However, renewables are steadily becoming a greater part of the global energy mix with double-digit growth rates being observed in the last decade for some RE technologies (WEC, 2013).

Within the RE share, hydropower is the most dominant form of energy generation with an overwhelming 16.4 per cent contribution¹. Following hydropower is wind (2.9%), bio-power (1.8%), solar PV (0.7%), and Geothermal, CSP and ocean (0.4%). Figure 1.4 illustrates the breakdown of RE in 2013.

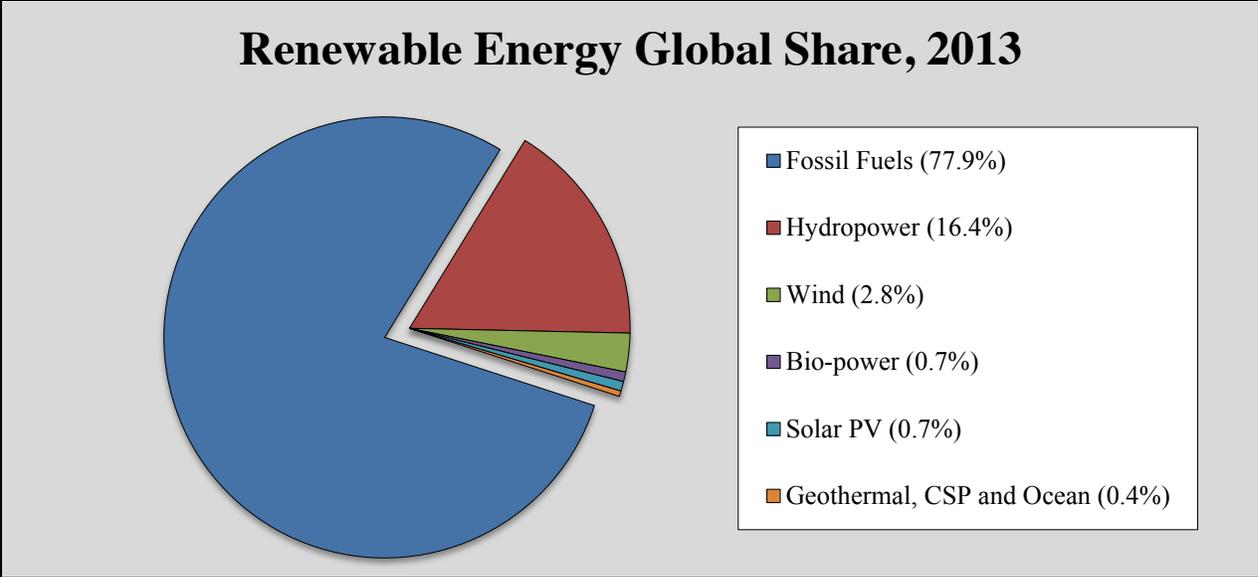


Figure 1.4: Renewable energy global share

Source: REN 21 (2014)

According to UNEP (2011), modern RE is being used increasingly in four distinct markets: power generation, heating and cooling, transport fuels, and rural/off-grid energy services. According to the REN 21 (2014), the market that experienced the highest growth was in the power sector. It is also important to mention that for the purposes of this study, where energy is presented as electricity, it is important to note the growth in the power sector. Figure 1.5 illustrates the growth in the RE between 2009 and 2013 within the aforementioned markets¹.

1 . Rural and off-grid statistics have been left out due to a lack of data.

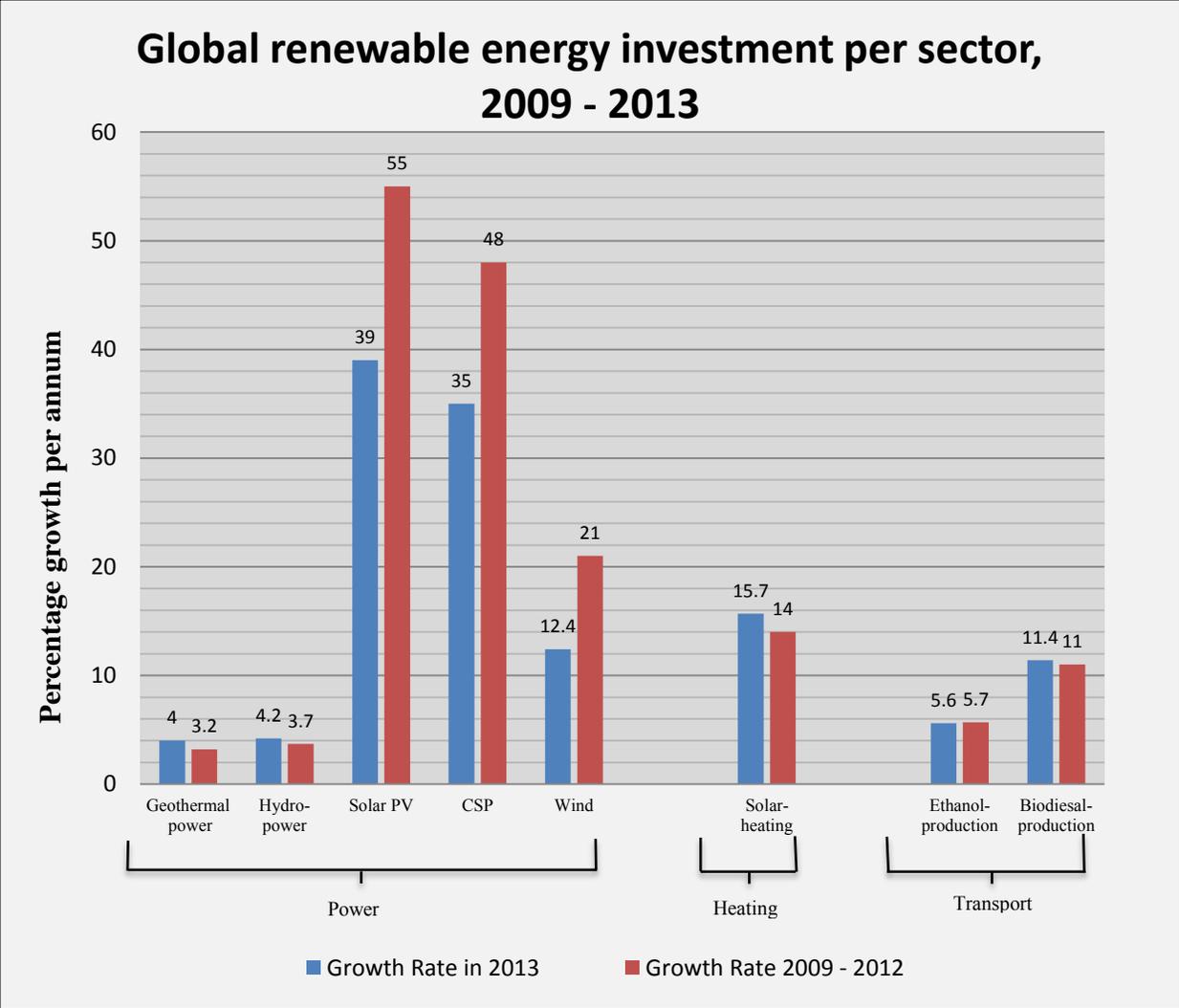


Figure 1.5: Global renewable energy investment per sector, 2009-2013

Source: Redesigned from REN 21 (2014)

In this study, energy is discussed in terms of electricity, and so the fact that the power sector has grown significantly is highly relevant. RE in the power sector has experienced significant growth when compared to the other three distinct markets as previously mentioned. This can be seen in Figure 1.5, where growth in the power sector was significantly higher than in the heating and transport sectors.

Global power sector capacity exceeded 1 560 GW in 2013, an increase of more than 8 per cent over 2012 (REN 21, 2014). In terms of power capacity additions in 2013, RE made up more than 56 per cent of net additions to global power capacity and represented far higher share of capacity

added in several countries around the world (REN 21, 2014). Table 1.1 illustrates the increases in global RE power generation between 2004 and 2013.

Table 1.1: Global renewable energy capacity – power sector, 2013

		2004	2012	2013
Power				
Renewable energy capacity (total, not including hydro)	GW	85	480	560
Renewable energy capacity (total, including hydro)	GW	800	1440	1560
Hydropower capacity (total)	GW	715	960	1000
Bio-power capacity	GW	<36	83	88
Bio-power generation	TWh	227	350	405
Geothermal power capacity	GW	8.9	11.5	12
Solar PV capacity (total)	GW	2.6	100	139
Concentrating Solar Thermal Power (total)	GW	0.4	2.5	3.4
Wind power capacity (total)	GW	4.8	283	318

Source: REN 21 (2014)

Investment in RE, particularly in the power sector, has increased considerably over the past decade, largely due to rising energy prices in the conventional energy system, as well as a reduction in cost of RE technology, largely due to rapid economies of scale. REN 21 (2014: 24) argues that the increase in the RE industry recently has been ‘*aided by continuing advances in technologies, falling prices, and innovations in financing, driven largely by policy support*’. REN 21 (2014: 24) further states that these developments are ‘*making RE more economical than new*

fossil fuel and nuclear installations under many circumstances, and this more affordable for a broader range of consumers in developed and developing countries’.

The increase in the global RE industry is also largely due to the plethora of benefits being realised by countries all over the world. There is increasing awareness of renewables and their potential to meet rapidly increasing energy demands while creating jobs, accelerating economic development, improving public health, and reducing carbon emissions (REN 21, 2014).

While policy uncertainty and falling system costs resulted in a decline in investment in power generating renewables in 2013, the RE industry nevertheless outpaced fossil fuels for the fourth year running in terms of net investment in power additions (REN 21, 2014). By the end of 2013, renewables comprised of 26.4 per cent of the world’s power generating capacity, enough to supply approximately 22.1 per cent of global electricity (REN 21, 2014). The incredible growth in investment in renewables in the past decade has been so astounding that annual investment in renewable powers and fuels has increased from USD 39.5 Billion in 2004 to USD 249.5 billion in 2012 (REN 21, 2014).

Countries throughout the world are increasingly realising the short-, medium- and long-term benefits of expanding their RE capacity. According to REN 21 (2014), by early 2014, at least 144 countries had RE targets and 138 had RE support policies in place. Interestingly, however, developing and emerging economies have led the expansion in recent years and now account for 95 per cent of the countries with support policies implemented between 2005 and 2010, up from a mere 15 per cent in 2005 (REN 21, 2014). Such developments make it evident that the global RE industry is not longer dependent on a small handful of countries. Table 1.3 illustrates the number of global states/provinces/countries with respective RE policies in place.

Table 1.3: Countries with policy target by type, 2004 – 2013

		2004	2012	2013
Policies				
Countries with policy targets	#	48	138	144
<i>Feed-in tariffs</i>				
Number of states/provinces/countries	#	34	97	98
<i>RPS/quota policies</i>				
Number of states/provinces/countries	#	11	79	79
<i>Tendering</i>				
Number of states/provinces/countries	#	8	45	55
<i>Heat obligations/mandates</i>				
Number of countries	#	n/a	19	19
<i>Biofuel obligations/mandates</i>				
Number of countries	#	10	52	63

Source: REN 21 (2014)

Table 1.3 clearly indicates that the global renewable industry is increasing rapidly. Although conventional energy systems, in the forms of fossil fuels, still dominate the global energy system, perceptions on RE have shifted considerably since 2004, with the number of countries implementing various RE policies and targets increasing almost threefold (REN 21, 2014). The past decade has demonstrated that RE potential can indeed be met, thanks to continued technology advances and rapid deployment of many RE technologies (REN 21, 2014).

1.2.3. South African energy sector– the context for renewables

The South African energy system mirrors the global energy system that has been described. Fossil fuels overwhelmingly dominate the South African energy system, with coal the largest contributor. Approximately 90 per cent of electricity needs are met by the combustion of coal at coal-fired power stations (Smit, 2009). The remaining 10 per cent is shared amongst other energy sources, including nuclear (5%), and RE (2%). In terms of overall energy consumption (not specifically electricity production), fossil fuels also dominate with coal, oil and natural gas making up over 95 per cent of total consumption. Figure 1.6 illustrates the total primary energy consumption in South Africa.

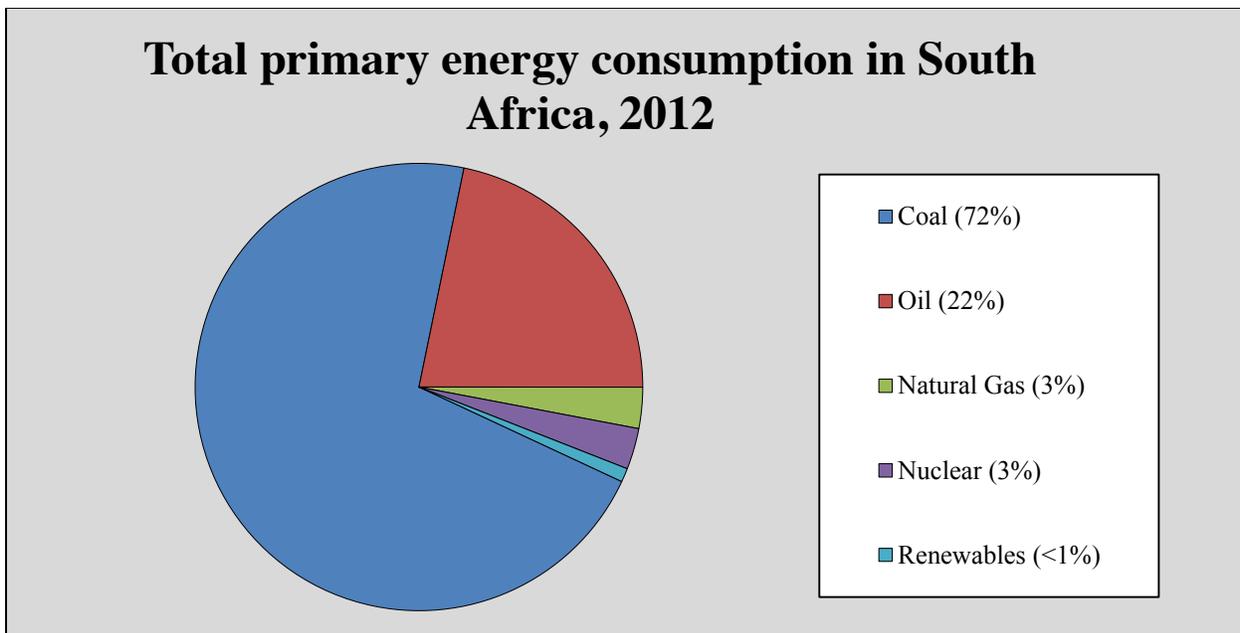


Figure 1.6: Total primary energy consumption in South Africa, 2012

Source: DoE (2012)

In 2009, South Africa had an installed capacity of 42 GW, and a peak demand of 36 GW (Swilling & Annecke, 2012). Eskom, the monopolistic electricity utility in South Africa, generates approximately 95 per cent of all electricity consumed South Africa, and has 27 operational stations that make up 40.7 GW of the country's capacity (Edkins, Marquard & Winkler, 2010). In addition to this, Eskom exports electricity, supplying approximately 50 per cent of Africa's electricity demands, relying on only a 10 per cent margin between supply and

demand. This narrow margin has led to numerous electricity crises; the most recent occurring in the 2007/2008 power shortages across South Africa. With such an overwhelming market share, Eskom is highly accountable for the energy – mix breakdown. Unfortunately, only 1 per cent of Eskom’s generation base is renewable (Crompton, 2009; Eskom Holdings Annual Report, 2007).

South Africa, therefore, has one of the most energy–intensive economies in the world (Swilling & Annecke, 2012). The primary reason South Africa uses coal as an energy source for over 90 per cent of energy needs is due to the fact that the country has extremely large coal reserves. At nearly 50 billion tonnes, South Africa has the sixth largest recoverable coal reserves in the world (McDaid, 2009). In addition, coal is of particular importance to the South African economy as it provides over 70 per cent of the country’s primary energy supply, supports over 90 per cent of electricity generation, and provides feedstock for nearly a quarter of the nation’s liquid fuels via Sasol’s coal-to-liquid process (Swilling & Annecke, 2012). At current consumption rates, the available coal supply in South Africa is estimated to last well over one hundred years (DoE, 2012). Another important consideration is the fact that historically energy production using coal as a primary resource has been relatively cheap.

While electricity prices in South Africa have been regulated for many years, it has, to a certain extent, reflected the balance of supply and demand. The surplus of supply over demand due to over-investment in generating capacity coupled with the abundance and low cost of coal has resulted in South Africa having some of the lowest electricity prices in the world (Crompton, 2009). The cheap price of electricity has therefore historically created a formidable barrier for other forms of energy such as RE. According to Swilling and Annecke (2012: 62), the country’s policy of keeping coal and mineral prices as low as possible has ‘*constrained diversification of the economy into more knowledge-intensive sectors and encouraged high levels of operational inefficiency*’.

The combustion of coal releases high levels of GHG gases into the atmosphere – carbon dioxide in particular. Due to the dependency of coal for its energy demands, South Africa ranks as one of the worst emitters of GHGs in the world. South Africa emitted 367, 6 million tonnes of CO₂ in 2011, representing 1.17 per cent of global emissions – making it the most carbon-intensive

developing country in the world (Swilling & Annecke, 2012). Krupa and Burch (2011: 12) argue that ‘South Africa is among a small number of countries that emit disproportionately high levels of GHG, mainly due to relatively high energy intensity per unit of GDP and a continued reliance on a heavily polluting minerals-energy complex’. In absolute terms, this positions South Africa as the 12th largest CO₂ emitter in the world.

Within Africa, South Africa’s CO₂ contribution to the continent’s total emissions (in absolute terms) is a staggering 42 per cent. Being the primary global warming ‘villain’ in Africa, South Africa is responsible for more CO₂ emissions than Egypt, Nigeria, Algeria and Libya combined (Bond *et al.*, 2009). Nigeria, Africa’s second largest economy and biggest oil producer, only emitted 52,8 million tonnes of CO₂ in 2011, ten times less than the continent’s largest economy, South Africa (Bond *et al.*, 2009). Table 1.4 illustrates South Africa’s GHG emissions when compared to the rest of Africa.

Table 1.4: South Africa emissions vs. rest of Africa, 2004

Country	Carbon Dioxide (CO ₂)	Methane (CH ₄)	Nitrous Oxide (N ₂ O)
South Africa	315 957. 24	2 057	66
Rest of Africa	700 940. 20	27 590	1 072

Source: Bond *et al.* (2009)

Not only does South Africa rank near the top of the list in terms of absolute CO₂ emissions, but so too does South Africa’s per capita emission statistics. South Africa has one of the highest per capita CO₂ emissions in the world – currently 11th on the global list. The average South African emits 7.27 tonnes of CO₂ per year - significantly greater than the global average of 4.50 tonnes of CO₂ (EIA, 2013). In addition to this, the average South African emits an overwhelming 7.8 times more CO₂ than the average person in Africa, which has an average of 0.93 tonnes of CO₂ per capita. It must be noted however that this is largely due to the minerals-energy complex in

South Africa, and not necessarily South African’s lifestyles. Figure 1.7 illustrates South Africa’s CO₂ emissions per capita compared to the global and African averages.

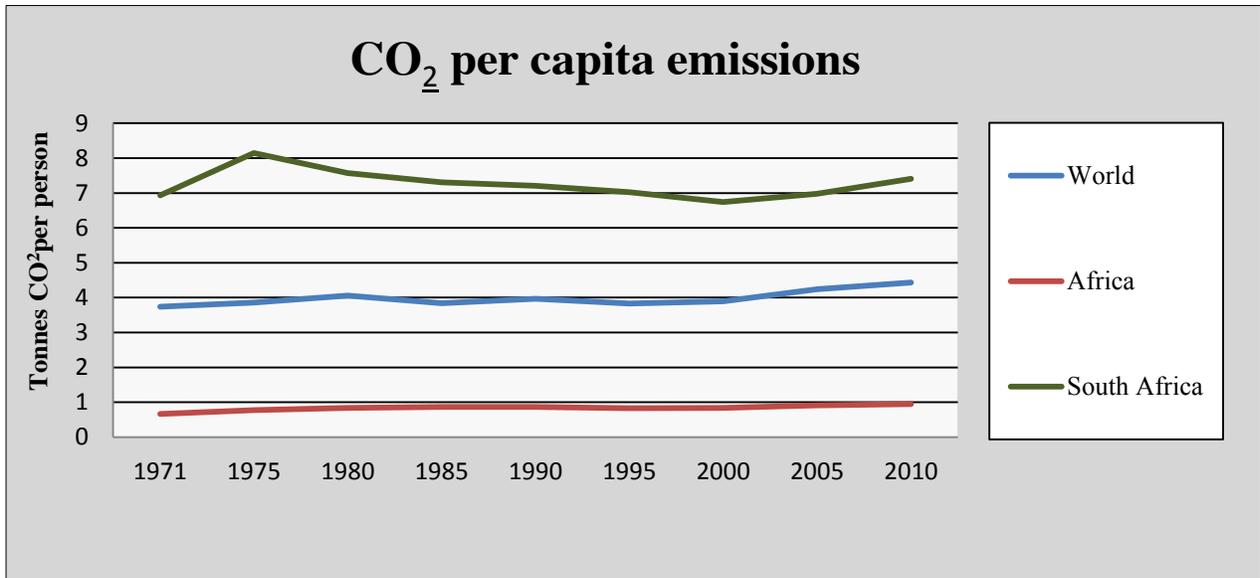


Figure 1.7: CO₂ per capita emissions. 1971-2010

Source: Redesigned from EIA (2013)

As income rises and the South African government continues its attempt to provide universal access to electricity, emission intensity is expected to increase (Pegels, 2010). Swilling and Annecke (2012: 65) state the following on the South African situation regarding high CO₂ emissions:

‘South Africa has to worst of all worlds: high CO₂ emissions on a per country and per capita basis, relatively moderate economic growth, together with the threat of carbon taxes that may prevent rapid increases in CO₂ emissions – perceived (incorrectly) by decision-makers as a constraint on much-needed economic growth to deal with poverty challenges’.

The high dependency on coal as a primary energy source creates long-term negative consequences on the environment, economic and social components of sustainability. Certain international efforts and treaties aimed at reducing global GHG levels – such as the Kyoto

Protocol² – will mean that South Africa will be required to lower their emissions drastically before being subject to international sanctions in the near future. With a majority of coal-based infrastructure and large recoverable coal reserves, it will not therefore be due to a lack of coal that an energy transition takes place in South Africa.

It is also important to distinguish the sectors in the South African economy that emit the highest levels of CO₂. Unsurprisingly, the electricity sector emits the majority of CO₂ emissions with 63 per cent. Following electricity is transportation (14%), manufacturing and construction (13%), ‘other’ fuel combustion (8%), and industrial processes (2%). Transportation, the second worst CO₂ emitting sector, uses petrol (oil), while manufacturing and construction use a combination of fossil fuels, depending on the product. These statistics demonstrate just how environmentally harmful the electricity sector is in South Africa. Figure 1.8 illustrates the CO₂ emission per sector.

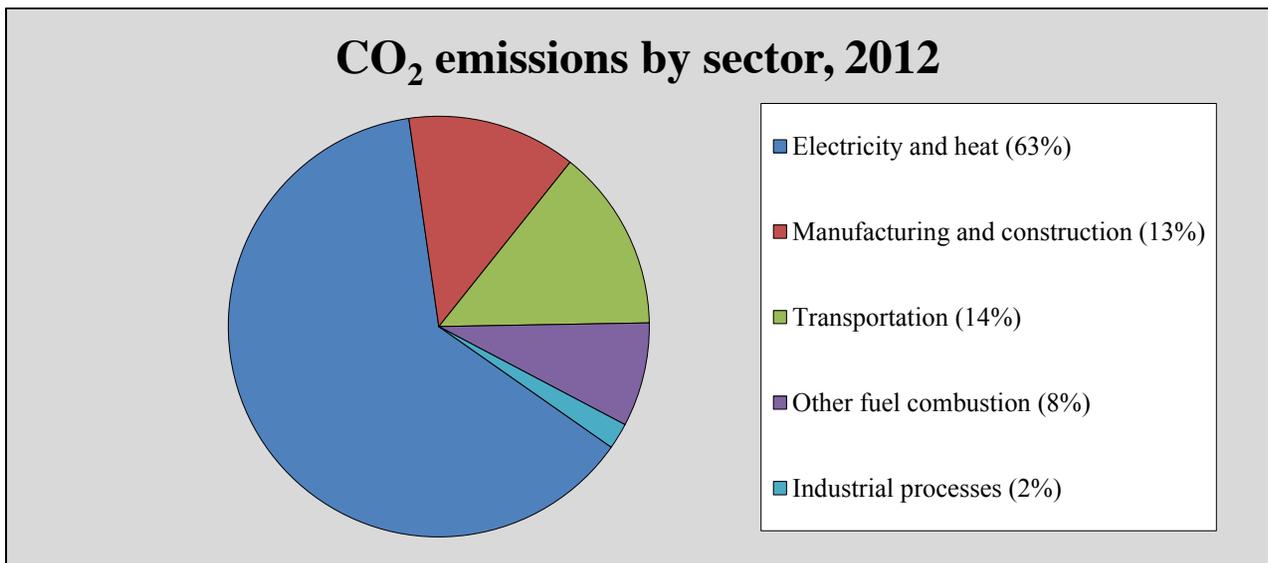


Figure 1.8: CO₂ emissions by sector in South Africa, 2012

Source: Redesigned from Carbon Disclosure Project (2013)

2. The Kyoto Protocol is an international agreement developed by the UNFCCC and implemented in 1997. The primary motive for the protocol was to collectively reduce GHG emissions by all member countries by 5.2 per cent below the emission levels of 1990 by 2012 (Valenti, 2013b).

South Africa also faces the inevitable challenges associated with increases in electricity demand resulting from rapid population and urbanisation growth. Growth rates in South Africa, however, will not exclusively follow the population patterns for developing nations as described in the global energy context. Edkins *et al.* (2010) state that due to the high rate of HIV infection in the country, population growth rates will not grow by more than 15 per cent of the 2011 population level. Nevertheless, projected electricity demand based on the Gross Domestic Product (GDP) and population growth forecasts, as presented in the Long-Term Mitigation Scenarios (LTMS), show an expected electricity demand of 430 TWh by 2030 upstream of transmission (Edkins *et al.*, 2010). This demand is almost double the current demand, as can be seen in Figure 1.9.

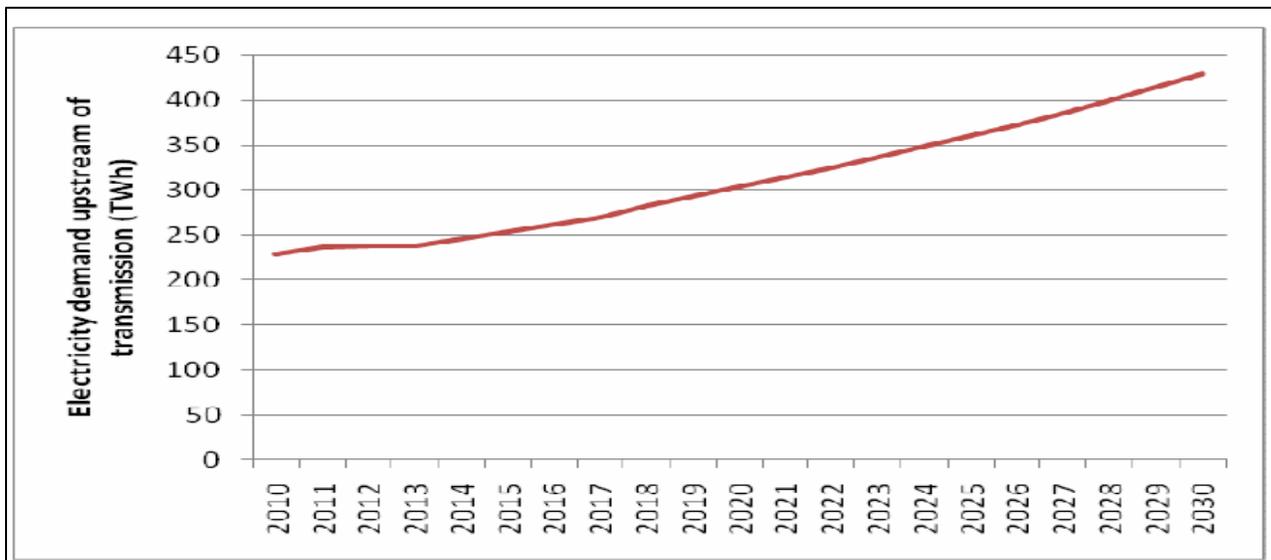


Figure 1.9: Electricity demand projections in South Africa, 2010 – 2030

Source: Edkins *et al.* (2010)

The use of coal as a primary energy source has three major implications for the South African market. Firstly, coal has a high carbon content. Secondly, the use of coal has historically resulted in extremely low electricity prices; these prices have not truly reflected the externalities associated with using coal for electricity production. Low electricity prices result in a formidable barrier for other energy sources, and therefore the diversification of the energy system is hindered. The third implication of depending on coal is the long-term challenges associated with retrieving energy sources. Coal, as with all fossil fuels, is exhaustible; South Africa will run out

of coal within the next one hundred years at current consumption rates. As such, it is imperative that RE capacity is increased sooner rather than later.

The South African Government's principle policy for RE is the 2003 *White Paper of Renewable Energy Policy* (RSA, 2003). In this paper, the South African Government committed to achieving a target of 10 000 GW, or a 4 per cent share, of energy produced from RE sources by 2013 (DME, 2003). To put this into perspective, the target of 10 000 GWh is equivalent of electrifying two million households having an annual consumption of 5 000 KWh each (DoE, 2012). However, looking at it from another perspective, this is also only equivalent to replacing two units (2 X 660 MW) of Eskom's combined coal-fired power stations (DoE, 2012). Until recently, the transition to RE was viewed as an economic cost. However, in the last few years it is being increasingly seen an opportunity to foster a more secure, labour intensive and sustainable economy and society (Edkins *et al.*, 2010).

While the South African energy system still heavily relies on coal as a primary energy source, by reviewing the *White Paper on Renewable Energy* (RSA, 2003), it can be said that South Africa is looking to diversity its energy mix substantially. According to REN 21 (2014), South Africa is ranked seventh in the world for total RE investment, with an estimated investment of USD 4.9 billion in 2013. Perhaps a more indicative statistic that illustrates Government's commitment to RE in South Africa is the share of total GDP that is allocated to RE investment. South Africa is ranked in the top 5 countries for investment in RE in terms of its GDP share, behind only Uruguay, Mauritius and Costa Rica (REN 21, 2014). With the natural resources necessary for RE generation in abundance, these investment figures should be expected.

Krupa and Burch (2011) argue that South Africa possesses some of the most promising available RE resources in Africa, if not the world. In addition, Krupa and Burch (2011: 12) further argue that South Africa has a '*plethora of assets for renewable energy generation – land, labour, and capital*'. South Africa receives approximately 280 TW of energy, some 6500 times more than the licensed capacity of the country's power stations (Eberhard & Williams, 1988). Howells (1999) estimates that the potential of solar energy at 8 500 000 PJ/year – compared to final consumption of 587 PJ/year in 2000 and the 621 PJ output of coal-fired power stations. With such a renewable

potential, South Africa theoretically has more energy per day than will ever be required (Crompton, 2009). However, as Winkler (2005: 3) argues, the *'diffuseness and intermittency of solar energy means that the technological, economic and market potentials for capturing it are less than the theoretical potential'*. Nevertheless, RE technology has been deployed in South Africa to capture some of this energy. The two sources of RE that theoretically have the highest potential are solar and wind, both of which are worth briefly discussing.

The use of solar energy is the most readily accessible resource in South Africa, and solar radiation levels in South Africa are amongst the highest in the world (Banks & Schaffler, 2005). Most areas in South Africa receive more than 2 500 hours of sunshine per year, and average solar-radiation levels range between 4.5 and 6.5 KWh/m² in one day (Krupa and Burch, 2011). The annual 24-hour global solar radiation average is roughly 220 W/m² for South Africa, significantly higher than the 150 W/m² for the United States and 100 W/m² for Europe (DME, 2003). The two major ways in which solar radiation is utilised in South Africa is through solar photovoltaic (PV) electricity generation, and solar thermal electric.

The second form of RE with high potential is wind. Wind is currently the fastest growing energy industry in the world (Seifred & Witzel, 2010), and the industry in South Africa has followed this trend. Wind farms offer the largest immediate potential for input into the national electricity grid and for significantly alleviating South Africa's power supply shortage as the technology is mature (Stiftung, 2014). While wind resources in South Africa are not as abundant as the solar resources discussed above, there is still a massive potential for electricity generation from wind. Wind power is consistently good along the coast, particularly the along the Eastern Cape coastline. In addition to the Eastern Cape coastline, a small area of the Drakensberg Mountains experiences strong winds. Winds in localised areas along the Eastern Cape coastline have mean annual speeds of over 6.5 m/s, which is ideal for consistently generating electricity renewably from wind. It must be noted that the total energy available from wind is proportional to the cube of the wind speed. Thus, an area with average wind speeds of 6m/s has the ability to deliver as much as eight times the amount of energy per km² as an area with an average wind speed of 3m/s (Banks & Schaffler, 2005). Of the 410 000 km² exposed to wind speeds in South Africa, only approximately 1 174 km² can be allocated to wind farms (Banks & Schaffler, 2005). While wind

turbines would effectively only take up between 1 and 2 per cent of total land area and approximately 0.003 per cent of the resource area, they would contribute almost 1 per cent of South Africa's energy needs. This statistic illustrates the potential of wind electricity generation.

Because solar and wind resources have the most theoretical potential for RE in South Africa, they have subsequently been the two types of technology that have generated the most interest from investors. In 2030, South Africa aims to produce as much as 18.4 GW of electricity from renewable sources (DoE, 2012). However, solar and wind technology will contribute 8.4 GW each, leaving all other types of RE to produce less than 2 per cent. As such, the future of the RE sector in South Africa looks likely to be highly undiversified.

Although South Africa has an abundance of RE natural resources, particularly solar and wind, the deployment of RE technologies has relatively been slow to take off (Edkins *et al.*, 2010). Certain barriers have halted the deployment of RE investment in South Africa. Firstly, South Africa has an abundance of easily accessible coal, which subsequently allows the power utility Eskom to produce the cheapest electricity prices in the world. Krupa and Burch (2011) argue that the fact that the costs of coal-fired power plants have been nearly amortized, the low electricity prices as a result will make any future changes politically and economically difficult. The second reason is the fact that Eskom has a monopolistic market share, and their share of producing electricity from renewable sources is minute (Crompton, 2009). In addition, the situation doesn't look any brighter in the foreseeable future, with Eskom planning to inject massive capital investments into an expansion of the country's energy infrastructure, with primary focus being on expanding new coal-fired generation infrastructure (Krupa & Burch, 2011). Edkins *et al.* (2011) state that in an attempt to alleviate the electricity shortfall, this expansion will result in an additional 10 GW of electricity being produced from coal.

Another major barrier for RE deployment was highlighted in an assessment done on RE potential in South Africa compiled by Greenpeace and the European Renewable Energy Council (EREC). The study assessed the likely outcome of three scenarios: *'the business as usual approach; the desired government approach of minor changes to the existing path; and finally a radical reformation of RE policies and massive RE deployment across the country'* (Greenpeace, 2009).

Furthermore, the study suggests that the first two approaches may *'potentially result in social, environmental and economic degradation, suggesting the need for a careful examination of policy approaches that would yield the third scenario'* (Greenpeace, 2009). In light of this, Krupa and Burch (2011) argue that *'...environmental goals [in South Africa] have been subsumed by other interests'*. The fact that the South African government has many other 'priorities', such as high unemployment and crime levels, has historically resulted in a relative lack of support for an energy transition at the highest levels of government. Nevertheless, recent efforts to implementing policies specifically aimed for RE have become more prominent, and have gained significant momentum during over the past five years in the South African market.

While the *White Paper on Renewable Energy* (RSA, 2003) is the principal paper for RE, the National Energy Regulator of South Africa (NERSA) along with the Department of Energy (DoE) have recently formulated and implemented support mechanisms with a primary focus on increasing investment in RE. These support mechanisms, in essence, are the means to achieve the policy target. To contribute towards the target of 10 000 GWh and towards socio-economic and environmentally friendly sustainable growth, an urgent need to stimulate the RE industry was identified by NERSA. Consequently, in 2009, NERSA formulated and implemented a feed-in tariff (FIT) scheme for South Africa.

The Renewable Energy Feed-In Tariff (REFIT) was designed to increase investment by providing financial incentives to RE developers by using FITs as the support mechanism – the international best practice support mechanism at the time. The intention of the scheme was to offer financial incentives for developers by providing long-term electricity generation contracts on condition the energy was generated from renewable sources. A tariff was determined and set for the different types of RE technology. In addition to the financial incentive, procurement contracts were set at twenty years. Initially, the scheme gathered significant interest from both local and international RE developers, who quickly made moves to secure land for project construction.

However, in 2011, the DoE unexpectedly opted to replace the REFIT scheme with a competitive tender mechanism, without having signed off a single MW of electricity (Eberhard, 2013). The

Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) was implemented by the DoE in 2011, completely superseding REFIT. Unlike FITs, which was internationally recognised – at the time – as the most effective way of increasing RE investment, competitive tenders had little experience to draw from. As such, the DoE received a great deal of criticism from investors, particularly those that had planned and secured land for the REFIT scheme.

This sudden policy change sent shockwaves through South Africa's RE sector, creating high levels of uncertainty amongst investors. Many experts felt that the policy change would significantly dent investor confidence in South Africa as a potential RE investment location, and the long-term prosperity of the industry would be greatly jeopardised. However, although very little was known about the adopted support mechanism, experience to date suggests that it could greatly benefit developing countries, as the South African model has proved it can work.

In the three years since the programme's inception into the market, the policy has however been hailed as a success. To date, the limited power allocations have resulted in competition amongst investors, which, in turn, has resulted in the price of RE decreasing. The success of the policy has been hailed for its robust and thorough design. However, as will be explored later on, this study suggests that while the current policy is effective at increasing RE capacity in South Africa and deserves its accolades, the policy framework is nevertheless not optimally designed to fully maximise the benefits associated with additional RE capacity.

1.3. BACKGROUND AND DEVELOPMENT OF TOPIC SELECTION

South Africa, given its RE theoretical potential, has an opportunity to become a world-leader in RE, and in doing so become an ever-present dominant global economy. In the future, countries with fossil fuels will not be as globally dominant as they are today; rather, the countries with developed and efficient RE capacity will be dominant. These countries will enjoy a consistent supply of clean, sustainable energy, as opposed to those relying on the increasingly volatile conventional energy supply. South Africa has the opportunity to diversify its current energy system to allow for less dependency on non-renewable resources; and in turn allow for a

transition to a greener economy. An opportunity has been presented that can facilitate an energy system that one day will allow for unlimited energy. And lastly, South Africa has the opportunity to find a solution now for a problem that will arise in one hundred years when the coal supply runs out. With all of this potential and opportunity, the researcher continued to be intrigued as to why Eskom's (the country's monopolistic electricity utility) expansion plan is structured primarily around the abundant supply of coal, and to why the South African government hasn't intervened accordingly until now.

Nevertheless, it was anticipated that extensively researching the RE sector in South Africa could potentially shed some light on the situation. Whilst looking deeper into the RE sector in South Africa, the researcher noticed that the current policy mechanism used for promoting RE in South Africa – competitive tenders – has little international experience when compared to FITs. In fact, South Africa is one of the first countries to exclusively use such an approach: FITs have been the most widely used support mechanism for promoting RE to date. It was then discovered that South Africa had previously developed a FIT scheme in 2009, only to then unexpectedly replace it in 2011 with competitive tenders. Therefore the interest persisted why there was such an unexpected change in policy after less than two years since its inception: was this enough time to sufficiently judge the effectiveness of the policy?

The two policies used in South Africa were then explored in greater detail with the focus on researching and determining whether the current policy is optimally designed to increase RE capacity. After critically analysing the current scheme, REIPPPP, the researcher concluded that there were certain elements that were not optimally designed. Therefore the researcher developed a 'proposed' framework that would be more effective than the current system. The quote below from Krupa and Burch (2011) justifies the exploration into this study:

'Despite the presence of numerous lobbying bodies and strong international interest in developing renewable potential across the country, confusing regulatory and investment signals have been sent out...the renewable energy policies [in South Africa] remain disjointed. It is clear that barriers exist that may inhibit both the large-scale development of renewable energy resources as

well as the design of a renewable energy system that supports authentic sustainable development. Additional work must be done to determine the optimal set of policies for realizing sustainable development in South African energy, how policy measures in other sectors [energy-intensive industries particularly] can stimulate economic growth, and how all policies can be harmonized to improve social justice and environmental sustainability’.

This quote by Krupu and Burch (2011) above was in essence a research problem worth investigating, with particular interest in investigating the possible reasons as to why the DoE decided to change policies from a FIT to a competitive tender mechanism. Once understanding possible reasons for the policy change the researcher wanted to critically analyse the current scheme to determine whether it was optimally designed.

A critical analysis of the two schemes was therefore necessary. Upon completion of this analysis, it became clear that the design and structure of the current scheme, and policy framework for that matter, are not optimal. This study is not criticising the current scheme as being completely ineffective or flawed. Rather, it seeks to propose an alternative, proposed framework that could theoretically be more effective. Although this was a rather ambitious goal it was understood that with an effective research methodology specifically aligned to policy development, coupled with a thorough literature review and in-depth understanding of the policy landscape, the researcher would be sufficiently equipped with the tools and knowledge to develop such a proposed framework.

1.4. PROBLEM STATEMENT

After a critical analysis of the current RE policy in South Africa, this study argues that the policy framework is not optimally structured to promote the deployment of RE to its full potential. The use of the competitive tender approach as the sole support mechanism to increase RE capacity has little international experience to date on such a large scale, and while this approach has nevertheless proved relatively effective, it is argued that it is not optimal. This study therefore seeks to develop and propose a revised framework that integrates both a feed-in tariff and

competitive tenders into a single system, effectively maximising and realising the full array of benefits associated with an increased RE capacity.

1.5. RESEARCH AIMS AND OBJECTIVES

When discussing future RE policies in South Africa, Krupa and Burch (2011) states that ‘...*multiple alternative frameworks need to be tested*’. In essence, this study attempts just that; develop and test an alternative framework. In the words of Von Weizesacker, Hargroves, Smith, Desha and Stasinopoulos (2009: 12), ‘...*we need to learn from what is being done in all four corners of the world and rapidly bring this knowledge together as a base for significant resource productivity improvements in coming decades...*’. With this in mind, the intention of this study is to investigate the RE policies globally available, particularly feed-in tariffs and competitive tenders, and ‘bring together’ information and knowledge to develop a framework specific for the South African market.

The overall aim of this study, therefore, is to develop a framework for RE policy in which certain characteristics of both FITs and competitive tenders are integrated into one framework. The framework was designed to not only increase RE investment and capacity in South Africa, but also allow for greater diversification within the RE sector, which in turn will bring numerous benefits that are not currently being realised. Once the framework was developed, the study tested whether it could potentially be successful in the South African market and ultimately increase investment in the RE sector over the long-run. The aim of the framework was therefore twofold:

- i. Increasing RE capacity and investment in South Africa; and
- ii. Allowing for greater diversification within the RE sector thereby maximising the full economic benefits associated with an increased RE capacity.

The various research objectives, on the other hand, are formulated to contribute towards the overall aims of the study as mentioned above. The research objectives are threefold:

- i. To understand the nature of the South African energy sector, and the policy instruments that can be used to provide the highest probability of its long-term success;
- ii. To explore the theoretical concepts associated with RE support mechanisms – in particular feed in tariffs and competitive tenders – and understand their application to the South African context;
- iii. To develop and propose a revised policy framework for diversifying the RE sector in South Africa.

Table 1.5 below illustrates the kinds of questions were explored in order to meet the overall research aims and objectives of the study:

Table 1.5: Research objectives and questions

Research Objectives	Research Questions
To understand the nature of the South African energy sector	<p>What is the current state of the energy sector in South Africa?</p> <p>What is the legislative framework in the energy sector?</p> <p>Why would RE contribute towards a sustainable energy system?</p> <p>Why is RE not competing with conventional energy?</p> <p>What are the barriers to RE?</p>

<p>To explore the theoretical concepts associated with RE support mechanisms – in particular feed in tariffs and competitive tenders – and understand their application to the South African context.</p>	<p>What types of support mechanisms are available?</p> <p>How do these support mechanism intend to promote investment in RE?</p> <p>What are feed-in tariffs?</p> <p>What are competitive tenders?</p> <p>What are the major difference between feed-in tariffs and competitive tenders?</p> <p>How have FITs and competitive tenders been implemented into the South African market?</p> <p>To what degree of success in terms of promoting investment have REFIT and REIPPP generated in South Africa?</p>
<p>To develop and propose a revised policy framework for diversifying the RE sector in South Africa.</p>	<p>How can technologies for example landfill, that do not generate electricity as cheaply as other forms of RE, for example solar, be competitive?</p> <p>If technology does not have as much theoretical potential as solar and wind, what can be done to make it attractive for investors to consider?</p> <p>How would diversification within the RE</p>

	<p>sector benefit the economy in the short, medium, and long-term in South Africa?</p> <p>What combination of policies would be support diversification, whilst still achieving significant investment and capacity expansion?</p>
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Source: By Author, 2014

The above questions were answered throughout the study. Different questions required different methods of research to effectively answer them. Various methodological approaches, therefore, will be required to meet the research aims and objectives of the study. The research methods required to address the general research aim differed to the methods used to meet the specific research objectives. However, all research methods are intrinsically interrelated.

1.6. INTRODUCTION TO RESEARCH DESIGN AND METHODOLOGY

The research design was informed by the aims and objectives as mentioned above. This study is methodologically qualitative and primarily uses three methods of data-collection in order to meet the aims and objectives of the study:

- i. Literature review;
- ii. Focus group; and
- iii. Semi-structured interviews.

According to Olsen (2012), sophisticated data-collection offers ways to execute the best kinds of research. This study, therefore, has relatively sophisticated data-collection methods, and uses research systemization to a high extent in order to ensure the quality of data is thorough. All three types of research designs were equally important for this study.

Before discussing the details of the data-collection methods, it is important to first understand the research strategy. The research process consisted of two stages: Stage 1 for addressing the first aim of developing the proposed framework; and stage 2 for addressing the second aim of testing the proposed framework. The two stages were conducted completely independently of each other, and were treated as individual processes.

Both stages consisted of different data-collection methods that were strategically selected for the objective of the stage. In other words, the data-collection methods used in stage 1 were selected due to their appropriateness for developing a proposed framework, while data-collection methods in stage 2 were appropriate for testing the framework. Both stages are extensively discussed in Chapter 2.

Develop the proposed framework for renewable energy in South Africa that promotes investment and diversification.



Test whether the proposed framework can work in the South African market.



1.6.1. Stage 1: Designing the framework

As mentioned above, the research objective for stage 1 was to gather data and information required to develop the proposed framework, and then use this information to design a proposed framework. The data-collection methods used for this stage included a thorough literature review and a focus group.

1.6.1.1. Literature Review

The literature review allowed the researcher to gain a thorough understanding of both FITs and competitive tenders, as well as certain standard policy considerations policy-makers should conform to, or at least account for, when formulating policies. Once this literature had been

presented in the review, it allowed the researcher apply the knowledge put forwards throughout the designing of the proposed framework. Without a thorough literature review, the researcher would not have been equipped with the theoretical knowledge of the concepts associated with RE policy, and hence the design of the final proposed framework may have been flawed. Understanding the theoretical characteristics of each component, therefore, was critically important for the remainder of the study.

1.6.1.2. Focus Group

After the literature review was complete, the researcher then developed a proposed framework based on the knowledge put forward. Once the design elements of the proposed framework were complete, it was necessary for the researcher introduce the framework to a panel of experts. A focus group was the method of research used for this stage of research.

The researcher organised a group consisting of three experts in the industry to critique the design of the framework. This specific method of data-collection allowed the researcher to gain insight from a number of industry experts and understand certain characteristics of the framework that required amending. In addition, the experts chosen to participate in the focus group were specifically selected from different expertise and backgrounds. This allowed the researcher to gain a better understanding of the framework from different perspectives. In addition, it was believed that the different expertise of the participants would facilitate interesting debates on certain fundamental characteristics of the framework.

1.6.2. Stage 2: Testing the proposed framework

Stage 1 and 2 were researched independently of each other. The objective of stage two therefore was to test whether the revised proposed framework could theoretically work in the South African market. In addition, the stage attempted to identify potential areas and design elements worth further investigation. The intention of this stage was not to change design elements, but rather test whether the framework could theoretically work in South Africa. There was one method of data-collection for this process: an in-depth semi-structured interview.

1.6.2.1. Interviews

Semi-structured interviews were organised between the researcher and experts with extensive experience in fields such as RE, policy-making, and economics. As mentioned, the aim of the interviews was not to change the design elements of the proposed framework, but rather to gain a better understanding of whether the framework would be successful in the South African context. In addition, the researcher wanted to identify potential areas that would require further research.

1.7. SIGNIFICANCE OF RESEARCH

As will be discussed in greater detail in the literature review in Chapter 3, the level of success in the RE industry in South Africa heavily depends on the policies that are implemented to promote investment. Without robust, well-formulated policies that are specifically aligned to the South African energy system, RE would not be able to compete with conventional energy sources in South Africa. With coal stocks estimated to last for at least the next one hundred years at our current rate of consumption (Crompton, 2009), the transition to a more sustainable energy system will require direct intervention from national government. For the long-term future of the country, South Africa is required to facilitate a transition towards a more sustainable energy system now. The introductory quote by Stiftung (2014) demonstrates that without such policies as discussed above, South Africa can miss another decade of RE potential.

While RE policies are a relatively new concept throughout the globe, they are particularly new in South Africa. The lack of experience in RE policy-making, coupled with an energy system almost completely dependent on fossil fuels, creates a difficult platform for policy makers in South Africa to formulate and implement effective policies that will increase RE investment – and diversify the energy system. Without having any form of ‘tried and tested’ policy designs at their disposal, policy-makers are tasked with formulating incredibly complex policies without a comfortable level of experience.

Due to the relative ‘infant’ stage of RE policy in South Africa, there is a need for further investigation into possible design options. New policy framework designs, new innovative ideas, and alternative ways of approaching the incredibly difficult challenge of addressing the energy

crisis in South Africa will all significantly contribute towards more effective policies in the future. This study is just that: the birth of an alternative approach. Experience from around the world suggests that RE policy-makers are increasingly seeing the need to formulate innovative policies.

This study does not provide the ‘be-all-end-all’ solution to RE policy in South Africa. Rather, this study intends to provide raise awareness into future debates and investigation into the appropriate RE policy for the South African context. The framework put forward in this particular study is thus merely one perspective of many, and should not be regarded as the ‘only’ solution for increasing investment in the RE sector.

Policies generally contain a plethora of extremely complex mechanisms, and the appropriate RE policy in South Africa in the future is no different: it will contain numerous systems and relationships that are all significantly important for ultimate success. Hopefully, a concept, idea, or approach put forward from the proposed framework in this study can contribute towards a successful, effective policy in the future that will one day make fossil fuels obsolete in South Africa.

1.8. STRUCTURE OF THE THESIS

Chapter 2, the literature review, will systematically discuss the important considerations with RE policy. The chapter will begin by presenting the emerging innovative model of promoting RE capacity through market-based instruments. Once this has been presented, the two types of market-based policy instruments that are increasingly being used for RE deployment - price-based incentives and quantity-based incentives – will be discussed. The chapter will conclude with theoretical concepts on both FITs and competitive tenders.

Chapter 3 discusses the research methodology used in this study in greater detail to that mention in chapter 1. This chapter will discuss the theoretical processes and practical logistics that the researcher used in order to best approach the specific research objectives. Although chapter 1 has introduced the research methodology, Chapter 3 will extensively discuss the details and

processes of all three stages of research: the literature review; focus group; and semi-structured interviews.

Chapter 4 will extensively discuss the two RE policies implemented into the South African market: REFIT and REIPPPP. Both schemes will present the important design elements, as well as a critical analysis of their effectiveness in the South African market. Chapter 4 will allow for a thorough understanding of the fundamental differences between the two policies that have been implemented recently. It is of utmost important to extensively discuss the policies that have been implemented in South Africa.

Chapter 5 will present the revised policy framework. The chapter will begin by discussing the important elements and considerations of both FITs and competitive tenders that were required to be included in the proposed framework design. The chapter will then discuss certain design elements, as well as the reasons and advantages of them. The chapter will conclude by discussing the certain benefits and advantages that would be realised with the proposed policy framework.

Chapter 6 discusses the findings from the in-depth interviews with industry experts regarding the workability of the framework in the South African market. The chapter will present the experts' opinions and comments on the proposed framework.

Chapter 7 will present the final stage of research in this study: Identifying future areas for investigation. With the responses received by industry and academic professionals throughout the interviews, this chapter will present three major design elements and considerations that could drastically improve both the effectiveness and viability of the proposed framework.

CHAPTER 2: LITERATURE REVIEW

2.1. INTRODUCTION

‘Over the course of the past twenty years, many countries have engaged in a competitive opening of their electricity markets. Investments in an electricity system that is open to competition will no longer be coordinated by the same mechanisms as in the past. The planning that enabled a monopolistic and vertically integrated producer to adjust base – and peak – load capacities, as well as generation and transmission capacities has been replaced by a series of decentralised decisions partly based on prices. This new decision set – which involves many agents and combines market signals with new types of regulation [particularly price and quantity based schemes] – must be understood in detail. A thorough understanding is necessary to reveal to what extent, and under what conditions, competitive opening will result in an investment level that is consistent with the public interest. Only this will allow identification and evaluation of solutions to situations of investment shortfall or oversupply such as those we have seen arise on several occasions’

(Leveque, 2006: 1)

The above quote from Leveque (2006: 1) reveals that policy design for electricity markets has changed considerably over the last two decades. It also demonstrates that a number of ever-changing considerations must be addressed before implementing a policy or policies that intend on creating a more competitive electricity market. In addition, the quote illustrates that the scope of considerations is increasingly becoming more complex; other factors including agents, mechanisms, instruments, market signals and the role of monopolistic utilities are becoming increasingly important considerations when designing policies intending to liberalise energy markets. Formulating a policy for RE therefore involves numerous considerations before being implemented into the market.

Environmental policies consist of two components: the first being the identification of an overall goal; the second being the means to achieve that goal (Stavins, 1997). The literature in this chapter deals with the second component – the means to achieve the overall policy goal. The policy instrument is one of the most essential design elements of a RE policy as it is the tool in which policy objectives are achieved. Because RE policy is not mandated, the choice and design of the policy instrument is the most important component in RE policy success.

Five ‘golden threads’ emerge from this chapter; all of which are related to the efficiency and effectiveness of RE policy in particular. The first emerging thread identifies the need for careful consideration into the policy instrument used, with particular reference to RE policy. A wide array of instruments is available, and the choice depends on many factors. A more innovative instrument is emerging in the RE industry that sees a combination of market-based instruments with price and quantity incentives. The two most effective MBIs to achieve RE policy objectives are price- and quantity-based incentives.

Secondly, the literature proposes the need for a tailor-made approach when designing RE policies; the policy needs to be designed in accordance with the conditions of the country in order to optimise efficiency and effectiveness of the policy. In light of this argument, the literature presents the notion that RE policy performance depends on a number of key factors that are all related to the specific conditions of the country it is designed for. RE policy design is a dynamic process that involves a host of considerations and factors: the key in designing an effective RE policy lies in the understanding of both the RE market and the available policy instruments. Once understanding the relationship between two considerations in great detail, an effective program can be formulated. In addition, it is important that policy-makers treat each stage of the policy design process individually whilst designing them systemically; the whole is the sum of its parts. The literature therefore presents the need to carefully consider and design each stage of the policy process in accordance with the overall policy objective; there can be no contrasting design elements.

Thirdly, policy sequencing is critical for the effectiveness of the policy; since legal and regulatory frameworks for interconnection and siting must be established before implementing

the RE policy. For the purpose of this particular study, the literature places important on the establishment of administrative capacity for implementing and managing RE policies. This chapter argues that South Africa lacks the administrative capacity to manage complex programmes; therefore, having a thorough understanding on the importance of having administrative capacity is essential.

Fourthly, the literature presents the need to extensively consider policy interaction and compatibility, as complex interactions among policies and programs can result in unintended consequences; thereby reducing the net benefits of the RE programs. A thorough understanding of contextual frameworks as well as legislative frameworks is therefore necessary.

The last golden thread that emerges in this chapter deals with the two RE support mechanisms central to this study: feed-in-tariffs (FITs) and competitive tenders. This section presents the literature on both of the schemes, and it becomes evident that both are unique and effective in their own way; the choice ultimately depends on the conditions of a country, as well as the intention of the RE policy implemented. Until recently, the contrasting schemes have been seen as mutually exclusive. However, recent experience suggests that the two instruments can be used in parallel. The literature therefore discussed the compatibility of the two mechanisms, and how, if used appropriately in parallel, the effectiveness of the policy can be increased.

2.2. POLICY INSTRUMENTS

According to Menanteau *et al.* (2003), the possibility of achieving RE policy targets at lower costs, which has until recently been a relatively secondary concern given that the objectives were limited, has since become a central issue in policy design. The choice and design of policy instrument essentially supports this notion. The type of policy instrument used is a significant factor influencing the success of the policy. In fact, the importance of the instrument is even more so considering RE policies is not mandated. In other words, without an appropriate instrument, players in the industry are not obliged to participate in the policy. Therefore, the choice of instrument for RE policy is one of the most critical factors in the overall success of the policy (Arimura, Hibiki & Katayama, 2007).

There is a wide array of policy instruments that policy-makers have at their disposal (Howlett, 2011). These include direct and indirect government regulation, codes and standards, tradable permits, voluntary agreements, and subsidies and incentives, among others. Depending on the legal framework within which each individual country must operate, these may be implemented at the national level, sub-national level or through bi-lateral or multi-lateral arrangements, and they may be either legally binding or voluntary and either fixed or changeable (IPCC, 2013). For the purpose of this study, the choice of instrument is related to the environment (specifically energy), and implemented at the national level.

Generally, environmental policies have utilised the conventional command-and-control (CAC) approach as the instrument of choice. This approach essentially makes use of government regulations whereby a public authority sets standards, monitors and enforces compliance to these standards, and punishes transgressions (Utting, 2002). However, as Arimura *et al.*, (2007) argue, this approach has been criticized as being somewhat heavy-handed, inflexible and cost-ineffective for RE policies. In light of this, the RE policy landscape in South Africa has yet to venture into mandating industry to participate, and so this approach is not applicable. This poses an important question: *what is the most appropriate instrument for increasing RE capacity?*

In theory, according to Menanteau *et al.* (2003), the '*simplest and most efficient solution for re-establishing fair competition between power generation technologies would be to correct the market imperfections by implementing an optimum environmental tax*'. A tax would therefore lead to technological innovations as well as consumer behavioural change. However, realistically, this situation does not happen; taxes are faced with major challenges associated with political acceptability (Howlett, 2011). In addition, an environmental tax may not be sufficient in itself to stimulate the dynamic learning process that is required to bring down costs (Menanteau *et al.*, 2003). Therefore, RE policy requires an alternative approach to both the command-and-control approach – the conventional environmental policy approach; and the environmental tax approach – the most theoretical instrument.

A somewhat new alternative to the traditional CAC approach has emerged in the combination of price- and quantity-based incentives that has been successful in promoting the deployment of

RETs in many countries. Theoretically, implementing a policy that provides incentives to the electricity industry incentivises electricity producers to adopt RETs and produce electricity renewable. This is what Menanteau *et al.* (2003) refer to as '*market opening policies*', which essentially stimulate technological change and learning processes that enable costs to be brought down to economically competitive levels, and can be achieved by using market-based instruments (MBIs), otherwise known as economic instruments.

2.3. MARKET-BASED INSTRUMENTS

MBIs have captured the attention of environmental policy makers in recent years because of the potential advantages they offer over traditional CAC approaches (Stavins, 1997). There is empirical evidence in support of the view that MBIs are inherently more efficient than other policy instruments in achieving environmental goals (Utting, 2002). MBIs seek to address market failures of externalities by incorporating the external cost of production or consumption activities by creating property rights and facilitating the establishment of a proxy market for the use of environmental services (Gonzalez, 2011). Stavins (1997: 2) defined MBIs as: '*regulations that encourage behaviour through market signals rather than explicit directives*'. MBIs therefore rely on market forces to correct producer and consumer behaviour.

The effectiveness of MBIs compared to CAC approaches has been largely contested. While traditional regulatory approaches are indeed valuable policy tools for certain types of environmental problems, MBIs are increasingly becoming more popular as they provide continuous inducements, monetary and near-monetary incentives (National Centre for Environmental Economics (NCEE), 2014). As such, MBIs have a distinct advantage over the CAC approach, as they encourage producers to incorporate negative externalities into their production decisions and prices (NCEE, 2014).

Another major advantage MBIs hold over their counterpart, with particular reference to RE, has to do with innovation. CAC have been criticized for restricting technology, as there is no incentive for firms to innovate. For firms, there are little or no incentives for them to exceed the limits or thresholds; both technology-based and performance-based standards discourage the

adoption of new technologies under a CAC approach (Stavins, 1997). MBIs, on the other hand, do not prescribe specific technologies that firms must use or adopt, or the amount of energy to produce renewably, resulting in greater flexibility for firms to manage their electricity production (Gonzalez, 2011). Thus, MBIs have the potential to provide powerful incentives for RE companies to either adopt cheaper technologies or to innovate (Stavins, 1997). According to Dolsak and Sampson (2011), MBIs can be viewed as smart regulation where regulators can achieve outcomes similar to the CAC regulation but at lower costs. Thus, MBIs are considered more effective for increasing RE capacity specifically than the environmentally traditional CAC approach.

Another important characteristic of MBIs worth mentioning is that they can be applied by government or non-government organisations and overlap with other economic measures (Windle *et al.*, 2005). MBIs thus provide for better coordination of environmental management activities. Figure 2.1 illustrates the centrality of MBIs in the policy instrument landscape.

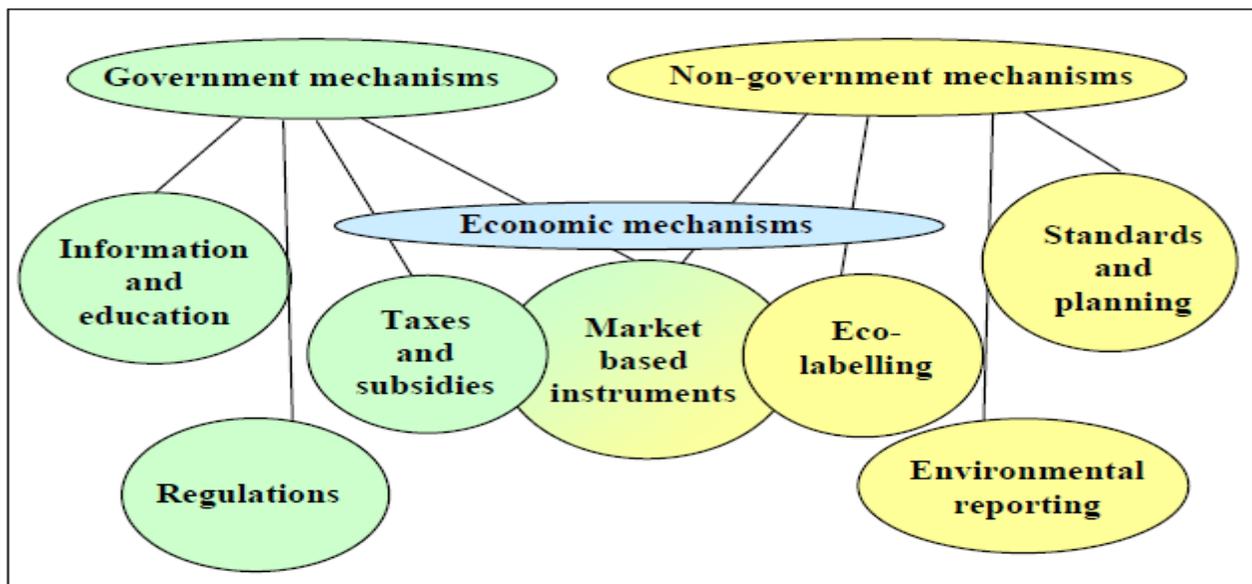


Figure 2.1: Centrality of MBIs in the policy instrument landscape

Source: Windle *et al.* (2005)

According to Gonzalez (2011), the primary criterion for comparing MBI and CAC designs is cost effectiveness. Ring and Schroter-Schlaack (2011: 2) state that: *'...current research on policy mixes highlights that MBIs provide an interesting option to increase the cost-effectiveness of the pursuit of environmental objectives beyond the level provided by CAC regulations'*. In light of this, Klassert and Mockel (2013) state that the idea behind the use of MBIs is to *'...lower the costs of achieving a policy objective compared with CAC by providing incentives for each actor to contribute to it according to his or her individual costs, instead of imposing a standard contribution on all relevant actors no matter what their compliance costs are'*.

According to Grau (2014), academic literature usually differentiates between two categories of MBIs to support deployment of RETs through incentives: price-based schemes, and quantity-based schemes. Menanteau *et al.* (2003: 800) state the following regarding price-based and quantity-based schemes:

'These incentive frameworks are based typically on the same approaches as some environmental policies: price-based approaches for the systems where electric utilities are obliged to purchase electricity from green power generators at feed-in tariffs, quantity-based approaches where the public authorities set an objective to be reached and organise competitive bidding processes, or where they impose quotas on electricity suppliers and set up a system of tradable green certificates'.

Economic incentives correct market externalities by: encouraging firms; persuading firms; convincing firms; bribing firms; punishing firms; rewarding firms; penalising firms and influencing firms. As mentioned above, there are two types of economic incentives that can be used to achieve this in the RE sphere: price-based and quantity-based incentives.

2.3.1. Price-based schemes

MBI price-based schemes can be divided into two instruments: those that provide negative incentives, such as taxes; and those that provide positive incentives (Klassert & Mockel, 2013). FITs fall under the latter. Positive incentives reward firms financially for making certain choices

and behaving in a certain way: in the case of RE, this means producing energy from renewable sources. These incentives are called positive, as they are associated with things firms want to acquire. Positive incentives are generally in the form of subsidies or financial payments (Klasserts & Mockel, 2013). According to Windle *et al.* (2005), these positive subsidies are used to encourage activities that are beneficial to the environment; the production of RE does this. In terms of using a FIT for increasing RE capacity, Huntowski, Patterson and Schnitzer (2012) conclude that positive price incentives are a highly efficient tool to achieve the objective.

Negative incentives, on the other hand, are the opposite of positive incentives: they punish people financially for making certain choices of behaving in a certain way. In essence, negative incentives force firms to pay for their wrongdoing; generally in the form of an environmental tax (for example a pollution tax). In a recent publication by Giberson (2014), he concludes that negative incentives show that there is a local condition of oversupply under which electricity is not an economic good, which society is willing to pay for. In the case of RE in South Africa, there is an undersupply; therefore negative price incentives cannot be used to increase RE capacity, but rather to decrease conventional electricity production. A negative price incentive should nevertheless be implemented in South Africa as it encourages production of RE through the reduction of conventional production. However, for the purpose of this study, the focus was on positive price incentives.

2.3.2. Quantity-based schemes

The second type of MBI that utilises incentives deals with quantity. Quantity-based schemes involve the setting of an imposed limit or cap (Windle *et al.*, 2005). A competitive tender system is a mechanism that uses quantity-based incentives; there is a limit on the amount of power for procurement. However, competitive tenders are unique in the sense that they also use price signals and price incentives (Windle *et al.*, 2005), and the cap is not applicable to individual firms, but rather to the entire industry. In addition, quantity-based schemes generally limit negative environmental activities, such as pollution; in a competitive tender, there is a limit on positive environmental activity. Therefore, competitive tenders are not only a unique form of quantity-based schemes, but somewhat of a hybrid (Grau, 2014). In a competitive tender system, firms are incentivised to reduce prices to win bids, as there is a limit on the provision of a good

or service (Windle *et al.*, 2005). This limit incentivises firms to reduce their costs so that they can win the bids and produce electricity – thus benefitting. The remainder of this chapter discusses two mechanisms that make use of MBIs through price- and quantity-based incentives: FITs and competitive tenders.

2.4. FEED-IN TARIFFS

On an international scale, FITs have proven to be the most effective support mechanism to rapidly increase the share of RE production and use (Mendonca *et al.* 2010). As an effective instrument which uses an ideal mix of simplicity, effectiveness and low costs, the FIT has the ability to provide a legally guaranteed long-term payment to producers of RE; thereby increasing RE capacity (Droege, 2009). FITs essentially set a fixed price for purchases of renewable power, usually paying producers a premium rate over the retail rate for each unit of electricity fed into the grid (Mendonca *et al.* 2010). This guaranteed price provides investors with incentives to participate in such programs by securing certain returns on their investment (Kim & Lee, 2012).

While FITs have proven successful in many countries, the success can largely be attributed to the design of the FIT system and not the FIT itself. In light of this, Mendonca *et al.* (2010) argue that even FIT systems that are robustly designed can still fail if the market structures are not supporting of the FIT ideology. Therefore, when choosing to use an FIT system, it becomes crucial for policy-makers to consider the interaction between the FIT and the existing market structure (UNEP, 2012). For policy-makers, it is also becoming increasingly important to consider how the FIT design will interact with potential future electricity market structures (UNEP, 2012). Keohane and Olmstead (2007) conclude that there are two major components regarding future electricity market structures: competition and prices. In terms of FITs, the prices (or tariffs) are an integral characteristic, and therefore important to discuss.

The level of tariff influences market interest: high tariffs or tariffs that are set to increase, create significant interest in the market; low tariffs, or tariffs that are set to decrease, tend to stagnate investment. Figure 2.2 illustrates the relationship between the tariff and RE capacity/investment.

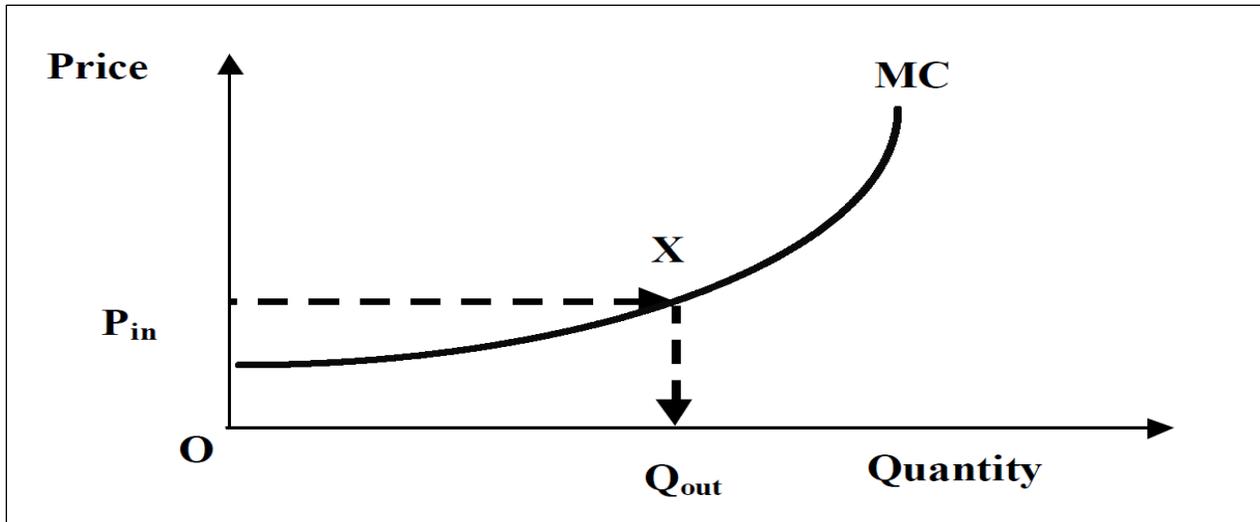


Figure 2.2: Relationship between tariff and RE quantity

Source: Menanteau *et al.* (2003)

It becomes noticeable from Figure 2.2 that the tariff and quantity are proportional: an increase in the tariff results in an increase in capacity; a decrease in the tariff results in a decrease in capacity. However, it is also important to notice that the Marginal Cost (MC) curve steepens out as quantity increases. It is therefore essential to set the tariff at the appropriate level so that the level of quantity is optimal. Tariff setting is therefore a crucial aspect in the design and implementation of a FIT.

2.4.1. Setting the tariff

When designing FITs, the idea is to provide a balance between investment security for producers on the one hand and the elimination of windfall profits on the other (Mendonca *et al.* 2010). Payment levels are set according to the production costs for each technology, and usually decline by a set percentage each year in order to anticipate technological development (Droege, 2009). It is imperative that the tariffs are set at the correct level, as they are vital for the success of the scheme, as well as the sustainability of the FIT system.

While there are numerous calculation methodologies available to help determine an appropriate tariff, the most common and successful FITs have been based on real generation costs plus a premium (Liang & Fiorino, 2013). Regardless of context, the legislator will always set the tariff

level in order to allow for a certain internal rate of return, usually between 5 and 10 per cent return on investment per annum (Mendonca *et al.*, 2010).

A common first step in the process of setting the tariff rate is to do an analysis on FIT countries with similar resources. For a policy maker, understanding the FIT in a country with a similar energy context can serve as a point of reference. However, while comparison to other countries indeed helps the process, it is not sufficient in itself to determine a price. In addition, Stavins (1997: 27) states that ‘...individual nations are required to choose their own sets of criteria [explicitly or implicitly] to distinguish among alternative policy instruments’. In the words of Arimura *et al.* (2007), the success of an FIT system is largely due to the appropriateness of the tariff for the specific technology, as well as the conditions of the country.

Mendonca *et al.* (2009) differentiates between three tariffs scenarios: tariffs that are set too high; tariffs that are set too low; and flat rate tariffs. A tariff that is set too low runs the risk of generating no investment, as investors find no reason to invest in the market. A tariff that is set too high runs the risk of causing unnecessary profits and higher costs for the final electricity consumer (Mendonca *et al.*, 2010). Then there is a flat rate tariff, which, according to Mendonca *et al.* (2009), results in a disastrous situation in an FIT system. The idea of a flat rate tariff is that all types of renewable technology are paid the same price per unit of electricity generated. This situation, however, undermines the based idea and principles of FITs (Mendonca *et al.*, 2010). After all, one of the primary reasons legislators opt to use price-based incentives in the form of an FIT is to establish technology-specific support (Menanteau *et al.*, 2003). This alludes to another important dimension of FITs; tariff differentiation.

2.4.2. Tariff differentiation

FIT policies range from undifferentiated to highly differentiated rates that reflect a broad range of different factors (UNEP, 2012). The issue of tariff differentiation is closely related to the issue of eligibility. UNEP (2012) states that tariff eligibility specifies which technologies can participate in the FIT, whereas tariff differentiation specifies the FIT rates that each technology will receive. FIT have commonly been differentiated (UNEP, 2012) by:

- RE type (wind, Solar PV, etc.);

- Project size;
- Resource quality (strong wind regime vs. weak wind regime);
- Technology application (e.g. ground mounted PV, roof-mounted PV, building-integrated PV, etc.);
- Ownership type (e.g. publicly owned vs. privately owned);
- Geography (e.g. mainland vs. island locations)

As mentioned above, differentiating tariffs allows technology specific support. This in itself has many benefits, including: energy access; additional job creation and diversification of the electricity mix. For this particular study, it is important to note that undifferentiated tariffs would not allow for effective diversification of the RE industry in South Africa. RE developers and investors would neglect to consider many of the less theoretical potential technologies. Table 3.1 represents the advantages and disadvantages of tariff differentiation³.

Table 2.1: Tariff differentiation – advantages and disadvantages

	Policy Consideration				
FIT design issue	Energy Access	Policy Costs	Electricity portfolio diversity	Administrative complexity	Economic development
Tariff differentiation	✓	✓	✓	✓	✓

Source: UNEP (2012)

3. Energy Access, Electricity Portfolio Diversity and Economic Development fall under advantages of tariff differentiation; Policy Costs and Administrative Complexity fall under disadvantages of tariff differentiation.

The above arguments have demonstrated that the design elements of FITs results in technological change in the RET. Essentially, technological change is a necessity should RE become competitive with conventional energy sources. The following section discusses the overall influence that FITs have on technological change; otherwise known as technological innovation.

2.4.3. Impact on technological change

The study of economics expresses the notion that firms constantly look to increase profits. In an FIT system, profits are increased by producing each unit of RE power as cheaply as possible; in order to increase the net profit, the difference between production cost per unit of electricity and the tariff must be maximised. Menanteau *et al.* (2003) argue that this can be achieved when firms invest profits into research and development (R&D) in order to improve technological innovation. This is an important argument for this study, as this process leads to economies of scale – which becomes an integral part of the proposed framework. In order to fully understand this argument, it is necessary to look at how consumer and producers surplus is distributed in an FIT system. Figure 2.3 illustrates the impact of guaranteed tariffs on technical change.

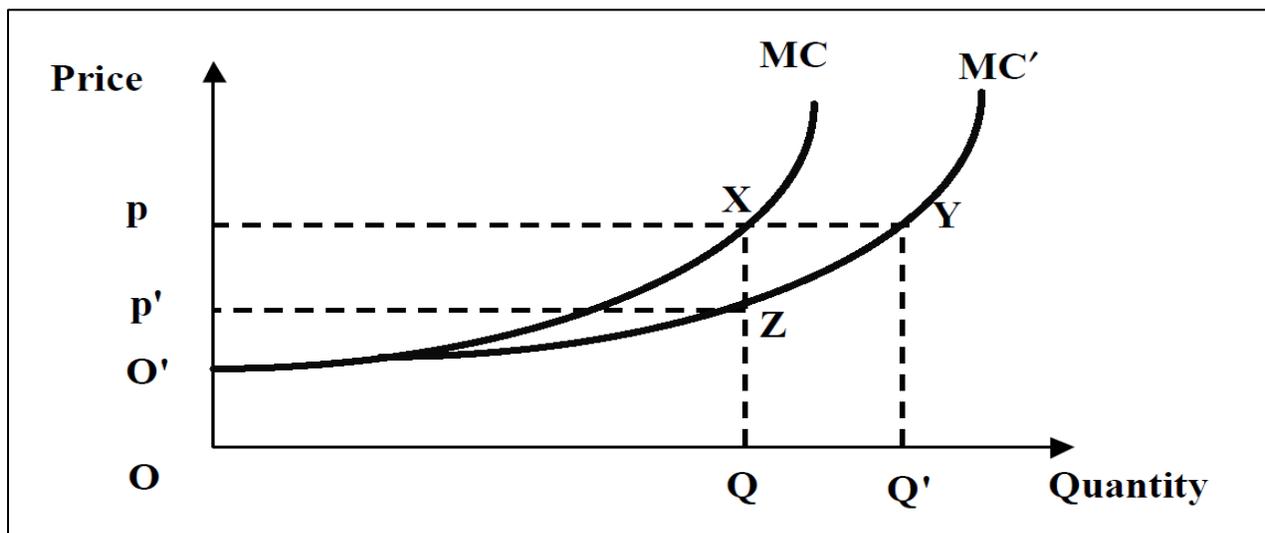


Figure 2.3: Impact of guaranteed tariff on technical change

Source: Menanteau *et al.* (2003)

The distribution of surplus differs between FITs and competitive tenders (Liang *et al.*, 2013). In the case of an FIT, where the price level is guaranteed, the marginal costs are included in the price level; production costs are therefore reduced from MC to MC', and RE capacity is increased from Q to Q' (Menanteau *et al.*, 2003). In this situation, society benefits from the increased generation of RE technologies, and the producers keep the surplus created by technical change. This is illustrated in the area $Q'XY$. This increase in producer surplus essentially encourages producers to innovate. This situation illustrates that FITs are capable of increasing RE capacity whilst ensuring technological innovation. However, a quantity-based scheme in the form of competitive tenders also has the ability to increase capacity whilst ensuring technological innovation.

2.5. COMPETITIVE TENDERS

Competitive tenders are another type of economic instrument that promotes the deployment of RETs. As opposed to FITs, which is a form of a price-based scheme, competitive tenders are one form of a quantity-based scheme. In simple terms, a competitive tender system 'sells' the rights to produce RE to developers; the availability of RE is limited. Developers that are successful in the bidding process are granted long-term payments contractually for electricity produced renewably and fed back into the grid – similar to the FIT process discussed earlier.

The primary difference between a FIT and a competitive tender is how the prices are determined (UNEP, 2012). Unlike FITs, where the price of the tariff is administratively determined, competitive tenders allow the market players to determine the prices. Because there is a limit on the power available, competition amongst developers results in the reduction of RE prices, as bidders reduce their prices to secure power procurements.

However, winning bids are not only selected according to project price factors. Non-price factors are accounted for in the bids, which is a major advantage of a competitive tender scheme. These non-price factors allow for indirect benefits of the competitive tender system, many of which are not possible in an FIT system (Grau, 2014). According to UNEP (2012), this is the direct result of an innovative policy configuration. Competition focuses on price and non-price factors during

the bidding process. Proposals are classified in increasing order until the total amount to be contracted is reached (Menanteau *et al.*, 2003). Once projects are rewarded the ‘rights’ to produce electricity, they sign long-term contracts to supply electricity at the pay-as-bid price. Figure 2.4 illustrates the relationship between quantity and prices with a competitive tender system.

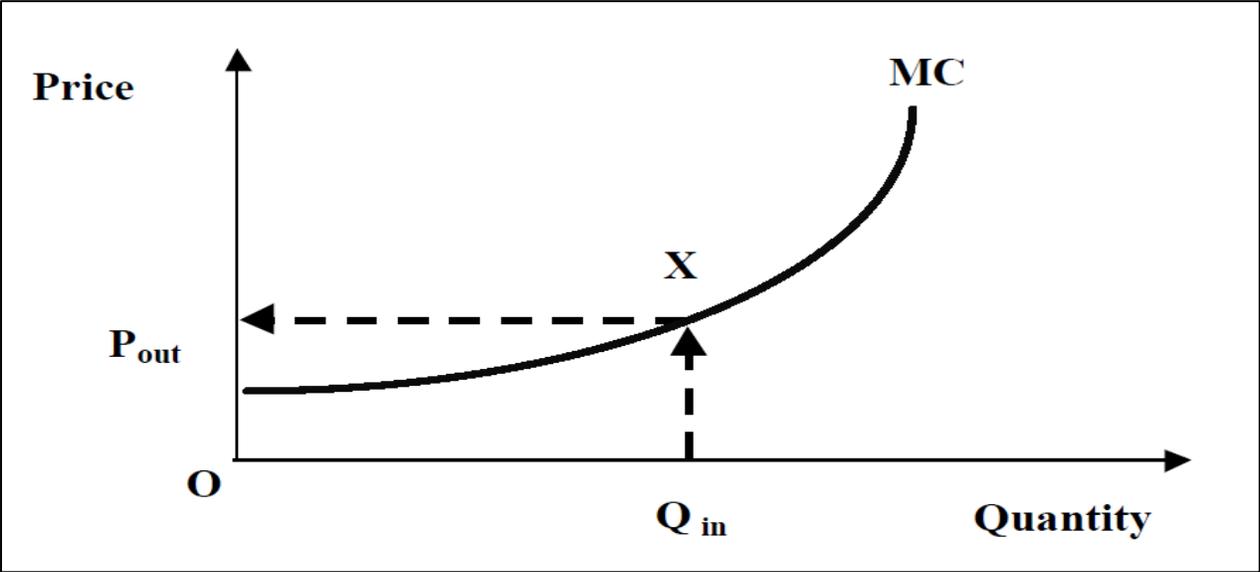


Figure 2.4: Competitive tenders and marginal cost curve

Source: Menanteau *et al.* (2003)

Figure 2.4 above illustrates that as the quantity of power and the price are proportional: as the limited quantity of power to be procured decreases, so too does the price. This is due to the basic economic principle of supply and demand: the less availability of a demanded good, the higher the production demand. It also illustrates that a competitive tender bidding system enables the marginal production costs of all the producers to be identified (Menanteau *et al.*, 2003). Figure 2.4 shows that the area underneath the marginal cost (MC) curve is the overall cost of reaching the target. It is also important to note that the MC curve in figure 3.4 flattens out as the quantity is reduced; it is therefore important that the optimal quantity is determined. Beyond a certain point, the price reductions that arise from a decrease in quantity become insignificant.

2.5.1. Impact on technological change

Competitive tenders distribute surplus differently to that of FITs as discussed above. By referring back to figure 2.3 on page 47, it was argued that FITs create a producer surplus equivalent to the area $O'XY$. Using the same methodology for competitive tenders systems, the inclusion of technical change results in the equilibrium point Z . Thus, the reduction in tariff prices result in a surplus equivalent to the area $O'XZ$; this is only applicable if the bid prices are according to the pay-as-bid price. As opposed to the FIT system, here the majority of the surplus goes to the consumer, or the taxpayer, while electricity producer gets limited surplus. Menanteau *et al.* (2003) argue that with limited surplus, electricity producers are not as encouraged to innovate as in a FIT system; however, they are compelled to remain competitive and so are still required to benefit from technological progress due to the pressures of the bidding processes. This is an important argument for the proposed framework in this study: competitive tenders result in less innovation amongst producers. Another important consideration is that due to the globalisation of the RE technology market, less innovation leads producers to turn to foreign technology; this in turn has other negative impacts of an economy (Menanteau *et al.*, 2003).

2.6. FITS OR COMPETITIVE TENDERS?

The literature presented above suggests that both FITs and competitive tenders can be successful given that they are well-designed and inserted into the correct market conditions that support their implementation. The decision to choose one over the other is therefore complicated, and involves a host of considerations and trade-offs. However, as Mendonca *et al.* (2010) argue, the choice largely depends on the specific conditions of the country, as well as whether the benefits of the respective instruments align with the intention of the RE policy. It would therefore be worthwhile to discuss each schemes application to a number of criteria, all of which are fundamental considerations for policy-makers: benefit to RE industry; incentives to innovate; incentives to reduce prices and costs; and incentives to enter market. Understanding the respective schemes application to these criteria will provide a greater context for the remainder of the paper.

2.6.1. Benefit to RE industry

While both mechanisms are beneficial to the RE industry, the benefits differ. FITs are extremely effective in increasing RE capacity given the correct conditions. With a strong financial backing, a FIT system is undoubtedly the most effective tool to drastically increase RE capacity (Grau, 2014). The FIT system is designed to guarantee payments for long duration; this creates significant market interest among investors. In addition, the arguments above have demonstrated that FITs allow for greater technological innovation. If the sole purpose of a RE policy is to increase capacity, regardless of any price restriction or budgets, then a FIT system should be the mechanism of choice (UNEP, 2012).

On the other hand, the nature of competitive tender systems drastically reduces the price of RE (Grau, 2014). The major benefit of a competitive tender system, therefore, is its ability to reduce RE prices and make them more competitive with conventional energy prices. Whilst achieving this, RE capacity is still nevertheless increasing. Another major advantage of competitive tenders to the RE industry is the fact that it has many indirect benefit; commonly referred to as local economic benefits. Because bids are not only judged according to their prices, firms improve their overall bids by involving as many non-price factors as possible (Mendonca *et al.*, 2010).

2.6.2. Incentives to innovate

Both FITs and competitive tenders support innovation; however experience suggests that FITs promote innovation to a much greater extent. The previous arguments discuss how the surplus resulting from technological change differs between the two schemes; in an FIT system, the producers benefit from the entire surplus resulting from lower costs; in a competitive tender system, the producers pass the surplus to the taxpayers or consumers (Menanteau *et al.*, 2003). The distribution of the surplus has two consequences that influence innovation.

Firstly, the technological learning effects have been much greater in counties that have adopted a FIT system; this is primarily due to the strong growth in generating capacities. Germany is an example of a country where innovation has thrived due to the implementation of an effective FIT system. Since the inception of Germany's FIT policy, namely the Erneuerbare-Energien-Gesetz (EEG), the country's RE share has increased from 3.1 per cent in 1990 to 22.9 per cent in 2012;

this has subsequently triggered massive innovation capacity which has resulted in Germany *'being one of the most innovative countries in the RE global market'* (Bohringer, Cuntz, Harhoff & Otoo, 2014). The second consequence stems from the reduced margins that are inherent in the bidding system. The reduced margins have limited the R&D investment capability of manufacturers and their suppliers (Menanteau *et al.*, 2003).

2.6.3. Incentives to reduce prices and cost

One of the fundamental differences between a FIT and a competitive tender system is that the latter incentivises price reduction to a much greater extent (Grau, 2014). Mitchell (2000) argues that insufficient incentives to lower costs has been widely acknowledged to be a principal weakness of the FIT system, while competitive tenders have proved to be highly effective in this respect. According to Bajari and Tadelis (2006), a competitive tender is viewed as a procedure that stimulates competition; in the face of this competition, all firms in the system have strong incentives not to inflate the price. Inflated prices result in lost bids, and in a competitive tender system for RE, the lost bids equate to significant financial losses derived from the preparation of the bid. Thus, in a competitive tender system, the incentive is to reduce the price as low as possible to win the bid. However, Menanteau *et al.* (2003) make caution that while the competitive tender system undeniably creates greater incentives to lower prices and costs of RETs, it should be noted that: *'price reductions observed are not necessarily related solely to technical change [falling investment costs, improved technical change etc.] or to its side effects [fall in cost of credit associated with a different perception of the technology risks] but also to a systematic effort to reduce costs through economies of scale and use of the very best sites available'*.

2.6.4. Incentives to enter market

Both FITs and competitive tenders exhibit radically different market entry incentives in terms of future profitability, risks and transaction costs (Menanteau *et al.*, 2003). However, the literature presented by Grau (2014) supports the view that the FIT system provides greater incentive for firms to enter the market for a number of reasons, predominantly to do with risk.

In a well-designed FIT system (such as the German FIT), the risks for RE developers are low; since subsidies are granted to all new projects and continue throughout the pay off period owing to a sustainable financial backing (Menanteau *et al.*, 2003). From a RE developer perspective, this results in lower market risks, and the profitability of their projects solely depends on their ability to control their costs – thus attracting them to the market. As their production costs are reduced (through economies of scale and innovation), their profits increase. This not only attracts investors into the market, but also incentives innovation.

The transaction costs associated with FITs are significantly lower than for its counterpart; competitive tenders require complex bids processes that require large financial funding. Because projects are not guaranteed a procurement contract in a competitive tenders system, the high transaction costs can act as a major deterrent (Bohringer *et al.*, 2014). For smaller companies and projects in particular, this has acted as a major deterrent.

The level of profitability of projects in a bidding system is also uncertain; due to the nature of a competitive tender system, profit margins are reduced and expected profitability rates are significantly lower (Menanteau *et al.*, 2003). Therefore, the balance between the risks involved and the expected profits is clearly a disadvantage of the competitive tender system, making it significantly less attractive for new investors to enter the market.

2.6.5. Overall cost of supporting renewables

Both systems have their pros and cons relating to cost. While FITs are considered relatively easy to implement from an administrative point of view, they have proved to be very costly (Menanteau *et al.*, 2003). In an FIT system, the cost burden falls on the consumers. As the number of projects benefitting from the FIT increases so too does the financial support required to sustain the system increase. Thus, a FIT may face many difficulties in achieving large-scale market penetrations: the more RE capacity is built, the higher the additional costs to taxpayers (Pegels, 2010). With electricity prices already being historically cheap in South Africa, this situation may not be well received. In the South African context, a FIT system may be practicable for only small projects; a political reality that may considerably reduce the effectiveness of the scheme (Pegels, 2010). Winkler (2005) argues that given the significant

demands on the South African governments budget for other social expenditure, approaches to increasing RE capacity that do not require as much government funding have a significant advantage. Competitive tenders achieve this, since the financial support from Government is considerable lower. Unlike in an FIT system, the developer funds the program, not the taxpayer. However, the transaction costs associated with competitive tenders have proved to be extremely expensive for both government and investors (Pegels, 2010).

2.6.6. Summary

Table 2.1 shows the comparison between FITs and competitive tenders with regards to the previously mentioned considerations in Section 2.6.

Table 2.1: FITs vs. Competitive tenders

	Feed-in Tariff	Competitive Tender
Benefit to RE industry	<ul style="list-style-type: none"> • Stronger of the two if financial backing is sufficient. • Without budgetary constraints, FIT is the most effective support mechanism. 	<ul style="list-style-type: none"> • Strong incentive to reduce price of RE whilst increasing capacity.
Incentives to innovate	<ul style="list-style-type: none"> • Higher incentive to innovate: Producers benefit from the entire surplus. 	<ul style="list-style-type: none"> • Lower incentive to innovate: producers pass surplus on to consumers and

	<ul style="list-style-type: none"> • Technological learning effects have been greater in countries implementing effective FITs. 	<p>taxpayers.</p> <ul style="list-style-type: none"> • Reduced margins are inherent in bidding systems, and reduce the R&D investment capabilities of manufacturers and their suppliers.
Incentives to reduce price and cost	<ul style="list-style-type: none"> • Very little incentive to reduce costs; has been widely recognised as the principal weakness of FIT systems. 	<ul style="list-style-type: none"> • Requires high degree of competition, which in turn reduces price of RE drastically. • Inflated prices result in lost bids; therefore producers keep prices as low as possible.
Incentive to enter market	<ul style="list-style-type: none"> • Strong incentives for producers to enter market due to the guaranteed tariffs. • Risks are low for producers; they do not run the risk of losing bids. • Low transaction costs required to enter. 	<ul style="list-style-type: none"> • High transaction costs (especially for smaller producers), high risk and uncertain levels of profitability allow for reduced incentive to enter the market.

Source: Author (2014)

CHAPTER 3: RESEARCH METHODOLOGY

3.1. INTRODUCTION

Chapter 1 briefly introduced the research methodology for this study. This chapter will extensively explore the various data-collection methods that were adopted during the two stages of research. As this study was highly systematic in terms of research, it is important to fully understand each component in greater detail. Although both stages were performed separately, they nevertheless had many influences on each other. These influences, as well as the interrelation between the different stages of research, can be effectively described by having a thorough understanding of the individual research methods used in this study. However, before diving into individual stages, it is important to first contextualise the nature of the research.

3.2. NATURE OF THE RESEARCH

The research design suited best to the nature of the qualitative approach in this particular thesis is that of an exploratory method. An exploratory method, according to Welman, Kruger and Mitchell (2005) does not start with a particular problem, but rather conducts study to find a problem or a hypothesis to be tested. Yin (2003: 9) asserts that if research questions focus mainly on ‘what’ questions, then they can be considered exploratory. Questions that contain ‘what’ in them are usually justify conducting an exploratory study, the goal being to ‘*develop pertinent hypothesis and propositions for further inquiry*’ (Yin. 2003: 9). Going back to the research questions mentioned earlier, a number of ‘what’ and ‘which’ questions arise, giving an exploratory approach a significant advantage over other approaches for this particular thesis. According to Smit (2009) exploratory research attempts to achieve the following:

- Satisfy the curiosity of the research and desire for a better understanding;
- Determine priorities for future research; and
- Develop new hypothesis about an existing phenomenon

Exploratory research identifies important variables in a particular area, formulate penetrating questions about them, and generate hypothesis for further investigation (Welman *et al.*, 2005). According to Smit (2009: 67) such studies are usually ‘... [conducted] by *in-depth interviews, case studies, literature reviews and informants [that] lead to insight and comprehension*’. Such an approach is valuable as it allows for primary research in which new data is generated (Smit, 2009), with the drawback being no conclusion to the research problem statement, but instead paving the way to an answer (Babbie & Mouton, 2008). This study was therefore a qualitative exploratory study.

3.3. THE RESEARCH PROCESS

A major element in the research framework is the specific research methods that involve the forms of data-collection analysis and interpretation that researchers propose for their studies (Creswell, 2009). As mentioned earlier, the research process was broken down into two equally important stages, each with its own set of unique, specifically-designed data-collection methods.

The first stage was the formulation of the proposed framework. This was achieved by using two different methods of data-collection. Firstly, by doing a thorough literature review; and secondly, by organising a focus group session. The second stage could only be performed once stage 1 had been completed, and involved the testing the proposed framework by interviewing individuals with relevant expertise. Figure 3.1 illustrates the two stages with information on the data-collection methods.

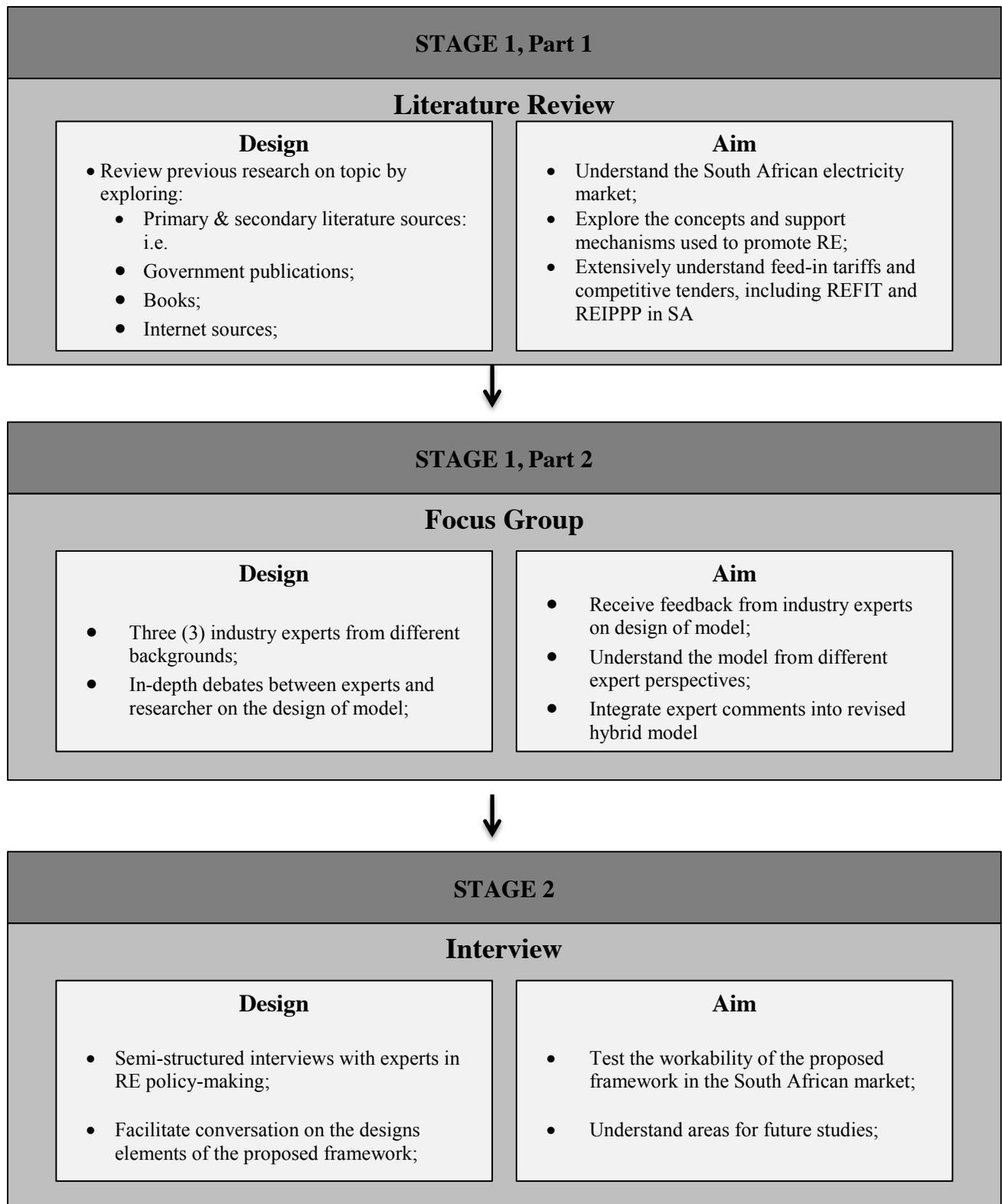


Figure 3.1: Details of stages and data-collection methods

Source: By Author (2014)

3.3.1. Stage 1: The proposed design

The first stage was the most difficult in terms of formulating the design, and certainly the more time-consuming of the two stages. Before the interaction with experts was possible, the researcher was required to develop an initial proposed framework. Only once this ‘basic’ framework idea was completed the researcher needed to obtain expert advice. The proposed framework was fundamentally developed using concepts and information provided by doing a thorough literature review.

3.3.1.1. Literature review

Barrientos (2007: 12) states the following about the importance of a literature review for policy-making processes:

‘...any kind of research or investigation in policy is going to at some level involve a study of the relevant literature. You should be able to analyse and use literature in order to support your own research project. It is likely going to involve you in a search for information using literature from a diverse range of sources, be they academic, non-governmental organisations [NGOs], governmental or community groups. You may well need to combine your use of literature with other sources of information such as interviews, surveys or data, and all may form part of any final report you present’.

The literature presented in chapter 3 was crucial for the remainder of the study for five equally important reasons (Welman *et al.*, 2005). Firstly, by conducting a thorough literature review, the researcher may become aware of inconsistencies and gaps that may justify further research. This also allows the researcher to indicate exactly where their research fits in to the field. Secondly, the literature review provides the researcher with important background information to the subject under study, including the various concepts as mentioned previously. The third important reason deals with previous research on the same or similar study. Reviewing previous research provides the researcher with valuable information about different aspects to the problem that are yet to be investigated. Fourthly, in exploratory studies, the literature review ‘*provides the researcher with a basis in order to determine variable relationships, types of relationships, and*

measurement' (Welman *et al.*, 2010: 42). Lastly, the literature review allows the researcher to determine findings and conclusions of previous studies, and then apply the lessons to their own findings and conclusions.

Barrientos (2007) argues that literature-based research is a constantly iterated process of:

- i. Gathering and assimilating;
- ii. Evaluating and analysing;
- iii. Formulating your own arguments on the basis of what you have gathered;
- iv. Structuring and writing up your arguments.

The first important step of the literature review therefore was the gathering and assimilation of data. This was achieved by identifying important concepts and key words relevant to the aims of the study. Specific words in this particular study included words and phrases such as 'feed-in tariffs', 'renewable energy policy', 'market-based policy instruments', 'competitive tenders', 'policy support mechanisms', and 'electricity generation incentives'. Literature on the aforementioned words and phrases was obtained through numerous sources including books, journal articles, government documents and publications, and Internet sources. It was important to have a balanced mix between primary and secondary literature sources, as each has its own advantages. It is therefore important to discuss these individually.

Primary literature sources are essentially the first occurrence of a piece of work. Examples of primary literature sources used in this study include the '*White Paper on Renewable Energy*' the '*Renewable Energy Feed-In Tariff*', the South African '*Long-term Mitigation Strategy*' and the '*Energy Efficient Strategy for South Africa*'. The researcher strategically analysed these primary literature sources before moving on to secondary literature sources for an important reason: by reading primary sources first, the research was open-minded and was not influenced by bias.

Secondary literature sources, on the other hand, include other publications such as books and journals. According to Welman *et al.* (2005) as information flows from primary to secondary sources, it becomes less detailed and authoritative but more easily accessible. The primary

function of researching secondary literature sources in this study was for information on the various concepts found throughout the primary literature sources. Books specifically focused on certain concepts provided the researcher with a greater understanding of them that could then be applied to the primary literature sources. For example, the researcher extensively investigated a book relating to the concept of ‘economic policy instruments’ in order to gain insight into the concept. This allowed the researcher to not only apply the knowledge and theory to the primary literature sources, but also in the process of developing the proposed policy framework.

Numerous questions arise for policy-makers when comparing arguments for numerous policies during a literature review. According to Barrientos (2007), a central question when comparing literature sources for policy-making is:

- *How do any two (or more) piece of literature relate to the central question you are asking?*

The literature review is not simply comparing the literature in a general way. Rather, you are ‘*weighing it up and comparing it in preparation for your own use, i.e. in order to formulate your own argument of to integrate it with other forms or research your question is leading to*’ (Barrientos, 2007). Therefore, analysing and probing it in terms of your own central question, or research aims, is a way of comparing literature, not in and of itself, but rather in terms of its relative importance to the project you are carrying out (Thomas & Mohan, 2007). In other words, a literature review, for policy-makers, is an important component of the policy development as it transforms a broad summary of literature into an analytical study through which the policy-makers can develop their own arguments and policy analysis. This was an important concept for this study.

3.3.1.2. Focus group

The second data-collection method used in stage 1 was a focus group. According to Flick (2007: 1), focus groups are becoming a ‘*major approach in doing qualitative research in different areas from market research to health research*’. A focus group is a process whereby a group of people is actively encouraged to interact amongst each other about a relate topic. Focus groups are

essentially a qualitative technique for obtaining data (Welman *et al.*, 2005), and can vary in structure depending on the aim of the investigation. It must be noted that a focus group is not a group interview; rather a group of people gathered together to discuss a focused issue of concern (Liamputtong, 2011).

The choice to use a focus group as the method of data-collection was relatively simple for a number of reasons. Flick (2007: 23) argues that *'the hallmark of focus groups is their explicit use of group interaction to produce data and insights that would be less accessible without the interaction found in a group'*. Stewart, Shamdasami and Rook (2007) further argues that this interaction creates a synergistic effect, as it essentially allows the participants to respond and build on the reactions of other members in the group. Lastly, Kritzingner (1994: 22) argues that *'with this kind of interaction, focus groups enter the terrains which other research methods such as in-depth interviewing methods or questionnaires cannot do; that is, unpacking aspects of understanding which often remain untapped by conventional methods'*. A focus group would therefore produce high quality data for the purposes of this particular study.

The intention of the focus group was to discuss the initial proposed policy framework for RE in South Africa, and progressively work on the design elements throughout the duration of the session. The focus group did not, however, develop the proposed framework from scratch; rather, the participants of the focus group discussed and amended the framework that had already been designed by the researcher.

Careful consideration was essential for the selection of participants for focus group sessions (King & Horrocks, 2010). The fundamental aim of focus groups after all is to facilitate interactive discussions and the sharing of understandings and views of particular topics, while at the same time ensuring that the data generated is aligned with the aim of the research (King & Harrocks, 2010). The correct selection of participants was therefore essential.

Woodhouse (2007) argues that the selection of informants is governed by the need to identify as wide a range of different viewpoints as possible. Woodhouse (2007) further argues that the use of key informants ('those who know') is effective in policy-making processes, as they are chosen

simply for their knowledge or distinctive viewpoint. Therefore, it was important to organise a focus group that consisted of three participants with contrasting including:

3. Experience in RE projects under REFIT of REIPPPP;
4. Experience in local, provincial or national policy-making process; and
5. Experience in macro-economic systems.

By having three participants with different areas of expertise, the researcher was able to obtain valuable input from different perspectives; thus allowing for a more holistic policy framework. As King & Horrocks (2010) state, the extent at which focus group participants share differences or similarities will ultimately impact on the interactions during the session and therefore the results that evolve from the session. It was therefore important to have the correct balance of similarities and differences between the participants. Details of the criteria used for selecting participants can be found in Appendix 2.

The focus group was scheduled to take place in Rondebosch, Cape Town. The researcher placed a great emphasis on the venue of the session, as the venue intrinsically creates an ambience, which can affect how people behave and interact. As King *et al.* (2010: 68) argues, *'it is vital that the room is quite and private, ensuring that the focus group will not be interrupted'*. In order to obtain data of the highest quality, this needed to be ensured and great measures were in place to assure this.

Prior to the focus group session, it was important that the researcher fully understood the moderator role, and what should be expected from the position. Although the role of the moderator differs somewhat depending on the nature of the research, there are nevertheless certain responsibilities that are required for all focus group sessions. The responsibility of the researcher in this particular focus group was the facilitation and coordination of arguments and debates, whilst taking on a more directive approach. As Wilkinson (2004) argues, the researcher needs to be able to manage people and interactions amongst people in order to facilitate debates. Kritzinger (1994: 116) defines the advantages of an effective moderator:

- ‘Highlight the respondents’ attitudes, priorities, language and framework of understanding;
- Encourage a great variety of communication from participants, tapping in to a wide range of form and understanding;
- Help identify group norms; and
- Provide insight into the operation of group processes in the articulation of knowledge’.

Because the effectiveness of the moderator can have such a decisive influence on the quality of data obtained from a focus group, the researcher placed great emphasis on fully understanding the moderator role. Once this was well-understood and the researcher had prepared accordingly, the focus group was ready for commencement.

The session began with an introduction from each participant. This was vitally important in order to make all participants aware of the level of expertise in the session. The participants were not familiar with each other, and so a more informal approach to commence to the session was utterly necessary. Once participants were settled in and comfortable, the moderator started facilitating debates.

The formal portion of the session began with a ten minute PowerPoint presentation to the experts highlighting the focus and the agenda of the meeting. The presentation begun with the research presenting information on the two central support mechanisms – feed-in tariffs and competitive tenders – and the advantages and disadvantages associated with each; although it must be noted that all participants were well educated on this. Finally, the researcher presented the proposed framework, which was the focus of the discussions that followed. Fortunately, the selected participants were already very familiar with both mechanisms, and so the session was able to move into debates relatively early on. The PowerPoint presentation that was delivered by the researcher can be found in Appendix A.

While the proposed policy was designed before the focus group, it had not been finalised, and the intention of the researcher was to identify the design element flaws that the experts could

foresee. Once these elements were identified, the focus group discussion allowed the researcher to gain valuable insight from different industry professionals, before going to the drawing board and further investigating the issues. A list of the challenges and design flaws that arose during the focus group will be discussed in detail in chapter 5. Only after the focus group session was complete was the proposed framework finalised.

Lastly, the focus group was audio recorded. However, in hindsight, this was the incorrect approach. As the research was not too familiar with participants prior to the session, voice recognition was difficult. It proved a timely and difficult process to differentiate between participants from the audio recording. Should the session have been video recorded, as opposed to audio recorded, this would have been significantly easier. The researcher also took notes during the focus group session, which can be found in Appendix A.

3.3.2. Stage 2: Testing the framework

The focus group session provided the researcher with invaluable knowledge from a panel of experts, and allowed the researcher to revise the proposed design based on suggestions of the experts. Once the research process on the development of the proposed design was completed, it was necessary to test its design elements and practicality. This was performed by strategically selecting appropriate individuals with extensive knowledge in the particular field and approaching them for their comments and thoughts on the framework. This research process was thus performed by conducting in-depth interviews.

3.3.2.1. Interview type

Interviews are one of the most common used methods of data collection (Crabtree & DiCiccio-Bloom, 2006) and are defined as ‘*a method of data collection in which one person (an interviewer) asks questions to another person (a respondent)*’ (Polit & Beck, 2006). For this stage of the research process, the researcher wanted to organise multiple interviews so that the quality of data was of the highest quality, as well as reducing the risk of individual perspectives. In addition, the level of expertise of the participants was also crucial for ensuring robust and high-quality data. The aim of the interview was twofold:

- i. Discuss certain design elements of the proposed framework; and
- ii. Determine the areas of the framework that need further investigation.

The choice of interview type was an important consideration for this stage of research. There are three types of interviews: structured, semi-structured, and unstructured. The type of interview used depends on the nature of the research problem or objectives. The researcher is not, however, only required to choose one particular type of interview, and researchers can greatly benefit by uses all three types as each offers a unique approach to data-collection. By using more than one type of interview, a researcher can gain additional knowledge on the topic. Hence, the interviews were semi-structured.

As the name implies, semi-structured interviews fall between structured and unstructured interviews. The level of structure in these interviews can vary according to the nature of the topic. Generally, however, any variation to a structured or unstructured interview is considered a semi-structured interview. In a semi-structured interview, the researcher has a general list of themes and questions that are to be covered; however, both the interviewer and interviewee have the ability elaborate on certain questions and explore certain themes deeper. A semi-structured interview therefore offered the most appropriate application for a number of reasons, including its ability to:

- i. Use unique questions in particular interviews, given the specific organisational context in relation to the topic;
- ii. Change the order of the question based on the way in which the interview develops;
- iii. To adapt the formulation and terminology of questions to fit the background and educational level of the respondents; and
- iv. Gain additional knowledge by asking the interviewee to elaborate on certain themes / questions.

For semi-structured interviews, the interviewer is nevertheless still required to formulate a predetermined set of questions and themes that are explored before conducting the interviews. This is called an interview guide, and provides the interviewer with a means to achieve the aim

of the interview. According to Welman *et al.* (2005: 166), an interview guide ‘*involves a list of topics and aspects of these topics that have a bearing on the given theme and that the interviewer should raise during the course of the interview*’. One benefit of a semi-structured interview is that certain questions can be used in particular interviews, depending on the ‘*specific organizational context that is encountered in relation to the research topic*’ (Welman *et al.* 2005 166). The interview guide, therefore, was an important aspect of the interview process. For this study, the interview questions were related to certain design elements of the proposed framework, as well as overall general composition of the framework.

3.3.2.2. Participants

Once the type of interview was established, it was necessary to find appropriate experts to partake in the one-on-one interviews. This was an incredibly important component of the research process, as the interviewees would essentially provide the final piece of information in the research design. In order to fully test the workability of the proposed framework, it was important to interview experts that had experience in various fields. As mentioned earlier, the level of expertise of the participants was an important criterion for selection. Morse (1991) identifies three key qualities of a ‘*good informant*’ and these attributes can be used to guide selection in terms of whom to interview. Such qualities include:

- i. Knowledge about the topic;
- ii. Ability to reflect and provide detailed experiential information about the area under investigation; and
- iii. Willingness to participate.

The search for potential interviewees that adhered to the criteria listed above proved to be rather time-consuming. In order to comprehensively test the workability of the framework and to acquire high-quality data, the correct participants needed to be selected. Potential participants were selected according to numerous factors, including their:

- i. Area and level of expertise;
- ii. Current positions in their company;

- iii. Experience in appropriate fields; and
- iv. Previous academic papers and publications.

Once a list of appropriate interview candidates had been assembled, emails were sent out inviting them to participate in the research. The emails included a consent form, which provided significant information on the study and the nature of the interview. All contacted potential interviewees made themselves available for participation in the interviews. The details of the participants, including experience, expertise, qualifications and achievements, can be found in Appendix B.

3.3.2.3. Conducting the interviews

Similar to the philosophy discussed in the focus group section above, the location of the interviews were an important consideration. However, as King and Horrocks (2010) argue, it is generally good practice to first ask interview participants where they would like the interview to be held. All participants opted to conduct the interview in their own territory, at their places of work. While this did indeed restrict and limit the researcher's ability to arrange the physical space for the interview, and therefore set an ambiance, it did allow the participants to feel at ease and relaxed during the interview.

The interviewees were given a three page summary of the proposed framework prior to the interview (two weeks before the interview date). The intention of this was to allow the interviewees to familiarise themselves with the framework, and hence prepare for the interview accordingly. The interviewees were, however, aware of the intention of the interview, namely: discussing the proposed framework's relevancy to the South African market. This was due to the information provided in the consent form as well as other emails and telephone calls prior to the interview. The three-page summary of the framework that was sent to the interviewees can be found in the Appendix C.

4.1. INTRODUCTION

While the previous chapter presented the all-important literature on RE policy instruments and mechanisms, the content in this chapter provides for a greater context for the remaining chapters by discussing the two policies implemented into the South African market in detail: REFIT and REIPPPP. It is important for the remainder of this paper to understand previously policies as the remaining chapters refer specifically to their design elements. After extensively discussing the design elements of the two mechanisms, the chapter concludes with a critical analysis of the current mechanism. Chapter 5 will present the framework, which will be an adaption to the model specific for the South African market. Therefore, understanding the past and present RE policies are of utmost importance.

4.2. RENEWABLE ENERGY FEED-IN TARIFF

4.2.1. Policy overview

The National Energy Regulator of South Africa (NERSA) has a mandate to set tariffs in accordance with section 15 of the Electricity Regulation Act (Act no. 4 of 2006) (RSA, 2006). In 2007, NERSA commissioned the development of a FIT scheme for South Africa (NERSA, 2009). The proposed scheme intended to contribute electricity to the national grid that was not produced conventionally, but rather from renewable sources. In 2009, NERSA announced the implementation of the REFIT regime, with main objectives including (NERSA, 2009a):

- ‘Creating an enabling environment for RE generation;
- Providing access to the grid and an obligation to purchase power;
- Creating a critical mass of RE investment and supporting the establishment of a self-sustaining environment; and
- Establish an equal playing field with conventional electricity generation.’

The REFIT draft document was first issued in December 2008. An important consultation process with the public then followed this draft before the Phase 1 was issued in March 2009

(NERSA, 2009a). Phase 1 of REFIT targeted four main RE technologies: landfill gas, small hydro (less than 10MW), wind power and concentrating solar power (CSP). Phase 1, similar to the case with the draft document, was then made available for public review and comment. A number of additional technologies, including: (i) CSP without storage, (ii) biomass solid, (iii) biogas, (iv) photovoltaic systems (large ground or roof mounted), and (v) Central Tower CSP with storage capacity of six hours, were included after the consultation process. Phase 2 was officially published in October 2009 and released into the market.

4.2.2. Qualification criteria

In order to improve the robustness of the policy, there were numerous qualification criteria that investors were required to meet before applying for the FIT. Below is the list of qualification criteria (NERSA, 2009a):

- ‘RE projects were required to be based on the technologies listed under REFIT;
- The project needed to be greater than 1MW in size;
- Only REFIT projects located within South Africa’s borders would qualify;
- REFIT projects would be qualified or selected in accordance with the provisions of the New Generation Capacity regulations;
- The REFITs do not apply to hybrid plants producing electricity from a combination of RE technologies and fossil fuels; and
- REFIT includes only new investments in RE power generation from IPPs connected to the National Transmission System or Distribution System and excludes off-grid power generation. Refurbished plants was not considered under REFIT.’

In addition to these general REFIT qualifying criteria, there was also technology specific qualification criteria. As with the tariffs, the qualification criteria changed after the consultation paper. Projects under REFIT were required to adhere to both the general and technology specific criteria. However, preference was shown to certain projects, including:

- ‘Projects that had plant locations that contribute to local economic development; and
- Projects with viable network integration requirements’

4.2.3. Tariffs

The proposed tariffs were derived from both local and international sources providing the most recent information available. Tariffs were designed to cover generation costs plus a real return on equity of 17 per cent and would have been fully indexed for inflation (NERSA, 2009). In line with international best practice, South African legislators calculated the tariff based full cost of recovery and reasonable returns on investment. Due to the fact that inflation rates in emerging economies is often higher, NERSA considered inflation-indexed tariff payments – which was expected to increase at a rate of 8 per cent per annum. NERSA (2009a) refers to this approach as the levelised cost of electricity (LCOE) approach.

The LCOE approach is often cited as a convenient summary measure of the overall competitiveness of different generating technologies (EIA, 2013). In simple terms, the LCOE represents the per-kilowatt-hour cost of building and operating an energy generating plant over an assumed financial and duty cycle. Included in these costs are other variables such as capital costs, fuel type and cost, fixed and variable Operation and Maintenance (O&M) Manuals and financing costs, among others. The importance of these factors differs among technologies. However, it is important to note that actual plant investment decisions are also affected by other factors, including the specific technologies and regional characteristics of a project. Table 4.2 illustrates the parameters used in the LCOE tariff methodology for REFIT.

Table 4.1: Tariff calculation methodology for REFIT

Parameter	Units	CSP Power trough w/o	PV Ground/Building mounted > 1MW	Biomass	Bioigas	Concentrating PV without storage	CSP (tower) with storage Of six hrs per day
Capital cost: engineering	\$/Kw	4700	4900	3000	2750	6841	5638
Land cost	%	2%	2%	2%	2%	2%	2%
Allowance for funds under construction	%	4.4%	0%	4.4%	4.4%	4%	4.4%
TX/DX integration costs	%	3%	3%	3%	3%	3%	3%
TOTAL INVESTMENT	\$/Kw	5152	5145	3289	3015	7499	6180
Fixed O & M	2009\$/kw/yr	66	16.19	54	170	64	66
Variable O & M	2009\$/kwh	-	-	0.0032	0.00001	-	-
Economic life	years	20	20	20	20	20	20
Discount rate real after tax	%	12%	12%	12%	12%	12%	12%
Plant lead time	years	2	1	2	2	2	2
Fuel type	-	renewable	renewable	renewable	renewable	renewable	renewable
Fuel cost	\$10^6BTU	-	-	3	-	-	-
Fuel cost	\$/Kwh	-	-	-	-	-	-
Heat rate	BTU/Kwh	-	-	15750	-	-	-
Assumed load factor	%	25%	16%	80%	80%	20%	40%
Levelised cost of electricity	\$/Kwh	0.3132	0.4488	0.1181	0.0962	0.5481	0.2308
Exchange rate	ZAR/\$	10	10	10	10	10	10
LEVELISED COST OF ELECTRICITY	R/Kwh	3.132	4.488	1.181	0.962	5.481	2.308

Source: Redesigned from NERSA (2009a)

As mentioned earlier, there were four types of technology that were included in the first draft of REFIT: wind; small hydro; landfill gas; and concentrating solar power trough plant with 6 hours storage. Table 4.3 illustrates the tariff prices for Phase 1 for the respective technology:

Table 4.2: REFIT tariff prices, Phase 1 and 2

	Technology	Tariff (Rand/Kwh)
Phase 1	Landfill gas power plant	0.90
	Small hydro power plant (less than 10MW)	0.94
	Wind power plant	1.25
	Concentrating solar power (CPS) with storage	2.10
Phase 2	Concentrating solar power (CSP) without storage	3.14
	Biomass solid	1.18
	Biogas	0.96
	Photovoltaic systems (Large ground or roof mounted)	3.94
	Concentrating solar power (CSP) central tower with storage capacity of six hours	2.31

Source: NERSA (2009a)

Once the tariff prices were set and approved, the policy became active in the market. According to Eberhard (2013), the initial tariff prices were seen to be rather generous, and therefore would inevitably attract potential investors to participate in the scheme. The additional tariffs were also popular with developers and potential investors, as they regarded these as generous too (Eberhard, 2013). In addition to the generously perceived tariff, the scheme guaranteed tariff payments for a period of up to twenty years, further adding to the attractiveness of the scheme. After the twenty-year period, the producers would have the possibility of bilaterally negotiating power-purchasing agreements (PPA) with the grid operator (Mendonca *et al.*, 2010). All relevant details about these payments were included in the PPA's.

4.2.4. Power Purchase Agreements

PPA's were set at twenty years, which required the Renewable Energy Purchasing Agency (REPA), in this case the Single Buyers Office (SBO) of the national electricity utility Eskom, to purchase the electricity from qualifying generators at pre-determined prices (NERSA, 2009a). Once approved, the tariffs would be reviewed on an annual basis for the first five years of the program and then every three years thereafter (NERSA, 2009a). Important extractions from the REFIT PPA contractual agreement between Buyer and Seller include (NERSA, 2009a):

- 'The Seller shall provide or procure all plant, equipment, machinery consumables, parts, materials and services whatsoever required for the Construction of the Source Facility;
- The Seller shall achieve the Commercial Operation Date (COD) on or before the Scheduled COD, which is defined as the first Business Day starting at 00:00 hours following the day upon which the Buyer receives from the Seller notice;
- The Buyer shall pay for Commercial Energy; and
- The Buyer shall, acting as a Reasonable and Prudent Operator, procure, install, test, commission, operate and maintain the Metering Installation at the Point of Metering including measurements showing frequency, maximum demand for each demand period; real time and time of day metering; and number of resets'.

It is also important to discuss how Eskom was obligated to purchase the electricity. The electricity generated from the renewable sources was considerably more expensive than the electricity Eskom produces through conventional sources, and so their involvement in the REFIT process was certainly not fully voluntary. During the design of REFIT, NERSA proposed that the SBO approach is the most appropriate model for the policy. NERSA argued that this approach is aligned with the aim to keep processes simple and avoid complexity in the initial phases. In addition, the SBO approach has been effective with FITs in many other countries.

NERSA had the ability to impose legal obligations on Eskom to be the purchase authority for the REFIT scheme. Section 15 of the Electricity Regulations Act (RSA, 2006) allows for NERSA to insert licence conditions that relate (NERSA, 2009a):

- i. ‘The duty or obligation to trade, or to generate, transmit or distribute, electricity;
- ii. The persons from whom and to whom electricity must or may be bought or sold; and
- iii. The types of energy sources from which electricity must or may be generated, bought or sold.’

NERSA’s authority was critical for the policy; without placing obligations on Eskom to purchase renewable electricity, the policy would not be financially feasible. The same obligations were used in the REIPPPP process, which will be discussed in greater details later on in section 4.4.2. However, it is worth mentioning that NERSA realised that the SBO approach may not be the most effective in the future; however, at the time, Eskom was seen as the most appropriate vehicle to purchase RE generator power.

4.3. POLICY CHANGE: FROM REFIT TO REIPPPP

Prior to 2011, NERSA was responsible for all processes involving RE support mechanisms in South Africa. Under the REFIT process, NERSA held a lead role in the designing of the FIT system in accordance with the new generation regulations (McDaid & Wood, 2013). In addition to designing the FIT system and determining appropriate tariffs, NERSA was also expected to also manage the procurement process between the buyer and seller.

However, new regulations were promulgated in May 2011 that superseded and replaced the previous regulations. Once this new law had been promulgated, and the REFIT had been replaced with REIPPPP, it was decided that the new programme would be led exclusively by the DoE rather than NERSA. Many experts felt that the sudden policy change did not allow the DoE enough time to increase its capacity to manage such a complex process. McDaid *et.al.* (2013: 11) states that: ‘*this sudden shift in responsibility from NERSA to the DoE could help explain why the DoE has been underprepared for its role: the DoE’s Annual Report for 2010/2011 lacks any mention of REIPPPP, revealing that the shift was unanticipated and not reflected in the budget or staffing patterns*’.

During the shift of responsibilities, the DoE recognised it had little institutional capacity to run a *‘sophisticated, multi-project, multibillion-dollar international competitive bidding process for renewable energy’* (Eberhard, Kolker & Leigland, 2014: 9). To its own admission, the interest from the market and the very success of the first bidding window is what overwhelmed the DoE, and it was unable to finalise the PPA within the announced time frame (Mcdaid *et al.* 2014). Consequently, DoE sought assistance from the National Treasury’s Public – Private Partnership (PPP) unit to help manage the process. Since the policy supersession, a small technical staff team established a project office, known as the DoE Independent Power Program Unit, which *‘functions effectively outside of the formal departmental structure of National Government to act as a facilitator for the REIPPPP process’* (Eberhard *et al.*, 2014: 9). Table 4.4 represents the shift in responsibilities from NERSA to the DoE.

Table 4.3: Shift in roles and responsibilities from NERSA to DoE, 2009 – Present

	REFIT: 2008 - 2011	REIPPPP: 2011 - Present
NERSA	Design REFIT guidelines; Consulted with public; Published for implementation; Reviewed with public input	License IPP’s with public consultation
DoE	Redrafted law on new generation (which excluded REFIT)	Design REIPPPP with Treasury and private consultants; Implemented REIPPPP

Source: Mcdaid and Wood (2013)

4.4. RENEWABLE ENERGY INDEPENDENT POWER PRODUCER PROCUREMENT PROGRAM

Having discussed REFIT in detail, the remainder of this chapter will discuss the RE support mechanism currently active in the South African market: The Renewable Energy Independent Power Producer Programme. The section will begin by presenting a brief overview of the policy. From here, the section discusses design elements of the policy in detail, including: the policy processes; allocation of power; qualification criteria; bid design and evaluation; effectiveness of the policy in terms of price reduction; and the results of bidding windows to date. The section concludes with a critical analysis of the policy and the overall relevancy of the policy in the South African RE industry.

4.4.1. Policy overview

The REIPPPP program envisioned the procurement of 3 625 MW of renewable power over a maximum of five tender rounds (Eberhard *et al.*, 2014). However, since the inception of the policy, this number has since increased by an additional 3 200 MW. Caps were set on the total capacity to be produced for individual technologies, with wind and solar PV being granted the largest allocations (Eberhard *et al.*, 2014). The rationale behind limiting the allocation of energy was to increase competition among technologies and potential bidders, ultimately reducing the price of electricity – the fundamental competitive advantage of a competitive tenders system.

RE developers were allowed to bid on more than one project, as well as more than one type of technology. However, there were limits set to the bids. All projects had to be larger than 1 MW, and less than the maximum limit allocated. In addition to limits on the size of the projects, there were also price caps. However, these were at levels not dissimilar to REFIT (Eberhard *et al.*, 2014).

Bids were due within three months of the request for proposal (RFP), and were required to contain information on the project structure, legal qualifications, land, environmental, financial, technical and economic development qualifications (Eberhard *et al.*, 2014). The selection of projects was based on a 70/30 split between price and non-price factors. This 70/30 split had

been adjusted from the government's norm of 90/10. This, according to Eberhard *et al.*, (2014), was intentionally adjusted to maximise local economic development objectives.

Since its inception in 2011, the Programme has experienced considerable success, and effectively managed to reduce the price of renewable electricity. According to Mcdaid and Wood (2013: 8), the competitive bidding approach '*...appears to have taken advantage of the rapid drop in global prices of renewable energy technologies*'.

Although there was high levels of uncertainty amongst investors during the initial inception of the Programme, specifically in terms of the perceived lack of flexibility to negotiate the terms of the various agreements, the '*overall thoroughness and quality of the standard documents seemed to satisfy most of the bidders participating in the three rounds*' (Eberhard *et al.* 2014: 11). To date, all three bidding rounds that have been completed have been successful. A total of 64 projects have been approved, accounting to US\$14 billion; combined projects are set to generate 3922 MW of renewable power (Eberhard *et al.*, 2014). In addition, the prices of renewable electricity have dropped significantly after only a two-and-a-half year period. The price of solar PV, for example, has dropped 68 per cent, while wind has dropped 42 per cent. In addition to this, the economic development criteria have benefitted many local communities, particularly rural communities. Eberhard *et al.* (2014: 1) labels REIPPPP as '*the most successful public-private partnership in Africa in the last 20 years*'.

However, with all its success, there have inevitably been some downsides to the Programme. Wind, solar PV, and to a certain extent CSP, have been awarded over 90 per cent of power allocation, with other types not having had a single bid approved to date. Although diversity within the RE sector was not a primary aim of the DoE, there are many benefits and opportunities that are lost in a RE system dominated by only a handful of technologies. This is a central argument in this study, and this concept is elaborated in Chapter 5.

4.4.2. How the REIPPPP bidding process works

The processes of the policy are relatively simple on paper. The process begins whereby RE developers/investors are first required to adhere to certain non-price requirements in order to qualify for the bidding process. Once these are met, the developers are allowed to enter the

bidding process. The bidding evaluation process differentiates between bidders based on two factors: price, and non-price criteria. The price factors count 70 per cent of the bid, while the non-price counts 30 per cent. The price factor is simply calculated from the price per Kwh or electricity the project will generate. Non-price factors, on the other hand, are more complicated and include a local development scorecard, which assesses other benefits of the project. These benefits include: local development, and employment of South African citizens. Once these two bidding criteria have been combined into a total score of 100, the DoE selects the preferred bidders.

Preferred bidders are required to reach financial close by a certain date before they are granted the rights. Bidders that adhere to the financial close essentially ‘win’ are then granted the rights to generate the electricity. Once this right has been granted, the individual developers sign PPA contracts with the SBO – in the REIPPPP, this is Eskom. In these PPA’s, the buyer (Eskom) and the seller (developers) agree to contractual agreements for the sale and purchase of electricity. Once Eskom has bought the electricity from the developers, it is then sold to the consumers on a business-as-usual approach. Figure 4.1 graphically illustrates the REIPPPP process.

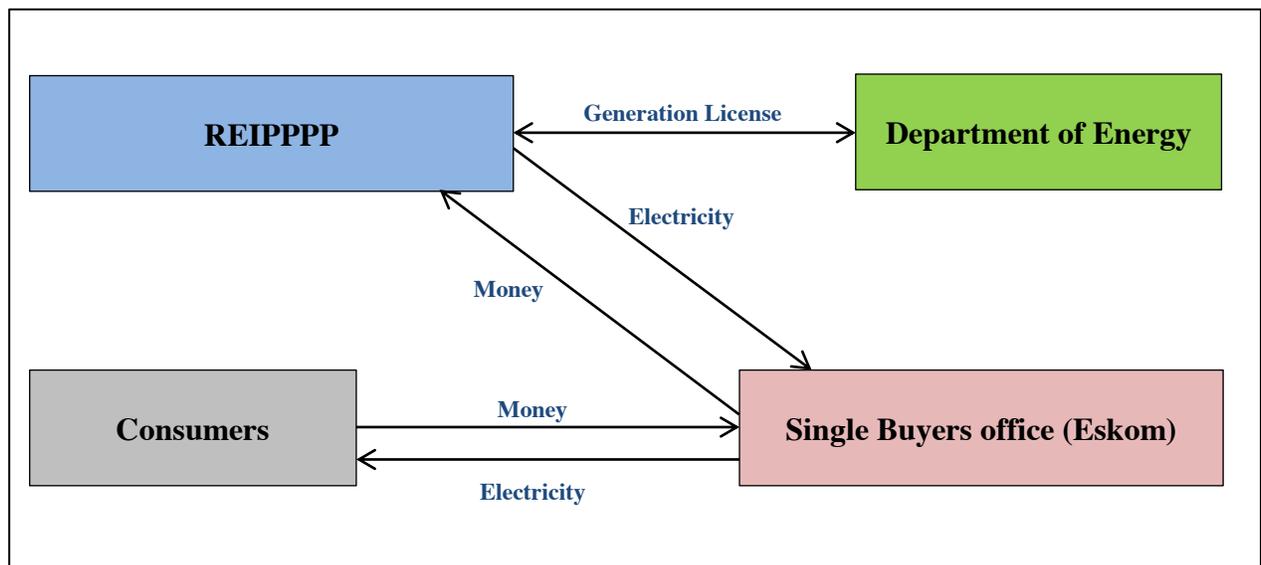


Figure 4.1: REIPPPP process

Source: Redesigned from NERSA (2009b)

Essentially, the effectiveness of the policy to achieve its objectives depends on the level of competition from interested developers. The level of competition is strongly related to the amount of power allocated. Therefore, the power allocations that were implemented during the bidding windows are important to discuss.

4.4.3. Power allocation

The amount of power allocated differed for the different types of technology, as well as the bidding window. Initially, a total of 3 725 MW of renewable power was to be allocated in total, 100 MW of which was set aside for small scale projects (Landfill gas and small hydro). The total allocated power to all projects has since however increased by an additional 3 200 MW. Each type of technology was set an allocation, which would be allocated through five rounds of bidding. For the remainder of this section, the initial allocations will be discussed. Table 4.5 illustrates the total power allocation by technology, while figure 4.2 graphically represents the allocation.

Table 4.4: REIPPPP power allocation by technology

Technology	MW Allocation
Onshore wind	1 850 MW
Solar PV	1 450 MW
CSP	200 MW
Biomass	12.5 MW
Biogas	12.5 MW
Landfill Gas	25 MW
Small Hydro	75 ME
Total	3 725 MW

Source: Redesigned from NERSA (2009b)

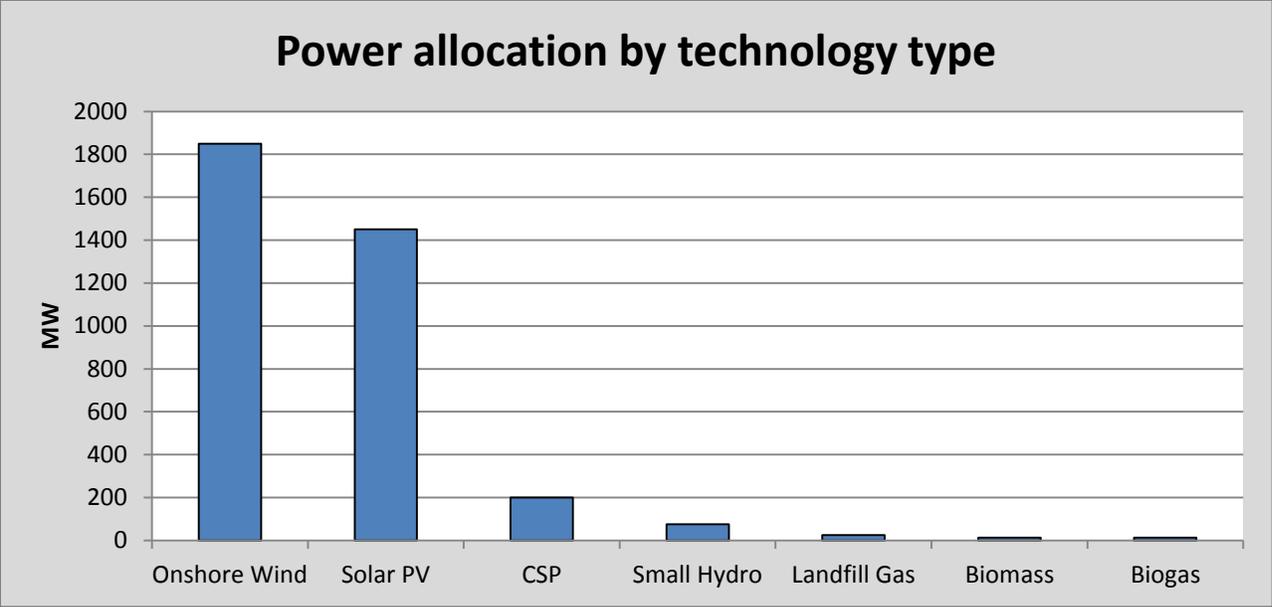


Figure 4.2: Graphical representation of power allocation

Source: Redesigned from Eberhard *et al.* (2014)

Table 4.4 and Figure 4.2 illustrate that wind and solar PV were granted an overwhelming majority of the power allocation. This immediately raises concerns over the lack of diversification within the sector in the long run. This will be discussed in greater detail in the critical analysis in Section 4.5.

4.4.4. Bid design and evaluation

As mentioned, successful bids were selected through price and non-price factors. The price factors count 70 per cent of the bid, while non-price factors counted 30 per cent. The rationale behind the adjustment from the normal government levels of a 90/10 split was to fully utilise the economic opportunities with RE projects. However, because bidders were first required to qualify to certain non-price factors before being allowed to bid on projects, it is worth discussing these non-price factors first.

4.4.5. Non-price factors

Although non-price factors only counted 30 per cent of the bid, bidders were still required to adhere to them in order to qualify for the bidding phase. The non-price bid evaluation involved a two-step process. In the first step, bidders were required to satisfy certain minimum threshold

requirement in six areas: environment; land; commercial and legal; economic development; financial and technical (Eberhard *et al.*, 2014).

One of the requirements worth mentioning is that all projects, whether from international or local developers, were required to have a South African ‘entity’ participation of at least 40 per cent (Eberhard *et al.*, 2014). In addition, 1 per cent of the projects revenues were required to go towards socioeconomic development. Before qualifying as a bidder, all projects had to submit the following documentation (Eberhard *et al.*, 2014: 24):

- ‘A completed economic development scorecard that scores bidders economic development performance against government targets;
- Various kinds of documentation to confirm compliance, including organisation charts, employee information, shareholder certificates and agreements;
- An economic development plan that identifies the socio-economic needs of the communities surrounding the project site and offers a strategy for meeting those needs with grant funding; and
- A reporting plan that breaks down the economic development obligations into quarterly segments over the lifetime of each 20 year project, along with quantitative measures for the obligations to allow for monitoring and evaluation by government’.

Once bidders had adhered to the qualification criteria, they moved on to the second step in the bid application process. Here, bidders were evaluated on the 70/30 split between price and local content factors. Bidders were required to submit an ‘*Economic Development Scorecard*’. This scorecard effectively counted 30 per cent of their bid. Table 4.5 illustrates the various non-price factors that contributed the 30 per cent of bid.

Table 4.5: REIPPPP Economic Development Objectives

REIPPPP Economic Development Objectives					
Categories	Overall Weights	Description	Objectives		
			BEE	Community Benefits	Jobs & SA Content
Job Creation	25%	SA-based employees who are citizens			6.25%
		SA-based employees who are black citizens	6.25%		
		Skilled employees who are black citizens	6.25%		
		SA-based employees from local communities		6.25%	
Local Content	25%	Value of local content expenditure			25%
		Black shareholding in the project company	3.75%		
		Black shareholding in the construction	3.75%		
Ownership	15%	Black shareholding in the operations contractor	3.75%		
		Local community shareholding in project		3.75%	
		Black top management	5%		
Management Control	5%	BBBEE procurement expenditure	3.33%		
		SMME procurement expenditure			3.33%
Preferential Procurement	10%	Women-owned vendor procurement expenditure			
		Community enterprise development contributions		5%	
Socio-economic Development	15%	Community socio-economic contributions		15%	
		Totals		32%	38%

Source: Redesigned from Eberhard *et al.* (2014: 44)

Bidders were required to meet the minimum thresholds for each category. The minimum threshold for local content was set at 25 per cent; however, bidders were encouraged to reach a target of 45 per cent. Table 4.7 provides an example of the thresholds for one wind technology.

Table 4.6: Minimum economic development thresholds for wind projects

REIPPPP economic development thresholds for wind projects		
Factor and criteria	Threshold (%)	Target (%)
Job creation		
SA-based employees who are citizens	50	80
SA-based employees who are black in project company	30	50
Skilled employees who are black citizens	18	30
SA-based employees from local communities	12	20
Local content		
Value of local content expenditure	25	45
Ownership		
Black shareholding in the project company	12	30
Black shareholding in the construction contractor	8	20
Black shareholding in the operations contractor	8	20
Local community shareholding	3	5
Management control		
Black top management	Na	40
Preferential procurement		
BBBEE procurement expenditure	Na	60
SMME procurement expenditure	Na	10
Women-owned vendor procurement expenditure	Na	5
Enterprise development		
Community enterprise development contributions	Na	0.6
Socioeconomic development		
Community socio-economic	1.0	1.5
Development contributions	1.0	1.5

Source: NERSA (2009a)

According to Eberhard *et al.* (2014: 24), the programmes strong reliance on non-price factors in the bid evaluation has been one of the most controversial aspects to date. The adjustment from the 10 per cent government norm resulted in non-price factors playing a much stronger role than anticipated. Eberhard *et al.*, (2014) argues that while many international investors felt that the inclusion of non-price factors were too demanding and played too substantial a role in bid evaluation, domestic participants felt they were not demanding enough. To a certain extent, international bidders are worse off when it comes to non-price factors compared to domestic bidders. In addition, both local and international bidders felt that the processes for preparing and submitting documents showing compliance to non-price factors were too vague. These challenges and concerns were, however, taken into account and subsequently amended as the bidding windows progressed.

4.4.6. Price factors

Price factors counted 70 per cent of the bid. The price bids were based on projections and not on actual experience in operating RE systems. Rycroft (2013: 4) argues that ‘...*under these conditions it can be assumed that bidders have built healthy safety factors into their pricing, to account for the many unknown variations in conditions*’. However, the inexperience of developers with competitive tender systems also resulted in optimistic prices in many circumstances. According to Eberhard *et al.* (2014: 13), ‘...*bidders were asked to provide two prices: one fully indexed for inflation and the other partially indexed, with the bidders initially allowed to determine the proportion that would be indexed*’. Both investors and operators, however, particularly liked the structure of the pricing, as the price levels were at levels similar to earlier FITs (Eberhard *et al.*, 2014).

One of the largest challenges facing the policy in terms of price factors was the concept of underbidding. The nature of the policy, as well as the stiff competition amongst investors, exposed the policy to underbidding: a situation whereby developers propose bids that are unrealistically low. The DoE was concerned that projects would underestimate their price factors, and subsequently provide prices that were too low and not truly reflective of the entire scope of price factors. In essence, underbidding results in projects that are effectively never

actually built. Stringent systems were however implemented to reduce the probability of underbidding occurring.

4.4.7. Bidding to date

To date, three bidding rounds have been completed. Bids for the first round were received in November 2011, with a total of 53 bids accounting for 2 128 MW of power (Eberhard *et al.*, 2014). Evaluation of the respective bids then followed. A little over a month later, 28 preferred bidders were identified with a power generating total of 1 416 MW. In financial terms, this was worth US\$5.97 billion (Eberhard *et al.*, 2014). However, this was still less than the total allocated power for Round 1. As such, most of the bids were at or just below the price caps. Of the 28 preferred bidders, there were eighteen solar PV projects, two CSP projects, and eight wind projects. There were no bids on the other types of technology: the uncertainties of the first round coupled with the small size of the projects meant that no one was ready to take such big risks, especially the banks.

The second round of bidding saw the total allocation of power reduced to 1 275 MW. The rationale behind this was to stimulate additional competition (Eberhard *et al.*, 2013). However, the price caps remained the same for Round 2. The competition in round 2 increased dramatically, with a total of 79 bids being received. Despite the drop in RE capacity, competition increased by nearly 50 per cent compared to Round 1, with 3 233 MW received in bids (Eberhard *et al.*, 2014). Although 79 bids were received, only 51 met the qualifying criteria. Of these, 19 projects were ultimately selected: nine solar PV; seven wind; two hydro; and one CSP. A total of 1 044 MW of power was signed.

In addition to the above, Round 2 was more successful in terms of indirect project benefits, or economic development objectives. As opposed to Round 1, Round 2 saw local content rising by 15 per cent for solar PV, 20.7 per cent for wind, and 9.2 per cent for CSP (Eberhard *et al.*, 2014). All other economic developments listed in the economic development scorecard also increased.

The third and most recently completed round commenced in May 2013. The total power capacity was increased from Round 2 to 1 473 MW. In August 2013, a total of 93 bids were received; an

increase of 11 per cent from Round 2. Although only 1 473 MW of power was to be allocated, the total bids received topped 6 000 MW – an overwhelming increase from Round 1 and Round 2. Although impressive, only 17 of the 93 bids were allocated power, totalling 1 456 MW. =

4.4.8. Changes in price

The primary intention of a competitive tender scheme is to allow for RE to become more competitive with conventional energy by reducing the price of electricity generated renewably. Because the scheme essentially ‘picks a winner’ through criteria including price and non-price factors, developers seek to deliver the electricity at the lowest possible rate. Although there are non-price factors, they only count 30 per cent of the bid, and so there is still a strong incentive to push down the price.

To date, the REIPPPP scheme has been successful in driving down the prices. The level of price change is an important consideration for this study. Since the introduction of REIPPPP in 2011, RE prices have dropped substantially. Of particular importance, this has occurred over the three bidding windows, which were all in relatively quick succession of each other. Table 4.9 below illustrates the reduction in price for wind, solar PV and CSP.

Table 4.7: Price reductions during bidding rounds for wind, solar PV and CSP

	Bid window 1	Bid window 2	Bid window 3
Wind			
Price fully indexed (Av. R/kWh base April 2011)	R1, 143	R0, 897	R0, 656
Price fully indexed (Av. R/kWh base April 2013)	R1, 284	R1, 008	R0, 737
Solar PV			
Price fully indexed (Av. R/kWh base April 2011)	R2, 758	R1, 645	R0, 881

Price fully indexed (Av. R/kWh base April 2013)	R3, 098	R1, 848	R0, 990
CSP			
Price fully indexed (Av. R/kWh base April 2011)	R2, 686	R2, 512	R1, 460
Price fully indexed (Av. R/kWh base April 2013)	R3, 017	R2, 822	R1, 640

Source: Redesigned from Rycroft (2013)

Table 4.9 illustrates that prices have dropped significantly during the three bidding rounds. Figure 4.3 graphically represents the deduction in price over the three bidding windows.

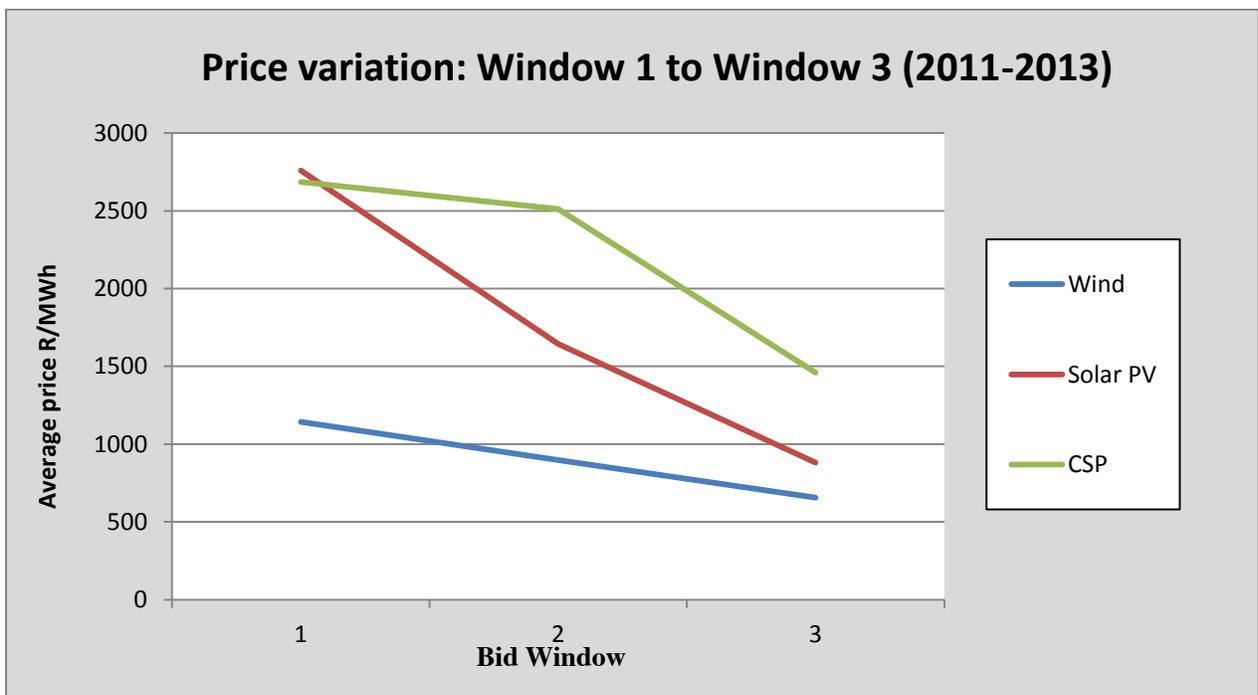


Figure 4.3: Price reduction, window 1 to window 3

Source: Redesigned from Rycroft (2013)

Eberhard *et al.* (2014) argue that increased competition was the main driver for falling prices in rounds two and three. However, increased competition was not the only factor that reduced

prices. Eberhard *et al.* (2014: 17) further argues that ‘*international prices for renewable energy equipment have declined over the past years due to a glut in manufacturing capacity, as well as ongoing innovation and economies of scale; REIPPPP was well positioned to capitalise on these global factors*’.

Another factor further reducing prices was that the transaction costs were lower in subsequent rounds, as ‘*many of the project sponsors and lenders became familiar with the REIPPPP tender specifications and requirements*’ (Eberhard *et al.*, 2014: 17). In addition, these prices became less significant once the larger developers started entering the bidding windows in the latter rounds; for example, larger companies had the in-house capacity to complete bidding documentation, and were therefore not required to externally source the capacity.

The last important consideration, which was of particular important for the formulation of the framework in Chapter 5 is the rate of price reduction. It is important to understand which of the technologies have the greatest ability to reduce prices of electricity generated. Figure 4.4 represents the change in percentage over the three bidding windows.

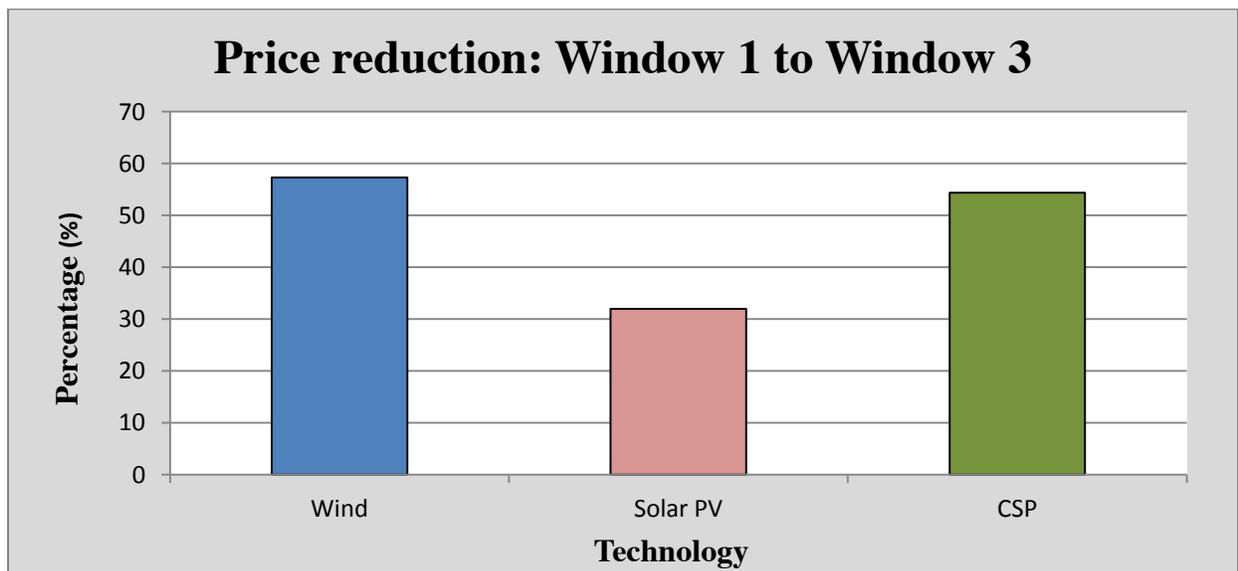


Figure 4.4: Technology price reduction for REIPPPP

Source: Redesigned from Rycroft (2013)

The technology that has reduced the price of electricity the most is wind (57.3%), followed by CSP (54.3%) and solar PV (31.9%). These statistics are rather interesting, when considering that CSP was only allocated 200 MW, compared to 1 450 and 1 850 for onshore wind and solar PV respectively. This potentially demonstrates that price reductions are more aligned with less power allocation; the fundamental principle of a competitive tender system.

4.5. CRITICAL ANALYSIS OF REIPPPP

Although many investors and industry experts were initially concerned about the policy change in 2011, REIPPPP to date can be considered a success. The policy has been commended on delivering a world class, thorough, robust and fair process for procuring RE generation rights. Hagemann (2013) argue that while the policy makes the lives of individual developers more difficult, it is nevertheless in the best interest of the country and the RE industry as a whole. REIPPPP has benefitted significantly from continuous decreases in the global price of renewable technology, as well as favourable market and geographical conditions found in South Africa. However, the effectiveness of the policy has been progressive throughout bidding windows.

The initial stages of the policy certainly had some challenges. For example, the first round of bidding saw less total bids than power allocated. This, in turn, resulted in an uncompetitive bidding process, as all bids that qualified were granted generation rights. As such, the majority of the bid prices were at or near the price cap. Experts argue that there were several reasons for this. Firstly, some argue that too much power was allocated in the first round. Secondly, some experts feel that the three months that developers were given to finalise their bids was nowhere near enough time. However, as the policy moved through bidding rounds, these challenges were overcome and the prices of renewable electricity started dropping, as originally intended.

As the bid windows progressed, the DoE learnt valuable lessons. For example, the allocation for wind dropped from 1850 MW to 650MW in the second bid window to allow for greater competition. In addition, the time developers were given to prepare their bids was extended to four months. These amendments and considerations ultimately resulted in a significant drop in

the price of RE for all technology type. The momentum moved on to the third bid window, which was hailed as the most successful of the bid windows to date.

The REIPPPP process has also been commended for facilitating a stable RE market in South Africa during a time when investor confidence was low (after the unexpected policy change from REFIT). For the most part of the last two decades, FITs were considered the most effective method of increasing RE capacity and investment. FITs were therefore exclusively used in many countries as they created market certainty and an environment for growth. However, experiences from South Africa suggest that competitive tenders can indeed be an extremely effective mechanism to not only increase RE capacity and investment, but reduce prices in the process. Through the design and implementation of a robust policy, the common misconception that competitive tenders lead to cheap projects that are never actually built has become less contested. The high bar set for qualification criteria ensures that only serious and bankable projects with little remaining risk are ultimately selected (Hagemann, 2013). Stringent processes in REIPPPP therefore have significantly increased the likeliness that winning bids will result in completed projects – a challenge that had loomed in the notion of competitive tenders since their origin. In addition, the design of the policy has been hailed for the local economic development obligations. The design of the policy has portrayed that the intention is not only to increase RE capacity in the country, but improve socioeconomic conditions in the process. This too demonstrates that policy-makers are determined to implement innovative policies that are beneficial to more than the single intended industry.

However, this study strongly argues that while the REIPPPP program has thoroughly deserved its appraisal, there are nevertheless certain design elements that were not optimal. As discussed in Chapter 2, RE policies that are innovative and contain elements of other mechanism are often found to be more effective than those with uniform mechanisms. The use of a uniform instrument in the South African RE policy is therefore a strong point of criticism. This study does not argue that the current policy is ineffective, but rather that the current policy could be more effective with adjustments to the model.

The fundamental criticism this study suggests is the fact that the current policy system heavily favours and promotes larger, more established RETs and projects. Smaller RETs and projects have been completely overshadowed, and are battling to compete in the current system. This, in essence, is leading to a RE industry that will be highly undiversified. Statistics illustrated in table 4.4 (pg. 79) and figure 4.2 (pg. 80) strongly support this statement.

Smaller RETs and projects are crucial to both the economy and the RE sector, and contain numerous benefits that cannot be provided by larger projects. Unfortunately, because these small RETs and projects are being overshadowed, the benefits associated with them are being lost. Chapter 5 will present the proposed policy framework, which essentially allows both the benefits from large and small RETs and projects to be realised concurrently through an amendment of the current policy framework. Before progressing to the next chapter, note the extract from International Renewable Energy Agency (IRENA, 2012: 46) which fundamentally summarises the importance this study places on smaller RETs and projects for the future of the RE industry in South Africa:

‘Most RE technologies are young or still being developed, and many new and important innovations in this field are likely to emerge. While it may be possible to identify the technologies that are most appropriate for a given context based on the status of the industry and local conditions at a particular time, it is unrealistic to assume that the best choice of technologies will not change in the future along with science, policy and evolving economies. For this reason, it is better for RE finance programmes to take a “portfolio approach” that can change over time, rather than choosing to support only a limited set of technologies to support. Some developing countries find it most feasible to begin with an exclusive focus on mature technologies. In principle, however, it is better – if possible – to support all stages of technology development and deployment, instead of limiting finance to either the early or late stages. In other words, focusing only on mature technologies has the drawback of ignoring new technologies that may have even better future potential’.

(IRENA, 2012: 46)

5.1. INTRODUCTION

‘The goal of incentives for renewable energy investments is to put renewable and conventional energy projects on a level playing field. Incentives provided at the kick-off stage should shrink as renewable energy becomes more competitive with other sources of energy. For that to happen, renewable energy projects should progressively be exposed to competition and market risks using market mechanisms (such as competitive tenders or feed-in tariffs). In addition, support for renewable energy should not seek to attract investment at any cost for consumers and governments—whether through high electricity tariffs for consumers or higher costs and risks for governments because of excessive guarantees—but also guarantee that the mechanisms selected are the most efficient. That approach imposes the least cost on the economy.

Gomez and Lecitti (2011: 6)

The Gomez and Lecitti (2011: 6) quote above illustrates that the initial incentives for RE is at a crucial stage of the potential success of any RET. Because different RETs are at different stages in their deployment in the South African industry, it is important to differentiate support mechanisms between the various RETs. For example, the current incentives for solar and wind technologies will differ significantly to those required to stimulate investment in landfill gas, for example.

The above quote also demonstrates that the choice of mechanisms requires careful consideration as to which approach is applicable, sustainable, and most beneficial to the industry. The decision-making process is complex and involves a wide array of considerations. The proposed framework in this chapter was formulated as it is strongly believed that such an approach would not only be the most effective way to increase RE capacity in South Africa, but also have a highly efficient balance between costs for consumers and Government alike.

The final important concept evolving from the above quote is the importance of progressive exposure to competition and market risks. On this note, the current RE policy in South Africa has failed miserably. Many RETs have been inserted into a support mechanism, in the form of a competitive tender, which requires heavy competition and has considerable market risks. The proposed framework supports the progressive exposure to competition and market risks.

Chapter 5 presents the proposed policy framework, one of the primary aims of the study. The chapter begins by presenting an overview of the proposed framework and then move on to discuss the individual components of the framework. The reasons as to why each design element has been proposed will be explored. The chapter concludes by discussing the benefits associated with the proposed framework.

5.2. OVERVIEW OF PROPOSED FRAMEWORK

This study fundamentally proposes an amendment to the current policy with an inclusion of a FIT component into the system, whilst keeping the competitive tender component largely unchanged. Although the competitive tender mechanism in the South African context can be considered a success, it is not optimally designed to increase RE capacity in South Africa whilst capturing all associated benefits. The RE policy in South Africa would be considerably more effective if a FIT and competitive tender mechanisms are to be used in parallel.

Because there are effectively two mechanisms to increase RE capacity instead of one, there needs to be criteria for which mechanism a RET should use. The differentiation between projects that fall under the competitive tender system and those that fall under the FIT system depends on two factors: (i) type of technology and (ii) size of project.

Essentially, the competitive tender system applies to wind and solar (both PV and CSP) RETs that are larger than 5 MW. These are the technology systems that are the most mature and established. They are also the RETs that have benefitted the most from investor interest during the initial stages of the REIPPPP, which, in turn, has allowed the price of RE to drop

substantially during the first three rounds of the scheme. Because they have proven interest amongst investors, these two RETs are more suited to the principles of a competitive tender.

The FIT system then applies to all other types of technologies, including: hydro, biomass, biogas and landfill gas. The FIT system would also accommodate solar and wind projects that are smaller than 5MW in size. In addition, any ‘new’ RE technologies that enter the industry in the future will also fall under the FIT system. All projects qualifying for the FIT would be required to be below 10MW in size, with the exception of solar and wind, which are required to be less than 5 MW. Figure 5.1 illustrates the proposed mechanism structure.

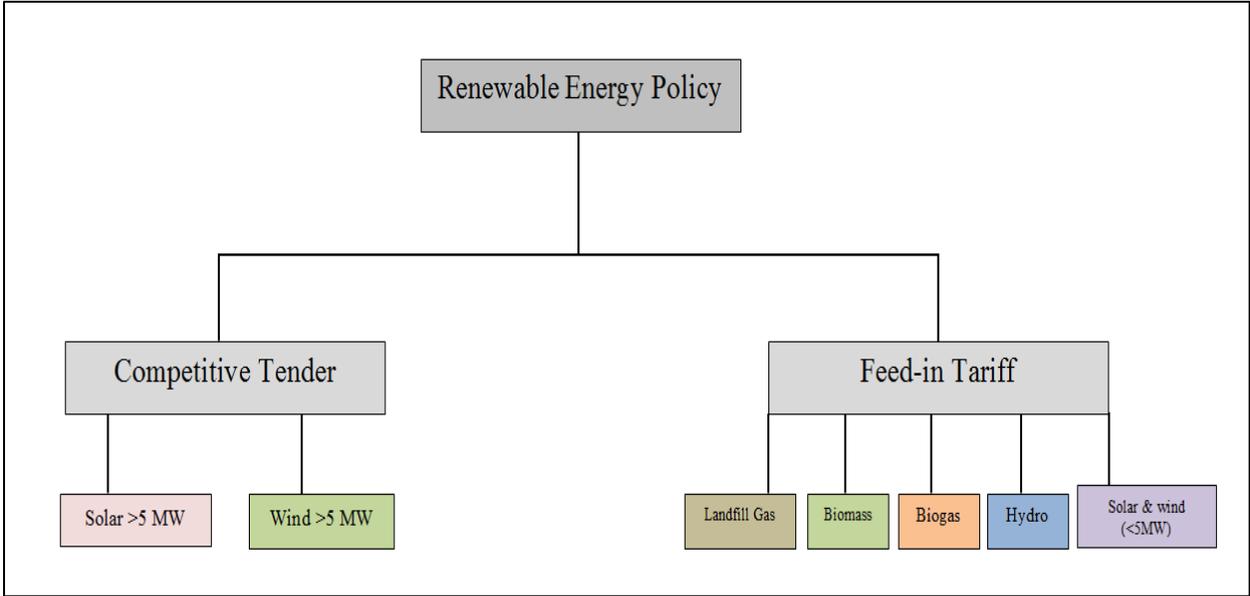


Figure 5.1: Proposed policy structure

Source: By Author, 2014

The framework has been proposed in such a way that eludes to the notion that technologies with little or no competition should utilise a FIT, while technologies with high competition should make use of a competitive tender. This notion is illustrated by the diagonal line in figure 5.2.

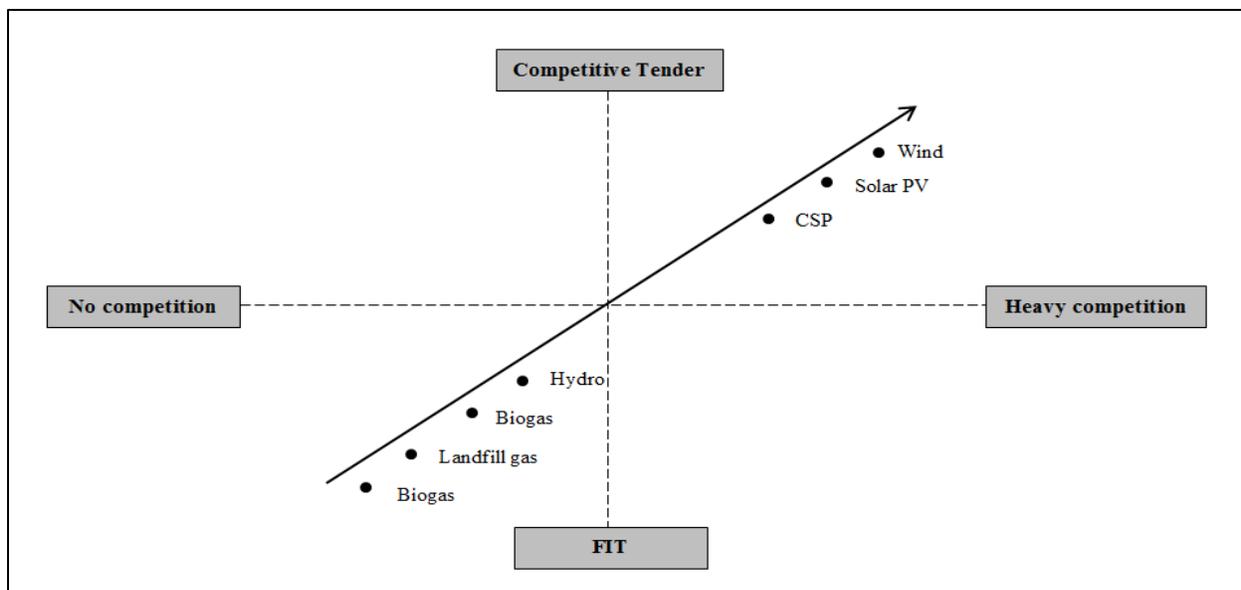


Figure 5.2: Graphical illustration of proposed framework concept

Source: By Author, 2014

Figure 5.2 illustrates that all RETs should remain on the diagonal line: no RET should have no competition and competitive tenders or heavy competition and a FIT. All technologies should rather be located within either of the remaining two quadrants: no competition and FIT; or heavy competition and competitive tender. As RE capacity increases per technology type, the RET moves along the diagonal line upwards, until they move from a FIT to a competitive tender (at the origin).

It would be worthwhile to discuss both the FIT component and the competitive tender component in greater detail in order to get a better understanding of why the proposed system has been designed and formulated in such a way. However, attention will be focused primarily on the FIT component, as the competitive tender is largely unchanged to that of the current system.

5.2.1. Feed-in tariff component

The major amendment to the current policy framework proposed in this study is the inclusion of the FIT into the system. As mentioned above, the FIT system would be applicable to all RETs

with the exception of solar and wind larger than 5 MW. In addition, all projects under the FIT would be limited to 10 MW.

Although there are many reasons for the inclusion of the FIT, which are discussed throughout this chapter, the primary reason for its inclusion as argued in this study is that smaller projects and RETs require a system that can accommodate and support them in order for their successful and optimal deployment. Unlike a competitive tender system, which largely benefits larger projects, an FIT would be more appropriate to increase RE capacity through smaller projects and less commercialised and mature technology types.

The FIT design would work similar to the methodology used in REFIT in 2009, as discussed in chapter 4. Individual tariffs would be set per RET type, and would be required to be differentiated. Differentiation is important as it allows for RE deployment of a variety of technologies and windfall profits for producers. As the Organisation for Economic Co-operation and Development (OECD, 2013: 56) notes, ‘...a high level of differentiation ensure that jobs, manufacturing opportunities and associated activities are equally spread over several renewable energy sectors’.

While the FIT component is designed similarly to the design of REFIT as discussed in chapter 4, there are nevertheless certain design elements that are proposed to differ somewhat. It is important to discuss these design elements and their associated advantages over the previous FIT design: (i) qualification criteria and controlling volume; (ii) inclusion of solar and wind < 5 MW; and (iii) grid access.

5.2.1.1. Qualification criteria and controlling volume

An interesting debate involving the relationship between local economic development benefits and an FIT system evolved in the focus group session. The crux of the debate had to do with whether projects qualifying for the FIT system should be required to adhere to minimum local economic development criteria similar to those in REIPPPP before being able to benefit from the FIT. These minimum qualification criteria would differ from the previous REFIT criteria, as they

would deal exclusively with local economic development. As opposed to REFIT, the proposed FIT component would largely be beneficial to communities, as in the current REIPPPP scheme. The focus group was divided on the matter. Two participants believed that such a system would benefit communities more; two participants felt that it would require additional transaction costs which are against the fundamental principles of the proposed framework, and too aligned with the philosophy of a competitive tender. The participants who were against the minimum qualification criteria also felt that it would act as a significant barrier to entry, into a market that should theoretically be more open to entry than not. However, this barrier to entry provided an interesting idea.

After a lengthy debate on the matter, it was determined that the local economic content criteria should nevertheless be a minimum qualification criteria for projects wishing to benefit from the FIT. South Africa is one of the few countries that have implemented such an initiative, and it was determined that continuing this process would allow communities to continue to capture some of the indirect benefits associated with RE projects, such as in the REIPPPP. One interview participant was totally unaware of the non-price factors that went into the bid proposals for the REIPPPP, and felt that this was an extremely beneficial initiative. They also strongly felt that it was an initiative that can strongly encourage community involvement, something which has lacked considerably in the UK RE industry.

However, interestingly enough, the final decision to include the minimum qualification criteria was not for the initiative and community involvement (although this was a strong factor), but rather from a volume and tariff management perspective. As Chapter 3 reiterated, the setting of the tariff in a FIT system is vital to the effectiveness of the mechanism: over-priced tariffs would attract significant investment (and potentially become financially unsustainable in doing so); under-priced tariffs wouldn't generate sufficient investment. Continually reviewing and amending tariffs can be extremely financially demanding and requires considerable expertise, along with time and capacity considerations. In other words, continually monitoring the tariff to control the volume of players entering the FIT can be extremely demanding.

However, by introducing minimum local economic criteria, authorities would be able to adjust the minimum threshold in order to manage the number of players entering the FIT system. In other words, if there are too many projects under the FIT system (perhaps the tariff is generous), and subsequently the financial long-term sustainability is jeopardized, then authorities can increase the minimum qualification criteria and deter some projects from entering the FIT. Instead of reducing the tariff, which in effect will result in a less attractive market for players, authorities can effectively achieve the same scenario by adjusting the minimum qualification criteria as required. On the other hand, if there are not a sufficient number of players entering the system, instead of increasing the tariff to attract investors, authorities can simply reduce the barriers to entry by reducing the minimum qualification criteria, and effectively achieve the same result. This not only solves the issue surrounding investor confidence related to a fluctuating tariff, but reduces the need for on-going tariff monitoring and evaluation. Resources required for continual monitoring of tariff to determine whether they are optimally priced could therefore be injected into local economies. One interview participant believed that such an approach would be more attractive to policy makers, particularly in a solar PV system:

“The tariff level of solar is very binary: either it is enough, in which case it will take off, or it’s simply not enough. There is a very fine line between what is sufficient, and what is not, and it’s really demanding and hard to keep following those prices. But now there’s another means of controlling the volume coming through by means of the economic criteria”.

Ultimately, policy-makers have an additional tool to monitor volume, whilst the remainder of the communities in which the projects are located largely benefit from the local economic development. According to IRENA (2013), the tariff adjustment process is challenging and complex, and regarded as a fundamental weakness of a FIT. This additional volume-monitoring tool addresses that weakness.

5.2.1.2. Inclusion of solar and wind < 5 MW

The inclusion of solar and wind projects of less than 5 MW in the FIT provided for interesting debates during the research, particularly during the focus group session. With regards to solar,

the focus group unanimously agreed that the technology should somehow benefit from an FIT system. Solar projects have proved to be highly beneficial at a micro-level. A major advantage of small solar projects is the fact that land availability is not as strong a factor as for other types of technologies; solar technologies can be installed on smaller surfaces such as buildings. An interview participant stated that '*...solar PV in particular has strong advantages over other RETs as it can be deployed at a small to medium scale in the middle of a city, literally, just by installing some solar panels onto unused rooftops*'. Solar projects below 5 MW in size are extremely viable and as financially sustainable, and have the ability to provide significant energy supply.

The inclusion of wind farms less than 5 MW in the FIT system was not as unanimous as that of solar for a simple reason: wind farms almost always exceed 5 MW. One of the participants pointed out that wind projects are not generally feasible below 10 MW. Unlike solar technology, wind projects require considerable land availability. However, as one of the participants strongly argued, it is nevertheless utterly important that there is a system that can accommodate smaller wind projects as the South African manufacturing industry for wind related products is increasing. There has been an expansion in wind product manufacturing in South Africa, and this can benefit from the inclusion of wind in the FIT system. With large projects, companies are importing the wind products as it works out cheaper; smaller projects may make use of the locally manufactured products. With a demand for these goods, the local manufacturing industry will naturally expand. After all, a principle of the proposed framework is the notion that all types of projects and RETs should be able to be competitive and benefit from a mechanism that is aligned with their needs.

Another strong factor influencing the inclusion of these RETs was the financial systems for small-scale application. The financial system required for the proposed framework is likely to lie between a micro-finance system and a macro-finance system. Micro-finance refers to financial systems that are applicable to residential or single homes scale. Macro-finance, on the other hand, refers to the financing of large RE projects (generally those under the REIPPPP). A large factor influencing the inclusion of small-scale solar projects into the FIT component was the fact that solar PV is well aligned with the microfinance system: '*the size and modular character of*

solar PV are well suited for individual small-scale applications and easily adaptable to microfinance solutions' (IEA, 2013: 61). In addition, mini-grids are suitable for micro financing in regions with higher population density: the inclusion of solar PV into the FIT will likely increase solar PV deployment in cities where density is highest. Lastly, microfinance is most suitable, and also most effective, when electricity is for productive means (IEA, 2013). Mini-grid and FITs will be discussed in greater detail later on in this chapter.

5.2.1.3. Grid access

Grid access is another important consideration for the FIT system. One of the criticisms of the REFIT deals with the fact that as a qualification criteria, projects would only qualify if there IPPs were connected to the National Transmission System or Distribution Systems. The REFIT also excluded off-grid power generation. The proposed framework would, however, allow projects to produce off-grid power generation, as mini-grids are drastically becoming more effective at electrification initiatives for rural communities compared to grid expansion initiatives.

As it is extremely expensive to expand and construct national transmission lines, smaller projects cannot afford this. The proposed framework therefore allows smaller projects to generate power and feed into mini-grids, which will be financed by national, provincial or local government. As FITs have massive potential to power mini-grids, it is critical that they are allowed to produce off-grid power, and the barriers for FITs producing electricity for mini-grids are reduced considerably.

Smaller projects would not only encourage mini-grids, but would also benefit largely in the sense that the probable location of a majority of projects would be located where there are well established transmission lines and access to the grid. As many of the FIT projects would be deployed within close proximity to cities, grid access would not act as a barrier. According to Couture *et al.*, (2010), a guarantee to grid access is extremely important for small-scale projects at both transmission and distribution levels. Mendonca *et al.* (2010) argue that this practice can help accelerate small-scale RE development significantly. It is therefore important that there exists a balance between FIT projects that are located in areas of well-established grids, and those that are located in areas on no grid access. For the latter option, responsibility should lie on Government on providing the finances for successful deployment in such areas.

5.2.2. Competitive tender component

As discussed above, while the FIT component remains somewhat unchanged, there are nevertheless certain design elements that have been amended. The competitive tender component of the framework, however, would operate similarly to the current mechanism implemented in South Africa. As mentioned previously, only solar PV, CSP and wind projects larger than 5 MW would fall under the competitive tender system. The previous chapters have presented the literature that suggests a competitive tenders system are more aligned with larger, more established and mature RETs with heavy competition. Thus, solar and wind projects larger than 5 MW are the proposed RETs under the competitive tender system. Another reason for applying a competitive tender to these RETs stems from recent experience in the REIPPPP.

The initial stages of the REIPPPP have proven that there is considerable competition in the market for these three types of technologies. Success of the program to date and the subsequent drop in the price of RE suggests that the system for these technologies should remain unchanged. The number of interested RE developers has increase exponentially between the bidding rounds, and this is set to continue rising. Chapter 4 in this study presented the REIPPPP scheme and illustrated how for the solar and wind projects the policy has been a success and ultimately reduced the price of RE. As such, it is suggested that the policy remains largely unchanged for these two types of RETs. However, there were nevertheless some recommendations from research participants suggesting some degree of amending is necessary.

One argument that protruded from the focus group session was that power allocation should start small and increase. In other words, contrary to the current system, each bidding window should start off with less power allocation and slowly increase as the rounds progress. According to Eberhard (2013), because both the size and readiness of the local renewable energy market were initially overestimated and the legal and financial advisory services were stretched to their limit, it is suggested that it might have been more prudent to start small and ramp up. It is therefore suggested that future bidding rounds adopt this mentality.

5.2.3. Discussion

The philosophy on the proposed framework is that the FIT will stimulate initial investment in smaller projects that currently cannot compete in the competitive tender system. As smaller projects benefit from the FIT they slowly gain momentum and increase their capacity over the medium to long-term. Naturally competition for the technologies will increase as they become more established and benefit from learning curves and economies of scale. When this scenario arises, it would be required that the system moves into a competitive tender, just as solar and wind is currently. The question is: *when does the FIT system fall away?*

The entire FIT system would not fall away at once. Rather, it would be technology-specific. When competition for the provision of RE through a specific type of RET becomes significant enough then the RET can make the transition from the FIT to competitive tender system. In an ideal situation, all RETs would make use of a competitive tender system. However, this is not realistic at the current time, and so intervention is still required to stimulate the RETs that are lagging behind. Stimulation of these RETs will essentially create a diversified RE industry in South Africa.

A fundamental argument in this study alludes to the notion that it is incredibly important to diversify the RE industry, and South Africa should make a great effort to do so. A more diverse RE industry will lead to numerous additional benefits including: increased energy security and supply; additional jobs and skills transfer; increases in local manufacturing content; competition for RETs and reduction of prices; among others. The proposed framework provides the platform for diversifying South Africa's RE mix, and does so by including a FIT component into the current policy system.

5.3. REASONS TO INCLUDE FIT INTO THE POLICY FRAMEWORK

Because the competitive tender component of the proposed framework remains largely unchanged and the primary difference in proposed framework is the inclusion of the FIT component, it is necessary to discuss reasons as to why a FIT should be incorporated into the policy landscape. In addition, the fundamental proposal deals more with an amendment to the

overarching policy framework as opposed to amendments in design elements of individual mechanisms. Extensively discussing the benefits that would be realised should a FIT be integrated will effectively communicate the reasons as to why the proposed framework has been designed in such a way. Among others, there are six reasons as to why inserting a FIT into the policy landscape will be highly beneficial: (i) diversification of the RE industry and stability of energy supply; (ii) stimulation of small and new technologies; (iii) project financing; (iv) volatile nature of competitive tenders; (v) mini-grids; and (vi) price strategy.

5.3.1. Diversification of RE industry and stability of energy supply

One of the central criticisms of the REIPPPP proposed in this paper is that it does not sufficiently promote diversification within the RE industry. Currently, over 95 per cent of power in the REIPPPP has been allocated to wind and solar resources. Because these are the two resources with the highest theoretical potential, both the DoE and RE investors have shown greater interest; in the process neglecting all the other technology types. The ‘other’ types of technologies have therefore not been as attractive to invest in as wind and solar projects have been. While it cannot be argued that the theoretical potential of these two resources has indeed played an influential role in the decision-making processes of investors, the challenges and barriers associated with a competitive tender and small technologies coupled with the inability of the current system to promote them has been a major criticism and cannot be ignored.

The implementation of a FIT system would allow for smaller technologies to not only compete, but thrive. The option of entering into an FIT system for smaller projects would be considerably more attractive compared to entering into the large, complex competitive tender system. As such, the small technologies would begin to gather momentum, resulting in a more diverse RE industry over the medium to long-term. A diversified RE industry is incredibly important for many reasons; the most notable being (i) a more stable energy supply; and (ii) the creation of additional and specialised jobs as per technology type.

5.3.2. Stimulation of small and new technologies

As mentioned above and throughout the previous chapters, the smaller technology types have been neglected in the REIPPPP process. Due to many barriers, the most notable being the high

transaction costs associated with the REIPPPP, a number of small projects have been deterred. Using a FIT system for the smaller technology types would kick-start these niche industries. The literature review provided the argument that a FIT is more attractive from a developer's perspective: guaranteed long-term payments as opposed to a risky bidding system are significantly more attractive. If investors are guaranteed payments for electricity generation, then they are likely to participate in the system. It is for this argument that this paper proposes using an FIT system in parallel with a competitive tender system to stimulate investment in smaller RETs. Once these smaller RETs have benefitted from a considerable amount of investment, they can shift towards a competitive tender system; however this is an argument that will not be discussed further, as it is beyond the scope of this study.

An interesting analogy evolved from the focus group related to this particular element of the proposed framework: stimulating investment in smaller and new RETs. The analogy dealt with a comparison between price reductions of television sets (TVs) and the RE industry. When flat screen TVs entered the technology scene, it were considered a luxury and extremely expensive – which only a minority could afford. However, as people started purchasing it, the prices began to reduce due to technological advances – the technology learning curve. As the price came down, more people who previously could not afford it bought TVs. As more people bought TVs, the technology improved once again and subsequently the price of TVs reduced. This process has continued since the initial inception of flat screen TVs into the market, as the price of TVs is still reducing. However, there are different types of flat screen TVs: LED and plasma, for example. The RE industry can be perceived in a similar way: the industry is the TV, the different type of RETs are the different types of TVs. When the price of a LED flat screen TV decreases, there is an incentive for plasma manufacturers to also decrease their prices. This same price-evolution philosophy can be applied to individual RETs. It is therefore critical that the initial interest is stimulated and kick-started for each individual RET in order for the same process to apply. The overall RE industry is already experiencing major price decreases, and certain RETs can lag behind if they are not stimulated.

5.3.3. Project financing

Funding for small-scale projects has been a massive barrier in South Africa, with banks preferring to finance larger projects with less risk. As such, the majority of small-scale RE projects have been locally financed. However, in an ever globalising world, financial aid from abroad can contribute significantly to the deployment of RE projects in South Africa. Unfortunately, the current policy framework is not as favourable with international investors as the proposed framework, according to many interview participants. All participants felt that the current system is not designed to encourage international financing.

International funding has played a vital role across many countries in financing RE projects. While this has indeed been the case in South Africa, research strongly suggests that international finance is more likely to be injected into a FIT system as opposed to a competitive tender system. As UNEP (2012) states:

'FITs fit into the paradigm of results-based financing, which is of increasing interest for international development agencies and donor countries. Results-based financing, and related concepts such as results-based and output-based aid can provide incentives for national and sub-national actors to create new markets for renewable energy deployment'.

Other innovative models have recently emerged that have been established to support FIT project financing. A notable example of such a model is the Global Energy Transfer Feed-in Tariff (GET FiT) developed by Deutsche Bank. In essence, the GET FiT report outlines potential structures under which public sector resources can be used to de-risk RE investments in developing countries (UNEP, 2012). According to UNEP (2012: 87), the GET FiT *'envisions that public sector resources could be used to support national FITs and catalyse massive private sector investment...and envisions a flexible framework within which a range of different types of support could be provided to developing countries'.*

Although no concrete initiative based explicitly on the GET FiT concept has been developed to date, the dialogue is on-going and has been noted by international authorities including the

World Bank and UNDP. As such, when initiatives are eventually developed, South Africa could be at a massive disadvantage if there is not FIT system to benefit from the concept. To conclude, UNEP (2012: 88) states the following:

‘During the next several years, for example, it could be possible for international resources—either through existing channels of international support focused on results-based financing or through the emerging climate finance mechanisms—to be coordinated and focused in support of national FIT policies in developing countries’.

5.3.4. Volatile nature of competitive tenders

According to OECD (2013), competitive tender systems have a tendency to create ‘stop-and-go’ development cycles in the RE industry. A ‘stop-and-go’ development cycle occurs when periods of development and activity are quickly followed by periods without any activity. This, in turn, can affect the prosperity of the system. At any stage, a lack of continuous support for a competitive tender system can offset the establishment of a national industry and result in a ‘stop-and-go’ cycle. As such, authorities are required to continuously call for tenders periodically in order to continue the system’s momentum. However, this can pose major challenges.

Because of its nature, a competitive tender system comprises of numerous highly complex components. Inefficiencies in any of these components can result in a lack of continuous support for the system, which can have major implications and result in a ‘stop-and-go’ cycle. This has already been evident in the South African case, with financial close for Round 3 having already been delayed. The introduction of a FIT system can offset the times when the competitive tender is not operating optimally and experiencing a ‘stop-and-go’ cycle. In addition, the presence of the FIT system would place less pressure on authorities to continue tender rounds on a regular basis.

5.3.5. Mini-grids and FITs

Unfortunately, a large majority of people in South Africa do not have access to electricity. In addition, an overwhelming majority of these people are in rural areas that are not reached with

the national electricity grid. Instead of extending the national electricity grid to these isolated areas at extremely high costs, mini-grids can provide high-quality indigenous electricity to these areas (Mendonca *et al.*, 2010). The FIT component of the proposed framework would be more effective at supporting self-sufficient mini-grids compared to the competitive tender component.

The establishment and construction of mini-grids in areas without access to the national transmission line should be seen as a priority governmental objective, and financed by national government. Regardless of project size, the finance for establishing mini-grid infrastructure should come from the public sector. The FIT projects would support mini-grids falling under the hybrid business model. As opposed to community-based or private-based models for mini-grids, the hybrid business model is quite diverse, and combines different ownership and management structures. For example, private sector can own the RE project, national government can own mini-grid system, while the local community can manage the system on a daily basis. This coordination of responsibilities effectively reduces the onerous nature of completing sustainable mini-grid systems: government focuses on installing transmission lines; the private sector focuses on generating the power; and local communities focus on managing the system optimally and sustainably.

An interview participant also noted that Government should avoid limiting private investment in off-grid projects. In addition, Governments should not solely rely on grid expansion as the primary means to electrify communities without access to electricity, unless the grid expansion is the most cost effective method. The quote from Gomez and Licetti (2011: 3) summarises the above arguments:

'In rural and remote areas renewable energy is preferable if natural resources are available, large and dispersed populations lack electricity access, potential electricity consumption is not large enough, and renewable energy plants are cost-effective in the medium term relative to grid connections and fossil fuel plants'.

5.3.6. Price strategy

The pricing strategy is an interesting debate. According to an interview participants, the price of RE should be the single most imperative objective of the RE policy in South Africa, and whatever combination of mechanisms that can achieve the most effective price reductions over the long-term should be utilised. The price consequences of the proposed framework is therefore of utmost importance.

The price of RE needs to be broken down into different time frames: short-; medium-; and long-term. Over the short-term, the prices need to be reduced to a level that starts to become more competitive with conventional energy; according to members of the focus group, this level is around 20 per cent more than conventional energy prices. At this level, interest in RE deployment would begin to gather momentum. Over the medium-term, the price of RE should be on par (level) with conventional energy. As this point, consumers will likely opt for clean energy as opposed to ‘dirty’ energy, as they are the same price. Lastly, over the long-run, the price of RE needs to be significantly lower than that of conventional energy; this would inevitably result in energy generated by conventional sources becoming unnecessary. The major influence on rising conventional energy prices includes resource scarcity, while the major factors reducing prices for RE includes technology development and large-scale deployment. Figure 5.3 illustrates the three different time frames.

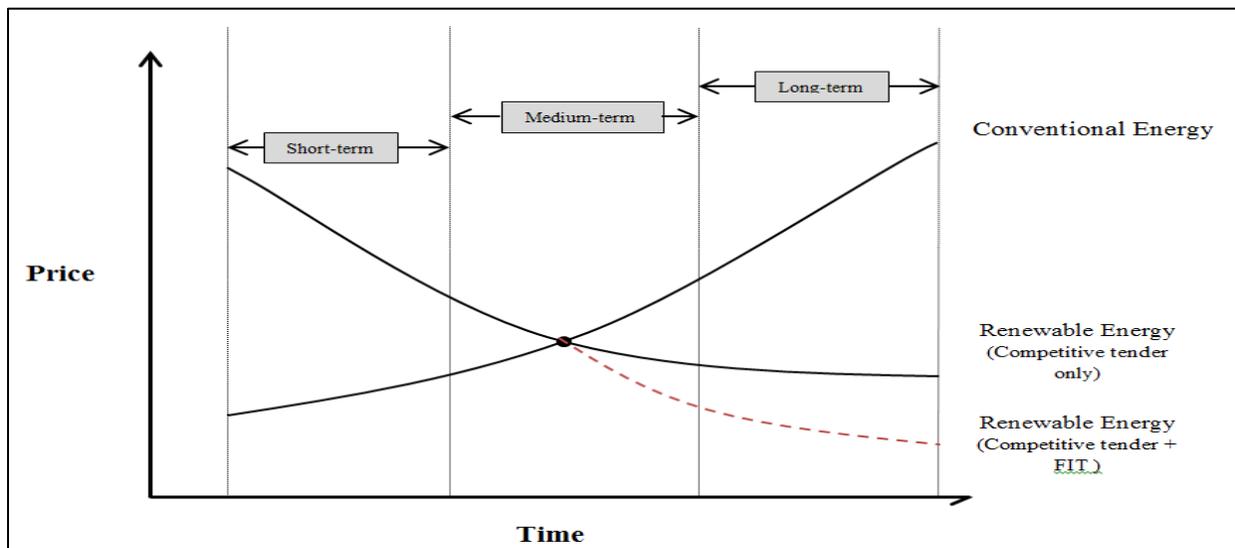


Figure 5.3: Short-, medium-, and long-term prices of energy

Source: Author, 2014

The proposed framework has an important effect on the price after equilibrium point. Without the FIT component, note how the price of RE stays relatively constant (flat) after the equilibrium point. However, the inclusion of the FIT essentially results in continued decreases in prices over the medium to long-term. This is illustrated by the dotted red line after equilibrium point. Note the following statement from IEA (2014: 45):

‘...the key to stimulating investment in decarbonisation is to supplement electricity markets while seeking to minimise distortions, and should rely on market mechanism for mature technologies while minimising costs through timely technology deployment non-mature technologies’.

The important message is that timely deployment reduces costs of RE over the longer-run. Although the FIT component won't drastically reduce the price of RE in the short-term, it will have an enormous influence over the prices in the medium to longer term. However, the competitive tender component is responsible for reducing the prices in the short-term. This is a fundamental advantage a competitive tender approach holds over a FIT approach.

5.4. SUMMARY

The proposed framework has been designed in such a way that accommodates for all RET types, and makes use of the most effective mechanism for each. Because all RETs are at different development stages in South Africa, a uniform support mechanism is not the most effective and optimal tool for successfully promoting individual RETs.

The fundamental amendment in proposed framework is the inclusion of a FIT system for smaller RETs and projects. The inclusion of this mechanism into the policy landscape will allow smaller RETs and projects to not only compete in the industry, but thrive. The current policy is favourable for larger RETs, more specifically wind and solar, but not so much for smaller RETs. While construction of large projects is still absolutely critical for the future of RE in South Africa due to reduction in prices over the short-run, there are nevertheless considerable advantages with increasing RE capacity through smaller RETs and projects. The increased capacity in smaller

RETs and projects would have major benefits over the medium and long-terms. Table 5.1 illustrates the reasons discussed in this study as to why it is of utmost importance to include FITs in the South African RE policy.

Table 5.1: Reasons to include FIT into policy framework

Reasons to include FIT into policy system	
Diversify the RE industry	<p>Diversifying the South African RE industry will have numerous benefits. The most notable benefit would be the increase in energy supply and security.</p> <p>Unlike conventional energy, RE is only generating energy optimally at full capacity when conditions are right. Therefore, having a diverse RE mix will reduce the supply volatility of RE. If conventional energy sources are to become unnecessary in the future, a constant energy from RE sources will be a necessity.</p>
Stimulation of small and new technologies	<p>Stimulating investment in smaller RETs is important in order to realise economies of scale and learning curves.</p> <p>Stimulating new technologies provides additional jobs, as well as jobs that are specialised per RET.</p>
Project financing	<p>Smaller projects are more likely to receive finance from banks if they fall under a FIT system as opposed to a competitive tender system.</p> <p>Innovative international finance model, such as GET FiT, are emerging. Concepts similar to this show potential to</p>

	<p>drastically aid in RE financing in developing countries by using international finance.</p> <p>New emerging models catalyse private sector involvement in RE project financing.</p>
<p>Volatile nature of competitive tenders</p>	<p>One of the weaknesses of a competitive tender is the potential for ‘stop-and-go’ development cycles. These are periods of high activity followed by periods of no activity.</p> <p>FIT can provide for a more stable RE industry that is able to cope whilst in a ‘stop-and-go’ cycle.</p>
<p>Mini-grids and FITs</p>	<p>FITs support mini-grids more than competitive tenders, as they are more likely to be located within close proximity of local communities who are without transmission lines.</p> <p>Mini-grids can be more cost-effective compared to grid expansion projects, and FIT projects can support mini-grids.</p>
<p>Price strategy</p>	<p>The price under a competitive tender only approach will reduce drastically until RE and conventional energy are equal. From there, it will flatten out.</p> <p>The FIT component will then reduce prices over the longer term to levels lower than those if only a competitive tender approach was used.</p>

Source: By Author, 2014

CHAPTER 6: TESTING THE PROPOSED FRAMEWORK

6.1. INTRODUCTION

Chapter 5 presented the proposed RE policy framework suggested in this study. The chapter argued that the most optimally designed RE policy framework for the South African context would be a system that makes use of both competitive tender and FIT as support mechanisms. The appropriate support mechanism will ultimately depend on two factors: (i) the type of technology; and (ii) the size of the project. Not only would the use of a dual-mechanism system diversify the RE mix and stimulate investment in smaller technologies, but it would also allow for numerous benefits associated with an increased RE capacity that are currently not being realised.

6.2. EXPERT RESPONSES TO PROPOSED FRAMEWORK

6.2.1. General responses

The interviewed participants strongly felt that the current system requires some degree of amending. Although the current system has proven to be successful during the first rounds of bidding, and the majority of experts acknowledged this, all interview participants felt that a redesign of the system to accommodate for smaller RETs should be welcomed, as this would essentially have numerous benefits on the RE industry in the country. The experts agreed that while the current system is highly effective for larger RETs, it is not optimally designed for less commercialised RETs and smaller projects. The amendment of the current policy, and subsequently the proposal of a revised framework, was therefore well received amongst interview participants.

Interview participants did, however, caution that introducing an array of support mechanism into the market can have unintended consequences and effects on the industry, with one stating the following:

‘...it is important that policymakers are aware of the unintended effects of implementing an array of instruments into the market. It is also imperative that they periodically review the suitability of support mechanisms to minimize distortions on competition and efficiency. Failure to do either would be catastrophic’

Fortunately, South Africa has first-hand experience with both support mechanisms. The recent experience in setting tariffs, managing competitive tender bidding windows, and providing incentives to stimulate investment, to name a few, would contribute to existing knowledge of what does and doesn't work in the South African market. In addition, international experience has shown that the dual-mechanism approach can be successful, if designed and implemented correctly. Understanding specific conditions and formulating tailor-made policies, coupled with integrated knowledge from international best practice, would reduce the unintended consequences of using an array of support mechanisms within a single policy system. Thus, South African policy-makers have at their disposal an array of examples of successful policy designs.

6.2.2. Minimum FIT qualification criteria

One of the appraisals for the proposed framework that evolved from the interviewed participants was the minimum qualification criteria for any projects wishing to benefit from a FIT. A strong argument in favour of including minimum local economic development criteria for the FIT system was the ability to control volume entering the FIT system. A participant strongly agreed that adjusting the barriers to entry is a much more effective tool than adjusting the tariff for numerous reasons. They argued that it can often prove to be extremely difficult to predict the number of interested market players that are attracted by a certain tariff. The introduction of minimum qualification criteria can now 'pre-determine' the potential number of market entrants into the FIT system. This, according to an interview participant, gives authorities the opportunity to revisit any proposed tariff and change it accordingly.

One participant also alluded to the fact that minimum qualification criteria allows the local communities to largely benefit from projects over the longer run – something that has often been neglected in the past:

‘Traditionally, and I speak from experience, companies have allowed local communities to capture the benefits of the project by providing significant job during construction. However, once construction is complete the local communities with nothing except large wind turbines’.

A long-term commitment from the project authorities would also make local communities more accepting of projects. This in itself has numerous benefits, including local community involvement with operational jobs that projects require.

One interviewee mentioned that such an initiative has not been received well by investors in the European Union. Because the EU has open borders for trade and investment, investors are better off investing in countries that do not require stringent laws and policies for entrance into a RE policy system. According to the interviewee, many RE developers were deterred from investing in the UK during the 2000’s due to an unfavourable policy, and rather opted to invest in Germany. As such, she strongly argues that South Africa is at a major advantage, as investors are forced to comply with minimum qualification criteria, as there are no substitute countries with similar resources in close proximity to South Africa. Because South Africa boasts immense RE potential, is considered relatively ‘cheap’ to invest in, and has the strongest economy in Africa, policy-makers can set relatively strict minimum qualification criteria without deterring too many potential entrants.

6.2.3. Limit of 10 MW for FIT system

The interviewed participants strongly supported the limitation of 10 MW for FIT projects. Although it is understood that the full benefits of economies of scale and the resulting technology development can only be captured when there are no limits of capacity (Mendonca *et al.*, 2010), they argued that this cannot be the case in South Africa. Due to limited financial

resources and buyers available for PPA's, a limit imposed on RE generation in the FIT system is required. However, technology development should not be a primary priority of the FIT system.

Another argument evolving from the interviews regarding limiting individual projects was that there would essentially be a larger number of producers. If there were no limit to projects under the FIT, then the system could be monopolised by a few companies. This, in turn, would not provide the platform for future competition in the industry. The larger the diversity of companies producing RE, the greater the potential for future competition, should the RET move into a competitive tender system. The framework proposed that as RETs become more exposed to competition and market risks they will slowly move towards a competitive tender: increasing the number of producers during the FIT would provide a strong platform for when the RET eventually falls under the competitive tender.

Lastly, the interviewed participants mentioned that having individual project caps can create a more stable RE market over the longer-run and subsequently reduce the probability of 'stop-and-go' development cycles – which could potentially be exacerbated in a monopolised industry.

6.2.4. Inclusion of wind and solar of less than 5 MW

One aspect of the proposed framework that the interview participants felt was completely necessary was the inclusion of solar and wind projects less of than 5 MW into the FIT system. Interview participants strongly believed that small scale solar PV projects (less than 2 MW) have massive potential to increase RE capacity in South Africa, but is currently being completely overshadowed by larger projects. One project developer, which commissioned the 1.2 MW solar PV system at Black River Park in Cape Town, agreed: *'small-scale solar PV systems have absolutely massive potential to increase RE capacity in South Africa'*.

In addition, all interviewed participants strongly felt that including these RETs into the FIT system would increase job creation significantly. The investment from local and international companies will be extremely high; as such, the minimum local economic development criteria that projects would be required to adhere to can be rather challenging to meet. Although projects would not be selected according to their local economic development criteria, but rather only to

qualify for the FIT, the heavy criteria would mean that only serious projects are constructed, and have the ability to allow for local jobs to be demanded.

6.2.5. Project financing

Interview participants agreed that project financing would be more effective for small-scale RE projects should they qualify under a FIT system. According one participant, in terms of RE, banks in South Africa is largely concerned with investment security and rate of returns. Because both the security and rate of return is superior for larger projects, banks opt to finance these instead of smaller projects. However, interview participants believe that banks would be more willing to invest in FIT projects, as the investment security is guaranteed.

6.2.6. Mini-grids

The mini-grid concept presented in the previous chapter was also well-received by interview participants. According to an interview participant, FITs are more aligned with supplying energy to mini-grids when compared to competitive tenders:

‘...large projects are only located where the natural resources required for the specific renewable energy type are extremely good. Because of the size of projects, investors cannot afford to construct projects in the wrong location where power generation is volatile. However, small-scale projects fundamentally have less to lose, and so they would be more willing to locate their projects where required’.

The general consensus from the interview participants regarding mini-grids is that they are the most effective way to provide electricity to rural areas where transmission lines are not established. Another interview participant noted the following:

‘...transmission lines are extremely expensive to build. Providing renewable energy into mini-grids to these secluded areas not only means that no transmission lines need to be built, but also means that renewable energy is being deployed: a sustainable means of energy’.

However, while the participants appraised the combination of FITs and mini-grids, they did indicate that there are certain elements that should be cautioned. The most notable concern dealt with the fact that mini-grids can often be more volatile than national grids in energy supply and security. In other words, the supply of energy in mini-grids is not as consistent as the supply in the national grid. While this is a concern, a diverse mini-grid system, one that makes use of numerous types of RE sources, would reduce the volatility of the grid.

An interview participant mentioned the idea that qualification for FIT projects that intend to provide energy into mini-grids where transmission lines are yet to be established could potentially differ from projects intending the opposite:

‘Perhaps projects that feed energy back into mini-grids could have less of a barrier to entry into the FIT. This offsets the potential loss of producing there [location of mini-grid] when resources may not be optimal, and essentially provides an incentive for projects to forego some power production for less of a barrier to entry’.

This argument indeed has its merits. However, this is not in the scope of this study and the proposed framework, and will not be discussed further.

6.2. SUMMARY

Chapter 6 presented the comments and opinions from both industry and academic experts on renewable energy in South Africa. The proposed framework was received well by the numerous experts. With regards to the general notion of combining competitive tenders with FITs, experts were strongly in favour of such an approach, especially in the South African context, where certain RETs are allocated overwhelming majorities of total power. All other of the proposed framework design elements, including minimum FIT qualification criteria, limit of 10MW sized projects for the FIT, inclusion of solar and wind projects smaller than 5MW, project financing and mini-grids, were also extremely well received by experts. However, some experts did suggest certain areas require further investigation in order for the optimality of the framework to be maximized. These are discussed in Chapter 7.

CHAPTER 7: RECOMMENDATIONS FOR FUTURE STUDIES

7.1. INTRODUCTION

This final stage of research in this study was aimed to present the proposed framework to numerous experts and receive their opinions, comments and recommendations on certain design elements of the proposed framework. Chapter 6 discussed the comments and general feelings towards the proposed framework. Chapter 7 will present the areas that experts felt required further investigation. The proposed areas for future research and investigation were formulated in the expert interviews, and not during the focus group.

7.2. FUTURE AREAS FOR INVESTIGATION

Three important concepts were identified in the interviews and are discussed below: (i) current status of RETs; (ii) identification of buyers; and (iii) the wheeling of electricity. These are the three fundamental issues that interview participants strongly felt would be beneficial to the viability of the proposed system.

7.2.1. Current status of RETs

It is important that further research is done to estimate where each RET lies on the diagonal line in figure 5.2 (pg. 98). Although the figure does show the various RETs on the line, this is merely the perception from the focus group. More investigation as to exactly where each RETs lies is incredibly important to two reasons. Firstly, the location of the RET on the line is important to know as it provides the information as to which system the RETs should fall into. If the location is not known, the RET can essentially make use of the incorrect support mechanism. This would drastically reduce the effectiveness of the proposed framework. The second important reason deals with the timing of the transition from one mechanism to the other. It is important have an understanding of when the RET is approaching the transition: this would allow authorities to notify investors that the RET will soon make the transition to the competitive tender. This allows investors to prepare accordingly, and results in zero momentum being lost.

A metric need to be developed that can measure and relate RETs to one another. After all, the factor that defines which quadrant each RET falls under is essentially the relatively in terms of competition to other RETs. A model that incorporates numerous criteria such as financial sustainability, level of interest from investors, elasticity on price changes, for example, should be investigated. In addition, research into the effectiveness of both support mechanisms to each individual RET should be done. Although to a degree this information can be extracted from the current policy, certain RETs have yet benefitted from the REIPPPP. This makes it difficult to measure the effectiveness of a competitive tender on them; however, the fact that they have not benefitted from the system strongly suggests some degree of ineffectiveness with the mechanism. Lastly, although the REFIT scheme was implemented into the market in 2009, not a single project was constructed under it. This means that there is no real understanding of the effectiveness of an FIT on individual RETs in the South Africa market. Although international experience can provide a platform for understanding the effectiveness, authorities are required to investigate the relationship specifically to the South African market, as there are many differentiating exogenous factors between countries.

7.2.2. Identification of buyers

The additional RE capacity generated through the inclusion of the FIT into the system will be significant. As such, it is unclear whether the current buyer, Eskom, will be able to cope with the additional capacity financially. The additional capacity would be significant, and without a host of willing buyers, the scheme could be highly unsuccessful.

Government needs to show support of the FIT and competitive tender system by either identifying potential buyers, or by buying the electricity themselves at local or municipal level. In order for the policy to work effectively, there should be no restrictions to the number of projects that qualify under the FIT. However, this poses a conundrum as ultimately the more projects and additional capacity that is constructed the more buyers the system requires. The possibility of municipalities buying back energy that is fed into their grids from FIT projects is a viable option, and should be investigated further.

However, the private sector is also becoming a more viable option. Although the price of RE is for now considered relatively expensive to that of conventional energy, the price will inevitably reduce in the foreseeable future and become more competitive with conventional energy. With RE prices expected to drop, and conventional prices expected to rise, a promising business model for the private sector emerges; one that could, if communicated properly and effectively to the private sector, produce a number of interested companies.

7.2.3. Wheeling of electricity

The wheeling of electricity In South Africa is another element that is required to be investigated. Wheeling is the transfer of electrical power through transmission and distribution lines from one utility's service to the next (IEA, 2014). To add to this, wheeling can occur between provinces, as well as national borders. One of the biggest advantages of effective wheeling is its importance to independent power producers (IPPs).

IPPs do not have the power of eminent domain and generally do not own transmission lines (IEA, 2014). This is the case in South Africa, as the transmission licence is held and operated by Eskom. Because IPPs do not own transmission lines, they are dependent on utilities (in South Africa this is Eskom) to move their power onto the market. According to the Independent Energy Producers Association (2013: 1), '*...in a competitive marketplace, where independent energy producers are competing with utilities or their affiliates, access to transmission can be used to limit the participation of independent energy producers*'. Because Eskom holds the transmission licence, they effectively have a strong influence on the barrier to entry for IPPs.

While Eskom does allow wheeling, there are strong conditions that IPPs are adhered to meet. One condition includes the requirement that either the IPP or the buyers are to be an Eskom customer. Without this drastic changes moving forward, Eskom will always play a role in the distribution of electricity in South Africa on the national transmission grid– whether with their own electricity or that produced by IPPs. This is not an ideal situation, as the electricity system needs to become competitive between IPPs. The wheeling situation in South Africa, therefore, requires further investigation on how the transmission lines can be opened up to IPPs. Without change, the progress of RE deployment in South Africa will be hindered

8.1. SUMMARY

The introductory components of this paper strongly suggested that the global energy system is on a highly unsustainable path. The South African energy structure mirrors the global system, which is currently dominated by non-renewable fossil fuels that make up an overwhelmingly large percentage of energy supply. These so-called conventional energy sources are considered extremely environmentally harmful and degrading to the natural world.

Currently, around 90 per cent of South Africa's electricity is produced by using coal as a primary resource. Even though coal stocks are estimated to last for at least the next one hundred years in South Africa, coal is nevertheless non-renewable, and so a move away from this particular resource is inevitable. However, without direct intervention the continued use of coal as a primary energy source looks likely for the foreseeable future.

South Africa has, however, realised the important role that renewable energy (RE) can play in alleviating the burden of the energy crisis on long-term growth and prosperity. The *White Paper on Renewable Energy*, released by national government in 2003, has been the principal policy for increasing RE capacity. The initial targets of 10 GW of RE capacity by 2013 were, however, considered relatively ambitious by many pundits and sceptics. While the release of the *White Paper on Renewable Energy* showed great promise and ambition to increase RE capacity in the country, the policy has since unfortunately failed to facilitate drastic changes in the energy mix and attract investment in the RE industry.

Following major energy blackouts across the country in 2007 and 2008, the National Energy Regulator of South Africa (NERSA) began investigating the possibility of a support mechanism to help attract RE investment. The Renewable Energy Feed-in Tariff (REFIT) system was formulated and introduced into the South African market in early 2009, and rapidly attracted interest amongst potential investors. The system made use of a feed-in tariff – a guaranteed payment for energy produced renewable for a buy-back period of up to twenty years. Tariffs were differentiated amongst the qualifying RETs, and initial interest suggested the tariff were considered generous.

However, before a single unit of electricity could be signed off under REFIT, the Department of Energy (DoE) decided to replace the policy with the Renewable Energy Independent Power Producer Procurement Plan (REIPPPP) a mere two years after its inception. The new policy made use of a competitive tender mechanism as opposed to a FIT, and would essentially be formulated, implemented and managed solely by the DoE, with NERSA no longer playing a part. Initial reactions suggested the policy change was unexpected and unforeseen amongst investors, who shortly thereafter began to question the future stability of RE policy in South Africa, as well as the ability of government to manage complex policy systems.

Nevertheless, since the replacement of policy in 2011, the REIPPPP has shown encouraging signs and has since been hailed as a success amongst investors, experts and academics alike. The first three rounds of tendering saw drastic increases in competition between bidding windows, which, in turn, reduced the price of RE in the country – one of the central objectives of the policy. Yet, with all the successfulness surrounding the incumbent support mechanism, there have been certain RETs that have been negatively affected by the change, and have been placed in an unsupportive system.

After a critical analysis of competitive tendering and its relevance in the South African RE industry, this study found that the current mechanism tends to favour larger, well-established RETs where competition is significant. In essence, competition is *the* primary requirement for a competitive tender system to operate as intended and achieve desired results. Because competition was centred primarily on solar and wind resources, the DoE acted accordingly and allocated a large portion of total power to these technologies. So much so that the remaining RETs were only allocated a mere 5 per cent of total power allocations. As such, this study argues that the current policy does not promote a diversified RE industry – something that can have major implications and consequences on the future of the industry.

These smaller RETs have been neglected have a massive role to play in the future of energy in the country. Increasing RE capacity through the deployment of small projects has numerous benefits, including additional job creation, stabilisation in power supply volatility, and ability to attract foreign investment, among many others. The truth is, however, that these small projects cannot cope and compete in the complex policy that is the REIPPPP. The biggest barrier for small projects entering the system is the overwhelmingly high transaction costs required to enter

and participate in the policy. High transaction costs, coupled with the risk of producing an unsuccessful bid, have deterred many small projects from even bidding in the scheme. To make matters worse, banks lack the capacity to review every project, and tend to prefer financing larger projects with less calculated risk and higher returns on investment.

As such, while this study acknowledges the importance of having a competitive tender system in South Africa – in order to reduce RE prices – it argues that having a uniform mechanism is not the optimal approach going forward. Intervention and amendment of the current policy system is therefore suggested.

This study embarked on research journey that attempted to identify and formulate a more optimal combination of mechanisms that would be more effective at increasing RE capacity in South Africa whilst maximising economic benefits. After a critical analysis of the current REIPPPP system, and a thorough understanding of the South African energy context, it was determined that the inclusion of an FIT back into the policy landscape would be extremely beneficial for the country and the RE industry as a whole. The negligence of the REIPPPP to support and stimulate investment in smaller RETs was one criticism argued in this paper, and the inclusion of the FIT in the proposed framework catered for this. Note the below quote from OECD (2013: 5) which summarises the fundamental principle of the proposed framework:

‘The possibility of providing specific support for each renewable energy technology is a major advantage of feed in tariffs over other support mechanism, such as quota based systems’.

Determining and proposing a policy framework that provides specific support for individual RETs was one of the main objectives of the study. After extensive qualitative data analysis and research, it was concluded that FITs are more appropriate for specific support when compared to competitive tenders. In order to provide this technology specific support, a FIT is imperative. This notion is exacerbated in the South African context, as the REIPPPP is far too focused on the larger, more established RETs which have a proven track record of attracting investor interest. As such, the major amendment of the current policy framework was the inclusion of a FIT component.

This study argues that the most optimal combination of support mechanisms is therefore coupling competitive tenders and FITs into a single policy system. The proposed framework states that projects should qualify for either of the two mechanism according to (i) the type of RET; and (ii) the size of the project. The competitive tender component of the framework would be applicable to solar (PV and CSP) and wind projects that are larger than 5 MW in size. The FIT component, on the other hand, would be applicable to all ‘other’ RETs, any new RETs entering the market, and solar and wind projects that are below 5 MW in size.

The competitive tender component of the proposed framework remained largely unchanged. Recent experience with the REIPPPP has demonstrated that there is significant interest amongst investors for certain RETs, namely solar PV, CSP and wind. Due to the design and nature of competitive tender systems, only those RETs with considerable competition are likely to capture the full benefits of competitive tenders. Because these RETs have proven interest, they have subsequently driven the price of RE down over the short run, one of the principle advantages of a competitive tender. This study also argues that it is imperative that the price of RE is reduced over the short-run to become more competitive with conventional energy prices, and so leaving the competitive tender component largely unchanged was based on a strategic price decision.

The FIT component, on the other hand, differed somewhat from the original FIT design introduced into South Africa in 2009 under REFIT. The three major amendments involved the inclusion of solar and wind projects less than 5 MW in size, the ability to produce off-grid power generation, and minimum local economic development criteria (similar to that under REIPPPP) for all projects wishing to qualify for the scheme.

The minimum local economic qualifications that were set for any project qualifying for the FIT provided for an interesting method of controlling volume entering the system. Ongoing and continuous review of tariffs can be both highly time-consuming and financially demanding. In addition, because the tariff level is so critical to the successfulness of a FIT system, having the correct tariff is absolutely essential. However, even the slightest change in tariff can often have numerous unintended consequences. In order to control the volume entering the system, authorities have traditionally adjusted the tariff level: increase the level if volume of players is insufficient; decrease the tariff if there are too much players. However, by being able to adjust the minimum qualification criteria and subsequently increasing or decreasing the barriers to

entry, authorities effectively have an additional tool to monitor and control the volume of players in the market. This was one of the principle findings of this study.

The ability for projects under the FIT to generate off-grid power was an amendment that was decided as a tool to aid the government's electrification processes moving forward into the future. FIT are more likely and able to provide power to mini-grids when compared to their counterpart, competitive tenders. In addition, due to the relatively small-scaled nature of FITs, they fit the profile of emerging internationally successful mini-grid models. The costs of national grid extensions to areas without grid access are becoming increasingly expensive, and the construction of FIT projects has the ability to offset this and provide a renewable source of energy for communities.

Project financing for small projects under REIPPPP has been a major concern of this study. Not only are banks less likely to finance smaller projects, but the high transaction costs associated with the policy has further deterrent potential players from entering. For small projects and less established RETs, project financing would be significantly more viable under a FIT. As projects wouldn't run the risk of providing an unsuccessful bid, and contracts would be guaranteed, banks would have greater investment security. FITs are also advantageous regarding financing as innovative global finance models are emerging. As UNEP (2012: 45) states, '*FITs fit into the paradigm of results-based financing, which is of increasing interest for international development agencies and donor countries*'. Without having a FIT, South Africa could potentially lose out on global finance models, and for a country with such RE potential, this could be disastrous.

It is therefore evident that the inclusion of a FIT back into the policy system would have tremendous benefits for the country, and would be advantageous to industry, government and society alike.

Once the final proposed framework had been presented, the final section of this study attempted to test the proposed framework by exposing the design elements to a host of industry experts and academics. Careful selection of participants was based on numerous criteria including qualifications, expertise, level of experience and recent publications. A total of five participates

from contrasting backgrounds and expertise were carefully selected to participate in the semi-structured interviews.

All participants unanimously agreed that while the current policy has indeed been successful in its own merits, the overall policy framework does require some degree of amendment in order to cater for RETs that have been overshadowed and neglected during REIPPPP. General consensus illustrated that diversification of the RE industry is important for many reasons, and that the introduction of a FIT component would facilitate this. The proposed framework, therefore, was received extremely well by some of South Africa's most respected individuals in the RE industry, with many design elements – such as the minimum qualification criteria for FITs and the inclusion of small-scale solar and wind projects into the FIT – being unanimously appraised.

The study found that there are, however, certain elements of the proposed framework that require further investigation and research. The current adoption of the single buyer approach, being Eskom in the South African context, could complicate matters going forward with the proposed framework. The increased number of renewable energy generators resulting from the proposed framework will require investigation into how the energy will be purchased. Two possible options stemmed from the study: municipalities and the private sector.

Another area that could prove problematic dealt with the concept of wheeling – the ownership rights of the national transmission and distribution lines. Currently, Eskom holds the transmission licence in South Africa, and, as such, they have authority on who can and cannot enter the national electricity grid. Small renewable energy generators are therefore strongly reliant on Eskom to allow their electricity to not only enter the grid, but be transmitted throughout the grid. A reconsideration of the sole licence rights to Eskom should therefore be undertaken. Without amendment to the current wheeling structure, Eskom will always play a pivotal role and have a defining influence in the distribution of electricity in the country. With one of the fundamental principles of the proposed framework being the liberalisation of electricity in South Africa and fostering competition amongst the private sector, this could hamper renewable energy deployment and act as a major barrier to entry into the electricity market.

8.2. CONCLUSION

In a recent publication by IRENA (2012: 46), the following extract emerges that summarizes this study's belief on the importance of a diversified RE industry in South Africa:

'Most RE technologies are young or still being developed and many new and important innovations in this field are likely to emerge. While it may be possible to identify the technologies that are most appropriate for a given context based on the status of the industry and local conditions at a particular time, it is unrealistic to assume that the best choice of technologies will not change in the future along with science, policy and evolving economies. For this reason, it is better for RE finance programmes to take a "portfolio approach" that can change over time, rather than choosing to support only a limited set of technologies. Some developing countries find it most feasible to begin with an exclusive focus on mature technologies. In principle, however, it is better – if possible – to support all stages of technology development and deployment, instead of limiting finance to either the early or late stages. In other words, focusing only on mature technologies has the drawback of ignoring new technologies that may have even better future potential'.

The above extract effectually summarises the intention of this study – to promote a more diversified RE industry in South Africa. With the abundant wealth, and diversity, of natural resources required for RE generation, South Africa certainly has the ability to support all stages of technology development and deployment. However, with conventional energy overwhelmingly dominant in composition of the current energy system, the most effective tool to increase RE capacity in the future will be the chosen policy, its design, and the support mechanisms accompanying it. Not only will the chosen policy have an influence on the structure of the national energy system mix, but so too will it influence the structure of the RE system.

This study acknowledges that the RE policy in South Africa is still in its infancy stage and that valuable lessons are still being learnt. In an industry that requires the highest level of precision and most effective mechanism combination in order to be successful, the lack of RE policy experience in South Africa has indeed been daunting for policy-makers. Without having a wide array of 'tried and tested' policy designs at their disposal, policy-makers are tasked with formulating incredibly complex policies without a comfortable level of experience.

Due to this, there is a need for research and investigation into potential combinations that can effectively increase RE in South Africa and realise the full array of benefits while limiting the cost to investors, Government and society. New policy framework configurations, new innovative ideas, and alternative ways of approaching the incredibly difficult challenge of addressing the energy crisis in South Africa will all significantly contribute towards more effective policies in the future. In essence, this study has attempted to achieve at least that.

In light of the above, this study has not presented the 'be-all-end-all' solution for increasing RE capacity in South Africa. Rather, it has raised awareness that the current policy is promoting a monopolised RE industry, and suggests that amendment to the current framework is necessary and worth further investigation.

Policies contain a plethora of extremely complex and inter-related mechanisms, and the RE policy in South Africa is certainly no different. To complicate matters further, exogenous factors are increasingly becoming an integral part of national RE policies and in an ever-changing, globalising world, policy-makers are forced to fully consider the influences these factors will have on national policies. Policies therefore require ongoing evaluation and relevancy assessments in order to effectively capture the full benefits of RE.

Note the concluding quote from (Gomez & Licetti, 2011: 7): *'Support mechanisms should be assessed regularly for their necessity and relevancy in light of technological improvements and the evolution of green markets.* This study has strongly suggested that the relevancy of South Africa's current support mechanism should be assessed sooner rather than later.

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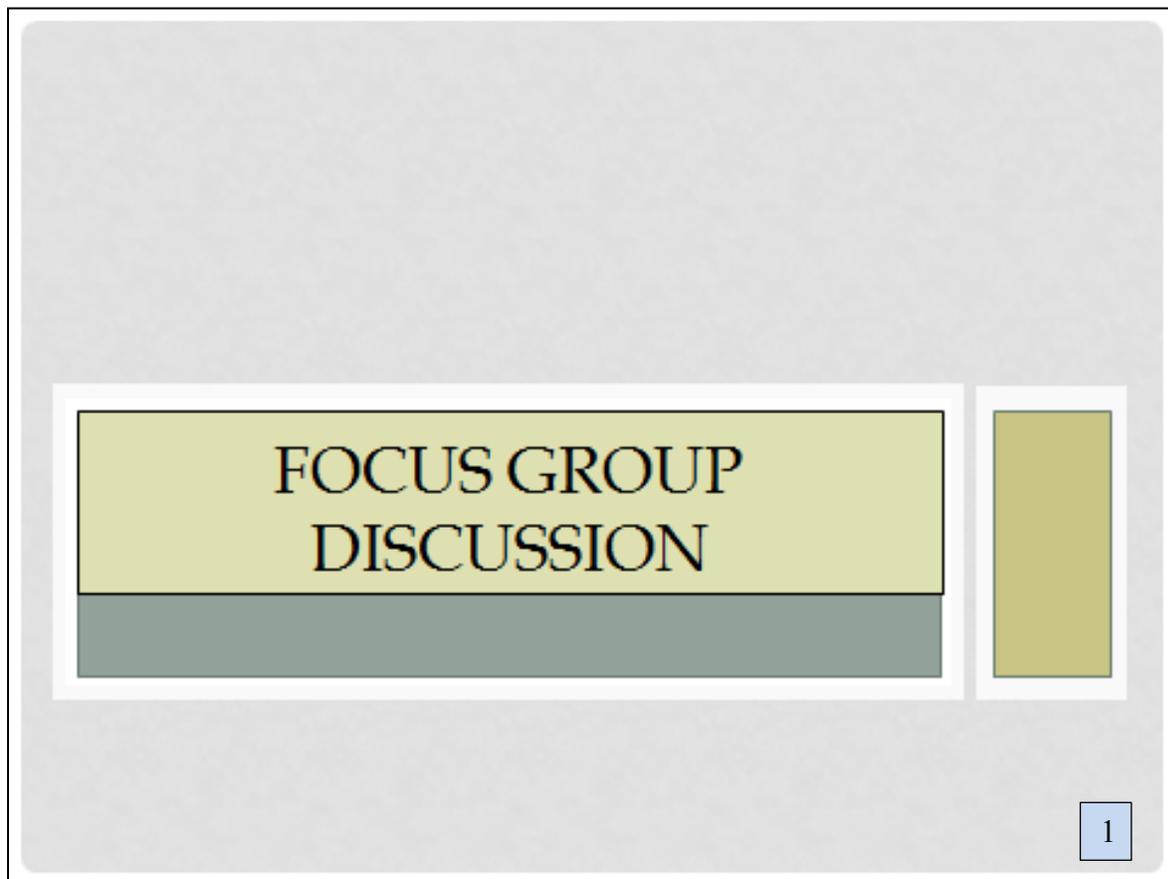
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APPENDICES

Appendix A

Focus Group Presentation and notes

The focus group session took place in early July 2014 in Rondebosch, Cape Town. The intention of the focus group was to discuss the proposed RE policy framework, which was developed by the researcher prior to the session. The researcher gave a ten minute presentation to the participants of the focus group, with the intention of informing the participants of the agenda for the session, as well as important theoretical knowledge used throughout the study. The slides seen below were the slides used during the introductory presentation to the participants of the focus group.



AGENDA

- Introductions (10 mins)
- Feed-in tariff discussion (10 mins)
- Competitive tender discussion (10 mins)
- Proposed framework discussion (30 mins)

2

INTRODUCTION

- Who am I?
- Who are you?
- What do you expect from the session?
- What do I expect from the session?

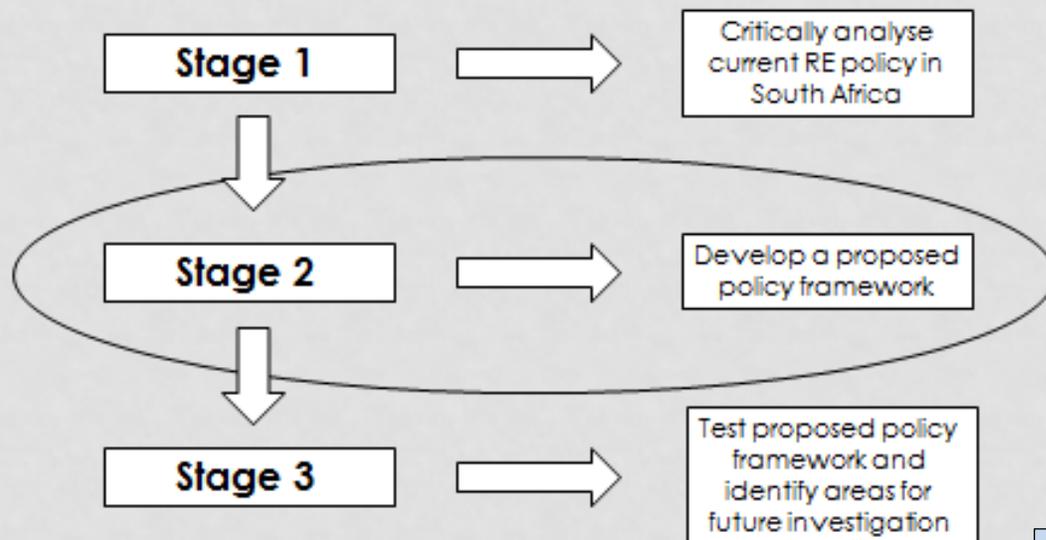
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ABOUT THE STUDY

Diversifying South Africa's renewable energy capacity through policy: A comparative analysis of feed-in tariffs and competitive tenders

4

RESEARCH METHODOLOGY



5

RENEWABLE ENERGY FEED IN TARIFF

- Implemented in 2009
- Managed by the National Energy Regulator of South Africa (NERSA)
- Feed-in tariff (FIT) system
- Removed in 2011 – replaced by REIPPPP

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FEED-IN TARIFF CONT.

Advantages

- Stimulates investment
- Increases RE capacity
- Tariff administratively determined
- Guarantees interest from market
- Tariff differentiation
- Relatively simple to administer/manage

Disadvantages

- Financially demanding
- Little incentive to adjust supply to demand
- Unresponsive to market forces
- High public cost
- No incentive for project location
- Distort electricity markets

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RENEWABLE ENERGY INDEPENDENT POWER PRODUCER PROCUREMENT PROGRAM (REIPPPP)

- Replaced REFIT in 2011
- Managed by the Department of Energy (DoE), not NERSA
- Competitive tender system

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COMPETITIVE TENDERS

Advantages

- Reduces price of RE
- Stimulates competition
- High non-price criteria – indirect benefits
- Tariff determined through market forces
- Technology price caps
- Limited public cost

Disadvantages

- Complex system to administer/manage
- Required to pick 'winners'
- Neglects smaller projects/RETs
- Limits potential RE capacity
- Potential to favour international or local companies

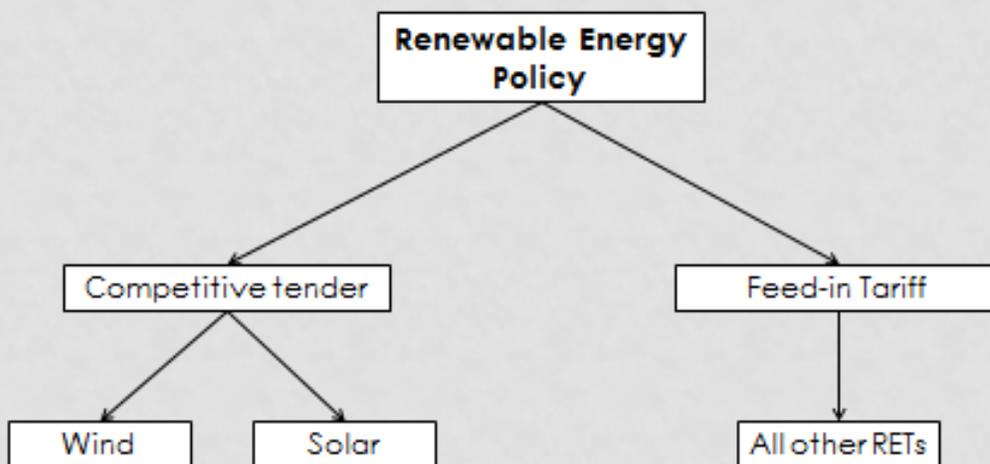
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FEED-IN TARIFF VS. COMPETITIVE TENDER

	Feed-in Tariff	Competitive Tender
Price of RE	Remains same	Decrease
Tariff determination	Administrative	Market forces
Benefits all project sizes	Yes	No
Limit to capacity	No	Yes
Promotes innovation	High	Medium
Non-price benefits	Low	High

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PROPOSED FRAMEWORK



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BENEFITS OF PROPOSED FRAMEWORK

- Diversification of RE mix
- Promotion of smaller REITs and projects
- Increased job creation
- Increased skill/knowledge creation
- Project financing
- Short, medium, long term prices

12

AREAS FOR FUTURE INVESTIGATION

- Point of transition – change from FIT to competitive tender
- Project financing
- Incentives to surpass point of origin

13

Important notes from focus group

Slide 7

- Participants noted that the fact that the FIT tariff is administratively determined can indeed be a disadvantage: an inexperienced entity determining the tariff can potentially set the wrong tariff. This can have major implications and consequences. The paper must reiterate the fact that if the tariff is set wrong, the FIT may be completely ineffective. Insert a section on the importance of tariff setting in the literature review.

Slide 11

- Participants agreed that there should be a dual-system: competitive tenders for specific RETs and projects sizes; FIT for specific RETs and project sizes. Participants also agreed that because solar and wind technologies have the greatest theoretical potential, as well as currently the greatest interest amongst market players, they should fall under the competitive tender system as currently is. While these two RETs should stay put in the competitive tender component, the participants unanimously agreed however that project sizes (specific for solar and win) should also be catered for. See below.
- Changes to the model:
 - Projects that are larger than 10 MW (regardless of type) should fall under the competitive tender component of the framework. Projects that are larger than 10 MW would be financially unsustainable, particularly in South Africa, if they fall under a FIT system.
 - Solar and wind projects that are smaller than 5 MW should fall under the FIT component: solar and wind projects that are larger than 5 MW should move into the competitive tender. There is a significant need for small-scale solar and wind projects (especially solar PV) in South Africa, most notably in cities. For example, rooftop solar PV have massive potential to increase RE capacity in South Africa, whilst providing important jobs in cities; however these are uncompetitive in the larger, more complex competitive tender. Therefore, they would benefit tremendously in supported by a FIT.

Slide 12

The participants strongly felt that the benefits of the proposed model are realistic and achievable.

- **Promoting of small RETs and projects**
 - The participants strongly felt that the inclusion of the FIT system will definitely kick-start investment in smaller RETs. If the FIT can prove to be financially sustainable over the long run, then it can be successful in initial deployment of RE capacity and investment.
- **Job creation**
 - The most prominent appraisal from the participants dealt with the potential of the FIT to promote localised jobs: jobs in cities. Instead of locating projects in secluded areas (used the example of the Kalkbult Solar PV system, built approximately 100km from De Aar), are not realising the full potential of job creation with increased RE capacity. The FIT system will allow jobs to be created in cities (for example solar PV rooftop systems on commercial buildings).
- **Price strategy**
 - Participants agreed that the price of RE is the most important aspect, and the single factor that will make it competitive with conventional energy. Therefore, the price needs to be a priority area. The competitive tender system is the most effective mechanism to reduce the price of RE; therefore, the decision to apply the mechanism to the two RETs with greatest interest and competition was supported. Participants also agreed that stimulating investment in ‘other’ RETs will significantly help the reduction of prices of RE over the medium to long-run. The greater the diversity and the available options of RE, the quicker the price will decrease.

Slide 13

- **Point of transition**
 - Concern was shown with regards to appropriate incentives to get projects to construct past the 10 MW size. Participants felt the incentives need to be

extremely beneficial for the RE developers, or else they won't want to enter into the FIT.

- **Wheeling of electricity**

- Importance to IPPs as it effectively increases their barrier to entry. This is exacerbated in South Africa as Eskom holds the transmission licence.

Other

Discussed the solar PV system in Black River Park – 1.2 MW solar system installed on rooftops within the park. There are 8 buildings, all with solar PV installed on, and contribute approximately 20-30 per cent of the park's total energy usage. The park have recently signed a contract with the city of Cape Town to sell back any additional, or weekend, energy at a tariff equivalent to that of Eskom's. This is under the city's target of 10 per cent renewable energy in 2020. This small system would be a great case study for the small FIT projects (solar) under 5 MW, and shows the potential.

Appendix B

Interview & focus group participants:

Below is information on the selected participants of the focus group and semi-structured interviews. Only participants that did not want to remain anonymous are described below.

Personal Interview 1

12 April 2014 – Unger, E. Director at Electrawinds (RSA)

Personal Interview 2

14 April 2014 – Young, A. Director at Cobalt Energy (U.K).

Personal Interview 3

29 September 2014 – Hartnell, G. CEO Renewable Energy Association (REA). (U.K)

Participant 1:

Name	Emil Unger
Organization (Current)	Electrawinds (Pty) Ltd.
Position	Country Manager (RSA)
Other positions held	N/A
Experience	N/A
Expertise	Solar Thermal; Wind technologies;
International experience	Yes

Participant 2:

Name	Alex Young
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Organization (Current)	Cobalt Energy Limited
Position	Director
Other positions held	Chair of Bioenergy Group at Renewable Energy Association (REA); Senior manager of leading UK based energy company
Experience	Cobalt Energy Limited (current, Director); New Earth Solutions Group (Energy Director, 3 years); Infinis Limited (Head of commercial, 2 years); EDF Energy (Manager, 5 years); Mott Macdonald (Project Engineer, 4 years); BKS Group Limited (Mechanical Engineer).
Expertise	Promoting sensible policy and legislative frameworks for renewable energy; Project development experience on major infrastructure projects in the power, water and accommodation sectors;
International experience	Yes

Participant 3:

Name	Gaynnor Hartnell
Organization (Current)	Freelance consultant
Position	Freelance
Other positions held	CEO of Renewable Energy Association (REA) (U.K) Director of policy (REA)

	Technical & Policy Analyst (British Wind Energy Association)
Experience	Renewable Energy Association (U.K) Confederation of Renewable Energy Associations Landfill Gas Association
Expertise	Energy policy Sustainable energy
International experience	Yes

Appendix C

Framework summary sent to interview participants prior to interview

Dissertation title

“Diversifying South Africa’s renewable energy mix through policy”

Research intention

The intention of my research is to determine whether the policies in place to promote renewable energy (RE) in South Africa are optimally designed.

Context

The National Energy Regulator of South Africa (NERSA) implemented a feed-in tariff (REFIT) system in 2011 to promote RE capacity in South Africa. However, in 2011, the Department of Energy (DoE) decided to replace the FIT system with that of a competitive tender system (REIPPPP).

Conclusion

No, the policy implemented into the South African market is not optimally designed. It must be noted that this paper does not state that the policy implemented is ineffective or flawed; rather, it is not optimally designed to maximise potential.

Policy criticisms

The Renewable Energy Independent Power Producer Procurement Program (REIPPPP) has been hailed for its success in the South African market; the policy has generated significant downward

pressure on the price of RE power, and competition has increased. To date, the program has procured over 4 000 MW of RE power, with the prices dropping for all technology types that have successfully allocated power to developers. However, through a critical analysis of the current program, coupled with a thorough understanding of the RE market in South Africa, I have concluded that the design of the policy framework for increasing RE capacity in South Africa is not necessarily flawed, but not optimally designed.

While the REIPPPP program has been hailed as success, there are numerous downsides to the program:

- The competitive tenders system tends to favour the larger, mature, and more established RE technologies and companies. The system is designed in such a way that promotes a reduction in prices; however, competition is required for this to be achieved. While the larger RE technologies (wind and solar) can accommodate this competition (as they are the resources with the most potential in SA), the smaller ones cannot. Because of the theoretical potential of wind and solar in SA, investors are attracted to these technologies; there is little incentives for RE developers to invest in other technology types. The RE industry in South Africa is therefore on a highly undiversified path.
- The transaction costs and increased risks associated with a competitive tender scheme are too large for smaller companies to submit bids; it has been estimated that as much as R2 billion has been lost due to companies submitting bids and not being awarded them – the majority of them being small projects. Many smaller projects have been deterred from entering bidding rounds due to these high transaction costs. In addition, small companies and projects do not see the need to risk high preparation costs with bids that may not win.
- Financing is another major challenge. Banks in South Africa simply do not have the capacity to review every bid. What is happening is that banks are only seriously considering the larger projects where they can make more profit; the smaller projects are completely overlooked and therefore required to revert to independent financing. Sometimes these projects get the independent financing, but they do not win bids. Therefore, for small projects under the REIPPPP scheme, financing is a major challenge.

Small projects are a vital for both the economy of South Africa, as well as the renewable energy industry. It is therefore recommended that a system to promote small renewable energy projects be investigated.

Proposal

I am proposing in my paper that a competitive tender and feed-in tariff (FIT) scheme should be used in parallel in the South African market. The competitive tender approach should be used for solar and wind and a FIT should be used for all other (and new) technologies. In addition, a FIT should be used for solar (PV & CSP) and wind projects that are smaller than 5 MW. Using a ‘dual’ policy framework would be beneficial for many reasons:

1. The guaranteed payment of an FIT system is considerable more attractive from a developer perspective. The attractiveness will subsequently stimulate investment in the smaller markets. To justify this argument, not a single unit of power has been allocated for certain technologies (biomass and landfill gas) during the first three REIPPPP bidding windows. The inclusion of the FIT will effectively promote greater diversification within the RE industry. This is extremely important as it has numerous benefits to the country and the economy, including: additional job creation, additional RE generation and specialised jobs, to name a few.
2. The use of an FIT and competitive tender will stabilize energy supply volatility in South Africa. In addition, one of the weaknesses of a competitive tender system is the fact that ‘stop-and-go’ cycles are imminent. These are cycles of high activity followed by times of no activity. Including an FIT into the system will offset these ‘stop-and-go’ cycles.
3. Financing would still be a problem with the FIT system. However, I am proposing that a national fund be implemented; banks would then pay into this fund as opposed to individual projects. This would thus reduce the risks for banks associated with project failure, as well as transaction costs.

4. FITs support mini-grids, which are quickly becoming a more attractive option for (current) off-grid rural areas. The expansion of transmission lines to these areas is extremely expensive. RE can be deployed at substantially lower costs, and the FIT component can cater for this. Off-grid (national grid) electricity will aid heavily in the governments national electrification targets. In addition, high income residential estates are moving towards 'island' grid systems that are independent of the national power grid. The FIT model also supports this situation.
5. FITs promote innovation; in a competitive tender system, the consumers receive the vast majority of producer surplus; in a FIT system, the producer surplus goes to the producer. This surplus is typically then fed back into innovation investment under a FIT system. This in itself has numerous advantages.

In summary, I am proposing the parallel use of FITs and competitive tenders in the South African market; FITs for certain technologies and smaller projects, in order to stimulate investment; and competitive tenders for larger projects and technologies that have the competition to effectively increase capacity whilst reducing prices. With specific reference to the South African energy market, the price of RE is a major factor; with conventional energy being amongst the cheapest in the world, only a reduction in price will make RE more competitive. While the REIPPPP scheme is effectively achieving this through the procurement of large – scale solar and wind projects, the remaining technologies are not thriving in the system and therefore not realising their potential. Treating these technologies and smaller projects under a different system will achieve this.
