Sustainability of the Renewable Energy Independent Power Producer Procurement Programme in South Africa

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ABSTRACT

The sustainability of the REIPPP programme was as yet unknown. Through this study control drivers critical for the sustainability of the REIPPP programme were identified and prioritised. As background sustainability was investigated on an international level and within the South African context. Control drivers are drivers that have a significant impact on the sustainability of the REIPPP programme and also have some level of controllability. These drivers were obtained and compiled based on appropriate literature. The Global Reporting Guideline (GRI) for sustainability was used as baseline for identifying control drivers.

To further obtain and verify the relevant sustainability control drivers, input from the REIPPP programme's key stakeholders were included in the research. The key stakeholders provided an impact and controllability rating via a questionnaire, which was used to prioritise the identified control drivers. Selected key stakeholder where requested to review control drivers that were identified and prioritised, providing the researcher a means of verifying the preliminary proposed control drivers.

Obtaining a final list of prioritised control drivers critical for the sustainability of the REIPPP programme was achieved by integrating the drivers identified by the researcher, stakeholder selected alternative drivers and their self-suggested control drivers. The prioritised control drivers could be used to promote or control the sustainability of the REIPPP programme by addressing and/or supporting the control drivers having the most significant impact.

The top 5 prioritised control drivers were selected to be used in an interview with high level key stakeholders. The interviewees provided their input on how these drivers could be supported or addressed to control or even promote the sustainability of the REIPPP programme. From the interview it was clear that the final list of prioritised control drivers was relevant and could influence the long-term sustainability of the REIPPP programme. Many insights were obtained which could provide significant role players, or even the South African Government, the guidance they need to take the REIPPP programme forward.

Key Words: Control drivers, Sustainability, South African Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), Renewable Energy, Global Reporting Guideline (GRI)

ABBREVIATIONS

Abbreviation or Acronym	Definition
BRICS	Brazil, Russia, India, China and South Africa group
CCGT	Closed Cycle Gas Turbines
CSP	Concentrated Solar Power
DBSA	Development Bank of South Africa
DEA	Department of Environmental Affairs
DESA	Department of Economic and Social Affairs
DFI	Development Finance Institution
DoE	Department of Energy
DTI	Department or Trade and Industry
Eskom	Eskom Holdings SOC Limited
FiT	Feed in Tariffs
GDP	Gross Domestic Product
GHG	Green House Gases
GRI	Global Reporting Initiative
ICL	Imperial College London
IEP	Integrated Energy Plan
ILO	International Labour Organisation
IOREC	International Off-Grid Renewable Energy Conference
IPP	Independent Power Producer
IRP	Integrated Resource Plan
MW	Mega Watt
NDP	National Development Plan
NGP	New Growth Path
NPC	National Planning Commission

NT	National Treasury
OECD	Organisation for Economic Cooperation and Development.
PIC	Public Investment Corporation
PPA	Power Producer Agreement
PV	Photo Voltaic
RE	Renewable Energy
REBID	Renewable Energy Bid
REFIT	Renewable Energy Feed-In Tariff
REIPPP	Renewable Energy Independent Power Producer Programme
RET	Renewable Energy Technology
RF	Reporting Framework
RSA	Republic of South Africa
SOE	State-Owned Enterprises
tce	Tonnes Coal Equivalent
TDP	Transmission Development Plan
toe	Tonnes Oil Equivalent
UN	United Nations
UM	University of Maryland
WNI	World Nuclear Industry
WPRE	White Paper on Renewable Energy

LETTER FROM STATISTICAL CONSULTATION SERVICES

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TO WHOM IT MAY CONCERN

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1 INTRODUCTION AND OVERVIEW OF THE STUDY

Coal alone is not the solution to our energy need; nuclear alone is not the solution to our energy need; not even renewable energy is the solution to our energy situation, but the combination thereof is. (Frei, 2012)

1.1 Introduction

South Africa has a diverse economy catering for a variety of customers and consumers. The GDP of South Africa demonstrates this diversity (Figure 1), and after further interpretation one will realise that most of these sectors are energy intensive (StatsSA, 2013).

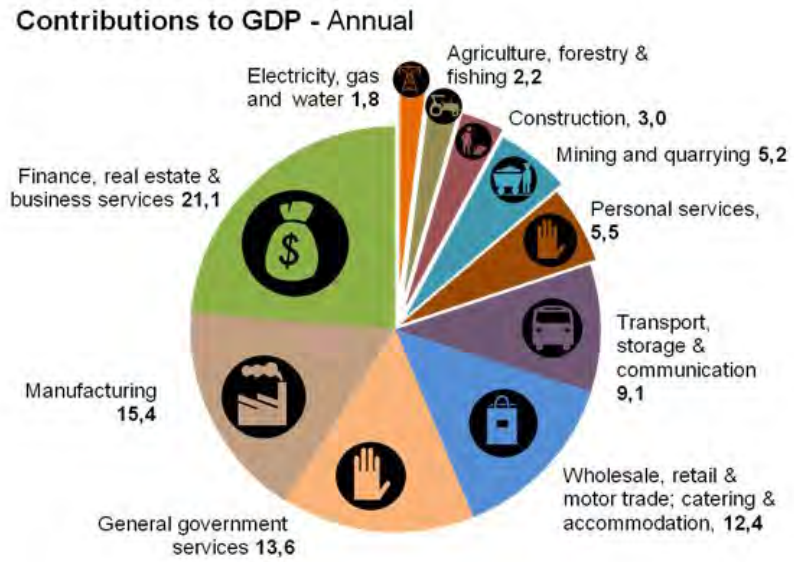


Figure 1: Annual GDP Contributions (StatsSA, 2013)

The manufacturing industry, residential/municipalities and transport remain the three major energy consuming sectors since 2003 and account for more than 78% energy use of the total supply (Figure 2). Mining and construction is also energy intensive and these add up to the total energy demand (Subramoney, 2010:6) (Eskom, 2013a).

The high residential energy use is, among others, due to increased electricity access from 34% in 1994 to 84% in 2011 (RSA, 2012:9). Furthermore there is a need for future power generation and the current need is increasing; new power capacity of approximately 30 GW between now and 2030 is needed, and about 10 GW of old power capacity will be retired over this time, which means more than 40 GW of new power capacity needs to be built by 2030 (Lund, 2012).

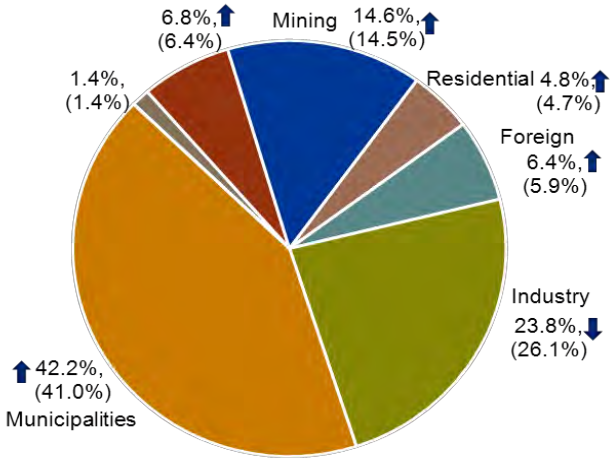


Figure 2: Consumption of energy by sector, 2013 (Eskom, 2013a)

From the information thus far it is clear that the present South Africa is, and the future South Africa will be, an energy intensive country and its economy is crucially depended on its power supply. At the time of this study, generating and providing the above mentioned large amount of power can only be achieved by coal, gas and/or nuclear, mainly produced and distributed by Eskom (Figure 3), but the producing of energy from coal, gas or nuclear is not what the mini-dissertation is about. The research focuses on generating renewable energy which will make its contribution to the energy mix and indirectly to various other sectors, championed by the Renewable Energy Independent Power Producer Programme (REIPPPP) of South Africa.

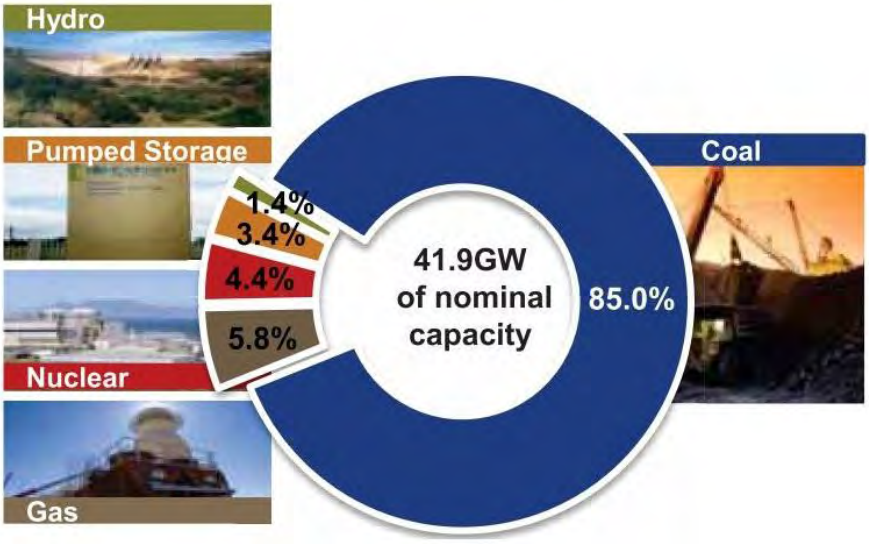


Figure 3: Eskom's generation capacity (Eskom, 2013a)

The REIPPP programme was introduced during August 2010 as a spin-off from the Integrated Resource Plan (IRP 2010-2030). The primary objective of the IRP was to determine the long-term electricity demand and detail how the demand should be met in terms of choosing generation capacity, type of technology to be used, timing and cost. It also serves as input to other Governmental planning including economic development, funding, environmental and social policy

formulation (DoE, 2010a). The IRP 2010 targets for the energy mix can be seen in Figure 4 (DoE 2011a). The REIPPP programme set a 3.2 GW installed capacity target for renewable energy that needed to be reached by 2020 providing for some of the above mentioned new installed power capacity. Renewable energy power sources, like solar Photo Voltaic (PV), Concentrated Solar Power (CSP), wind, biogas and hydro (Creamer, 2012a) (DoE, 2011a):

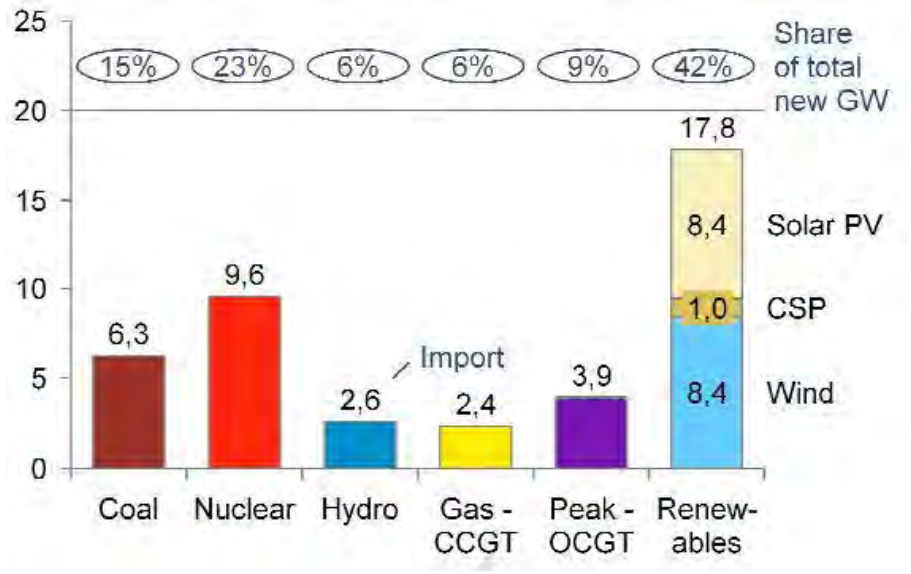


Figure 4: Total additional new capacity until 2030 (DoE, 2011a)

After the first phase of the REIPPP programme's first window in November 2011, 53 bids qualified representing about 2.1 GW of potential renewable energy capacity, and showing SA's readiness to enter the era of renewable energy power generation (Peo, 2012).

Following the final stage of the first window, the Department of Energy (DoE) under the REIPPP programme announced 28 renewable energy preferred bidders. The renewable energy mix for the first window is represented in Table 1 (Creamer, 2012a). Only 49% of the initial bids succeeded, due to stringent qualification and having a certain set out capacity of megawatt (MW) per technology. More information on the definition and concepts of window periods and bidding stages are available in the chapter 2.

Table 1: First window renewable energy capacity representation (Creamer, 2012a)

Technology	Project Quantity	Total Installed capacity
Wind Farms	8	633.99 MW
CSP	2	150 MW
Solar PV Farms	18	631.53 MW

Compliant bids of the first phase were evaluated based on price (70%) and economic development (30%), with the scorecard for economic development emphasising job creation (25%), local content (25%), ownership (15%), management control (5%), preferential procurement (10%), enterprise development (5%) and socioeconomic development (15%) (Esterhuizen, 2012). During the second

bid period a target of 60% local content would be expected from certain technologies. The bids were evaluated under six streams including environmental acceptability, land security, commercial robustness, economic development, financial viability and technical competence (Creamer, 2012b).

Set out and supported by the IRP 2010, the REIPPP programme was initiated by the Government to start renewable energy application on a large scale. The main goal was to increase generation capacity to provide for the current and future electricity needs. Fortunately this also served as a Governmental opportunity to address some of the country's key social and economic challenges. These challenges included job creation, addressing inequality issues with BBBEE application and promoting sustainable energy generation by using renewable energy technology. Indirect benefits of the last mentioned aspect are to increase energy security by energy diversification – to become less dependent of fossil fuels and decrease CO_2 and other GHG emissions.

Other expected benefits included providing electricity to remote areas which would not be financially feasible otherwise, and communities once deprived of electricity will be able to be entrepreneurial and create new jobs by harnessing the benefits of electricity access. According to Mr Bain Statham, chairperson of the South African National Energy Association (SANEA), it is apparent that generating jobs from the projects under the REIPPP programme is necessary and important, but the focus should also be on work opportunities generated due to energy made available to the people who did not have any significant energy access before (Statham, 2013).

Localisation for renewable energy projects remained a key thrust and Government intended raising the local content requirement in future bidding rounds. Editor of the newspaper Engineering News, Mr Martin Creamer stated that, according to Ms. Dipuo Peters, minister of DoE, the Government was especially keen to select projects with high levels of local content and they are committed to building local manufacturing capacity around the renewable roll-out (Creamer, 2012a). These projects should contribute directly and indirectly to the local community and to the whole nation by generating clean sustainable energy, creating job opportunities, developing skills and providing ownership to the previously disadvantaged (deVos, 2013).

From the above information it is apparent that there are, irrespective of the main goal, a multitude of potential benefits and spin-offs that could deal with some of South Africa's key challenges. To ensure that these objectives are achieved and benefits reached, it is necessary for the programme to be sustainable.

During the time when this study was conducted, it was not possible to determine if the REIPPP programme and the implementation thereof could and would be sustained over the mid- to long-term period. The programme was in its pioneering stage and most of the projects in construction phase, making it hard to accurately determine the sustainability of the programme and its projects. Even if there was an answer to the last mentioned question, another question would prevail: How

can the sustainability of the REIPPP programme be promoted so that all the above mentioned potential benefits become a reality?

1.2 Problem identification

For the programme to be sustainable it needs to make continuable positive progress by increasing investments, installed renewable energy capacity, as well as increasing support from Government and other key stakeholders. The development of the REIPPP programme can then continue to such a point where South Africa finds itself to be a leader in renewable energy technology; that the local content percentage of South Africa's future renewable energy projects not only exceed Governmental targets, but also help to place South Africa in a strategic position where these type of projects and relevant components can be undertaken and supplied internationally. As an example, Korea's nuclear programme was discussed to convey the potential that renewable energy can have if the REIPPP programme could be sustained in South Africa.

For the Republic of Korea it took 30 years to achieve maximum benefit from their nuclear programme. Korea's first nuclear projects were turnkey-based; similar to the first projects of the REIPPP programme. After 6 years of the first nuclear programme Korea participated in the nuclear projects on component level and after another 6 years Korea started to provide standardised nuclear human resources and supplies. It took 3 decades of investments, industry expansion, skill development and research to attain a point of becoming a leader in nuclear technology (IAEA, 2006). According to Mr Van Wyk, the International Atomic Energy Agency (IAEA) stated that Korea's nuclear industry made more than a 1.3% contribution of Korea's 2003's GDP, which is a competitive percentage if measured against the major Korean industries. The nuclear programme was sustained over a period of 30 years and ensured the position of the nuclear industry. Korea has become dependent on its nuclear power and commercial value, generating enough merits for the nuclear industry to obtain significant current and future support from their government (Van Wyk, 2012).

The sustainable implementation of the REIPPP programme is not a trivial or linear process. There are various sustainability aspects or drivers that can influence the sustainability of the programme. Identifying these vital drivers or aspects is necessary. Some of these drivers could include that renewable energy business is new to South Africa, policies and procedures are not clear and effectively implemented, bad decisions or unrealistic requirements were made by key stakeholders, and/or the electricity selling price for the consumer was badly accounted for; just like the South African e-toll dilemma (Dembovsky, 2013).

Other drivers like the reality of nuclear energy and fracking in the Karoo for shale gas could change the energy generation outlook in the mid- to long-term future. Labour protesting evident in the energy sector, cable and electricity theft, corruption and fraud are just some of the social drivers

that can prevent future investment or international involvement; inhibiting the sustainability of the REIPPP programme**.

***Statements made in this paragraph is discussed and referenced in chapter 2.*

The drivers mentioned above and the impact/influence these drivers have on the programme, are collectively unknown. There exist uncertainties regarding the overall sustainability of the programme and its projects resulting in potential lack of urgency to act proactively on drivers that could promote and support the sustainability of the programme.

There is also the possibility that the REIPPP programme is or will be unsustainable. The consequences of an unsustainable REIPPP programme is that many of the possible and documented benefits (already mentioned in section 1.1) would not materialise. If the programme was only sustainable to some degree, the optimised benefits would not be reached. When this study was conducted, according to various literature sources as seen in chapter 2, some of the above mentioned benefits and programme aims were met, but the uncertainty lay with the long-term result of the implemented REIPPP programme.

South Africa has the potential to gain a lot if the REIPPP programme was implemented sustainably, but there could be drivers that would support, inhibit or even prevent the sustainability of the REIPPP programme. The focus should not be placed on any sustainability aspect or drivers, but on drivers that could be managed, influenced and consequently controlled. That way the key stakeholders could put all their energy and time to address the key drivers and in that way control the future sustainability of the REIPPP programme.

1.3 Problem statement

A means to control the future sustainability of the REIPPP is not available. This research was embarked upon under the hypothesis that the future sustainability of the REIPPP was, as yet, unknown so that, should the controllable drivers be identified and prioritised successfully, a means to control future sustainability would become available.

1.4 Research aim and objectives

The main aim of this research was to identify and prioritise those drivers that could influence the long-term sustainability of the REIPPP programme in South Africa.

Secondary research objectives that were set to ensure a structured and logical approach to achieving the main aim were

1. to determine who the key stakeholders of the REIPPP programme were;

2. to identify those drivers, critical for the sustainability of the REIPPP Programme, relevant to the South African situation;

3. to prioritise the sustainability drivers according to their level of impact on the REIPPP programme; and

4. to provide recommendations on how sustainability of the REIPPP programme could be promoted or improved.

1.5 OVERVIEW OF DISSERTATION

The dissertation consists of the following chapters, structured in the following manner:

Chapter 1	The introduction provides background to the dissertation, the problem identification and main and secondary research objectives.
Chapter 2	To generate relevant sustainability drivers for the REIPPP programme a framework on sustainability was identified and used as baseline. Literature on the first 28 renewable energy projects and the implementation agents/stakeholders of the programme were investigated. The definition of sustainability and the concept of control drivers were defined.
Chapter 3	The planning and development of a survey as research technique and the questionnaire as research tool were discussed in this chapter. Statistical analysis was done followed by a follow-up interview design.
Chapter 4	In this chapter the results of the research were presented. Both qualitative and quantitative responses were obtained and analysed. The transcribed interviews were summarised and provided in the last section of chapter 4.
Chapter 5	This chapter highlighted the conclusions made from the investigation and analysis. The achievement of research objectives was confirmed and this chapter concluded with future research recommendations.

1.6 CONCLUSION

With the introduction given about energy in the South African context, the problem identified and problem statement made within the renewable energy sector, it was possible to set out a research aim with its appropriate objectives. The overview of the dissertation was given and literature regarding sustainability, the REIPPP programme, sustainability drivers and other relevant literature follow in chapter 2.

2 LITERATURE STUDY

"Renewable energy also creates more jobs than other sources of energy - most of these will be created in the struggling manufacturing sector, which will pioneer the new energy future by investment that allows manufacturers to retool and adopt new technologies and methods."
(Inslee, 2007)

2.1 INTRODUCTION

Chapter 2 discusses the literature review necessary to achieve the research objectives. Time was spent on the concept sustainability, its dimensions and its related aspects that can operate as *control drivers. The last mentioned was achieved by reviewing the international and South African perspective on sustainability, how to determine a country's sustainability profile, and the drivers to accomplishing sustainability. It is then supported by literature on how other countries pursue energy generation in a sustainable fashion; accomplished by implementing effective energy policies, utilising alternative energy and including renewable energy in their energy mix. The South African renewable energy potential, the REIPPP programme with its key stakeholders, was discussed and elaboration on inhibitors to sustainability was made. Finally the concept of control and drivers were investigated and the Global Reporting Guideline (GRG) for sustainability was presented as baseline for identifying the control drivers.

**Definition and concept of control drivers discussed in section 2.6*

2.2 SUSTAINABILITY AND WHAT IT MEANS

If one were to examine our everyday lives and the use of available energy resources, one will realise that, in many instances, people are living unsustainable lives – consumers are using or utilising resources at such a rate that the conservation of that resource cannot be assured. We live on a planet with finite resources and once these resources are scarce or even depleted, the user will be forced to adapt. Obviously this is something that won't necessarily happen in our lifetime, but over the long term, as long as our planet survives, this will most likely be the fate for finite resources, especially energy resources.

Dr Arnold agrees with the paragraph as stated above. We find ourselves in a situation where finite energy resources should be used more efficiently and energy dependence should be shifted to renewable energy resources like the sun, wind, geothermal and many others (Arnold, 2013). Another motivation for the use of renewable resources is to fight climate change. According to Dr Vent Cerf global climate change is a big problem and climate change is an issue that needs to be addressed (Cerf, 2013). Dr Donald Prothero also states that global warming is a reality and it has all to do with the way of life of people living on our planet (Prothero, 2012).

The ways and methods of man must be adapted so that life as we know it can be sustained: to achieve equilibrium between the use of available resources and the demand of the people. Achieving equilibrium is true for all parts of life and one of these parts is our everyday use of energy. The main objective of the REIPPP programme is to generate and provide energy in a sustainable way (Grimwood, 2012) (Anon, 2013). Even Ms. Dipuo Peters, Minister of DoE and REIPPP programme director, stated that diversifying and contributing to a sustainable energy mix by using renewable energy was a critical building block towards the ruling party's policy objectives (Peters, 2012).

2.2.1 Sustainability definitions

The following is a list of sustainability definitions obtained from various literature:

- Sustainability is the capacity to endure (Fogarty *et al*, 2013).
- Potential for long-term maintenance of well-being for humans (Godelink, 2012).
- Able to maintain the current way of life at a certain rate or level (Tverberg, 2012).
- Conserving an ecological balance by avoiding depletion of natural resources (Anon, 2012).
- To meet the needs of the present without compromising the ability of the future generation to meet their own needs (DESA, 2012).
- Sustainability is the careful and efficient stewardship of resources by businesses, communities and citizens (Anon, 2012).

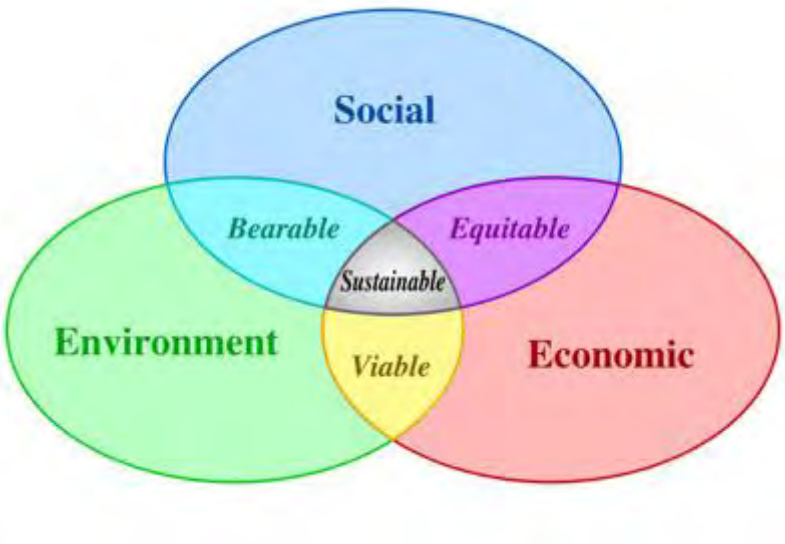


Figure 5: Sustainability diagram (UM, 2013)

From the list of definitions one can see that there are various ways of interpreting sustainability. To determine the South African interpretation of sustainability the list of definitions was used in the experiment part of the research, chapter 3.

The sustainability has three main dimensions, Economic, Environment and Social, as seen in Figure 5 (UM, 2013). The sustainability drivers was investigated and categorised according to these dimensions.

2.2.2 SUSTAINABLE ENERGY VS RENEWABLE ENERGY

It so happens that the concept of “Sustainable Energy” and “Renewable Energy” are interpreted as the same thing, but in theory sustainable energy has a much broader implication than renewable energy. Renewable sources, such as wind and solar, as well as non-renewable sources such as nuclear power, is a subset of sustainable energy as both energy sources could be used in a sustainable way. The only difference between the two is that renewable energy is generated from a source that is infinite – sun, wind, tidal wave and geo-thermal (ICL, 2013).

Sustainable energy is necessary to inhibit greenhouse gas emissions (GHGs) and carbon footprints. Sustainable energy can be achieved by using available renewable energy technologies, conducting relevant research, investing in new green technologies, improving energy efficiency of existing technologies, and reducing energy demand or waste of energy (ICL, 2013). To put sustainability into an international perspective a global view on energy sustainability is needed.

2.2.3 INTERNATIONAL STATUS ON SUSTAINABLE ENERGY

As the world population continues to grow, the criticality of achieving sustainable energy becomes much more intense. The debate on sustainable energy is necessary as it plays a vital role in the formulation of climate change policy and future urban development. To achieve these ideals, investment and research in sustainable energy is required for reductions in GHG emission through cost effective means, technology, education and appropriate policies.

According to the World Energy Council (WEC) report energy sustainability has three main dimensions i.e. energy security, social equity and environmental impact mitigation. The outlook on what sustainability is and how it can be quantified on an international level, is very well formulated by the WEC and was discussed accordingly. The dimensions of sustainable energy are:

- **Energy security:** For net energy importers and exporters this entails the effective management of primary energy supply from domestic and external sources. That is the reliability of energy infrastructure and the ability of working with energy companies to meet present and future energy demand. For sole exporters this also relates to the ability to maintain revenue from external sales. In 2012 South Africa imported and exported 1.7 billion kWh and 14 billion kWh respectively. South Africa is the 13th highest exporter of electricity in the world (IndexMundi, 2012).

- **Social Equity:** The main focus is the accessibility and affordability of energy supply for the whole population.

- **Environmental Impact mitigation:** The attainment of supply- and demand side to energy efficiencies and an increase of energy supply from renewable and other low carbon sources. Climate change, for one, is a global concern, calling for a change in consumer behaviour to protect and preserve the environment. According to Schaeffer global climate change is expected to have considerable impact on natural and human systems; hence environmental impact needs to be mitigated as far as possible (Schaeffer *et al.*, 2012).

Sustainability profile of a country

The sustainability profile of a nation's energy system is a function of three variables:

1. The country's energy resource endowment;
2. Its economic development stage; and
3. Policy decisions.

According to the WEC's report the higher economic countries with leading sustainability profiles have a low energy demand growth and robust policy environments. Most of these countries show a high level of energy autonomy with a strong emphasis on alternative energy or diversity in their primary energy mix. These countries also tend to have well-established energy efficiency programmes and strike a good balance between affordable energy and pricing that enables investment. Lower economic countries are leading in energy sustainability based on their effective use of their resource endowment and the impact of long-term inputs towards attaining full access to electricity for their inhabitants (Oliver, 2010:5,6).

Striking a balance between decarbonisation and energy price

According to the WEC report it is enlightening to note that there is no country that ranks high across all three energy sustainability dimensions. The scores of most states recognise that the decarbonisation of the economy comes at a large cost to energy affordability objectives. The decarbonisation is either acceptable or not based on the nation's stage of economic development. Brazil is a good example of reaching different objectives like hydroelectric power infrastructure, energy efficiency programmes and pricing governance at the same time (Oliver, 2010:6).

How countries pursue energy sustainability

Policies: The role players at the Summit of Sustainable Development 2002 recognised that sustainable development required a long-term perspective and broad-based participation in policy formulation, decision making and implementation at all levels (UN, 2002). These policies should also address climate change by increasing transfer of efficient technologies from industrialised to developing countries and provide incentives for investment through emerging voluntary and regulated emissions trading (Schaeffer *et al.*, 2012).

According to the *Pursuing sustainability* report there is a wide range of successful approaches. China, Japan and Russia have different effective approaches to developing resource-orientated partnerships with other nations, all based on strategic alliances, technological expertise and financial power. This is also true for South Africa being part of the Brazil, Russia, India, China and South Africa (BRICS) group. According to the *Sustainable Governance in BRICS Conclusion Report* coordinating policymaking between these nations is essential to guide the BRICS countries down the sustainability path. The BRICS group also provide a setting where South Africa can be benchmarked in terms of sustainability, hence providing insight and guidance of how to become more sustainable (Stiftung, 2011).

The technology investment made by the US have led to speedy advances in opening up new domestic natural gas resources by means of hydraulic fracturing of deep shale and to take advantage of their expertise overseas. Mr David Fig, a researcher on environmental policies, states that, even though the policy process, the IRP2010, does not mention fracking, it does allow for CCGT being part of the energy mix by 2030, hence creating an opportunity for fracking to play a role (Fig, 2012). Currently environmental policies, litigation processes and public protesting is preventing fracking from becoming a reality (Deal, 2013).

Germany and the Republic of Korea have mitigated security of supply risks by respectively increasing levels of import diversity and storage capacity (Oliver, 2010:6).

Alternative Energy: Germany and Texas made strong advances in deployment of renewable energy in their transmission infrastructure (Groebel, 2013) (Energy, 2013).

Brazil and Ghana are the leaders in using off-grid renewable energy to increase access to electricity to rural populations (IOREC, 2012).

The World Nuclear Industry (WNI) status report says that France and the UAE focused on carefully planning, renewing and improving their nuclear capacity, placing them in a situation where they can take advantage of their expertise (WNI, 2012) (McDonald, 2008). The contribution to energy independence is proving a key driver to both nuclear energy and the increasing obligation to renewable energy.

Energy efficiency: The WEC claims that, when it comes to energy efficiency, Japan reached considerable reduction in consumption by having programmes directed largely at industry.

Brazil promoted local manufacturers to develop appliances which are low on energy use.

Denmark is well endowed with benchmarking when it comes to building design standards and France progressed to reduce energy consumption in its building stock.

California is a leader in the development of smart grids and the Republic of Korea plans to overtake them through high levels of R&D investments. (Oliver, 2010:6)

Size and complexity of energy sustainability

The definition of energy sustainability has become broader and the trade-offs between policy priorities sharper. Energy demand is increasing in non-organisation for economic co-operation and development (non-OECD) countries, including South Africa, as they are undergoing rapid population increase and economic development (OECD, 2009). Non-OECD local fossil fuel reserves are decreasing and remaining large scale oil reserves are not easy to access. For Southern Africa a peak in coal production rate at approximately 284 Mt/year in 2020 was forecasted. At that stage almost 50% of the economical recoverable resources (which is about 23 Gt) will be exhausted; thereafter the annual coal production rate will decline (Hartnandy & Chris, 2010). The last mentioned forecast supports the claims made by Dr Arnold's in the introduction.

Most of the current energy infrastructure of OECD countries must be replaced, while non-OECD countries focused on expanding energy access to all people. South Africa finds its feet on both sides – that is to replace already existing energy infrastructure and expanding energy access to all communities. According to Eskom almost 30 GW of new power between now and 2030 are needed and about 10 GW of old power capacity will be retired over this time (Lund, 2012).

The past global financial crises not only induced a decrease in global energy use and a temporary stabilisation of emissions, but it also decreased the availability of investment capital and increased uncertainty about future infrastructure projects (Oliver, 2010:7).

Some drivers for energy sustainability

Transmission grid: Some nations that have achieved the greatest advances in generation capacity have paid insufficient attention to transmission grid enhancements (Oliver, 2010). In the past this seems to be the case for South Africa when reviewing the *Transmission Ten-Year Development Plan (TDP) 2011-2020,* which only took the allocated 500 MW wind generation into consideration and no other renewable energy generation (DoE, 2010b).

Fortunately the DoE changed their implementation of transmission infrastructure pace in their updated TDP. The changes of the 2012-2021 TDP were the addition of new substation projects, including wind and solar integration with a value of approximately R8 billion (DoE, 2011b). The 2013-2022 TDP mentioned the progress to date was that all renewable energy generation for the renewable energy bid (REBID) or otherwise will be connected at distribution level, which is at 132 kV or lower as seen in Figure 6. Projects for the REIPPP programme that are in budget quote phase have been added to the latest TDP plan (DoE, 2012a).

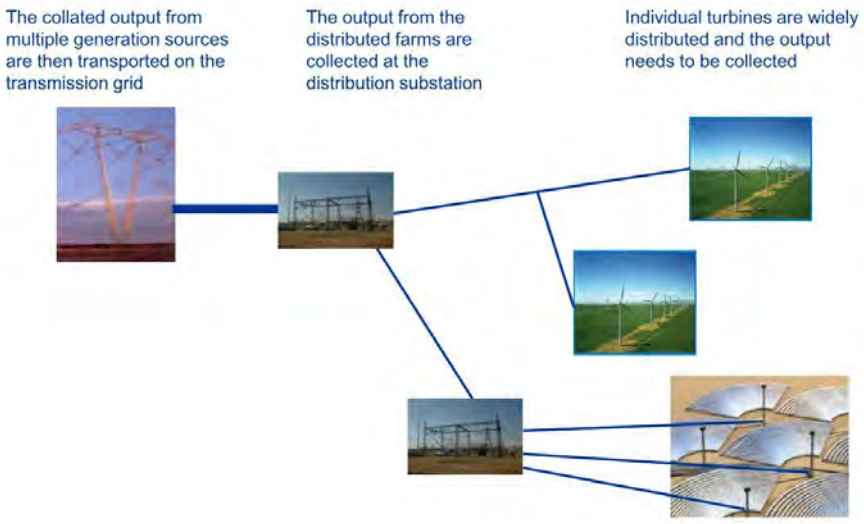


Figure 6: Renewable generation integrated at distribution voltage levels (DoE, 2012a)

Environmental agenda: The acceptance of the environmental agenda in OECD countries is inconsistent, while non-OECD countries remain stagnant (Oliver, 2010:7). Fortunately, as a non-OECD country, the South African environmental agenda is past the pioneering stage. According to South Africa's Department of Environmental Affairs, South Africa was a signatory in multilateral environmental agreements; *inter alia* the Ramsar convention on wetlands, the Bonn Convention on Migratory Species, the Convention on International Trade in Endangered Species and the Antarctic treaty. In South Africa's past, nature conservation was considered the most critical environmental issue, while aspects like hazardous waste management, ozone layer protection and climate change received little to no consideration. The present, however, presents a different picture in terms of South Africa's outlook on environmental ignorance. After 1994 South Africa became a full and active member of the global community and also a member of the Group of 77 (G77). It has become a nation committed to promote environmental protection and sustainable development. South Africa created, accepted and approved multiple additional conventions and protocols that promote the global sustainable development agenda, especially on issues related to trade, climate change, chemicals or waste management, biodiversity and activities that affect the ocean or marine environment (DEA, 2008:24).

Industry dislocation: In other countries programmes have proved to be expensive when incentives have failed to respond to alternating market forces. Moreover, schemes that have achieved large capacity of generation are beginning to result in industry dislocation as new energy investments are shifted away from traditional producers. South Africa should be aware of market dislocation when it comes to the country's energy future. The REIPPP programme should be an opportunity to obtain new investments, not to shift already made investments from coal, gas and/or nuclear to another (Oliver, 2010:7).

Policies: When it comes to energy efficiency programmes through the world significant and positive results were achieved; however, low regulatory standards, cumbersome administration, weak enforcement and inadequate report requirements need to be attended to if the country wishes to move forward (Oliver, 2010:8). Crucial obstacles to much-needed infrastructure investments are omissions in regulatory frameworks and existing market frameworks such as supplier diversity and long standing price misrepresentations. Other obstacles are the absence of strong and consistent global carbon price and this negatively impacts on the development of immature technologies and investment in projects like smart grids (Oliver, 2010:8).

The policy weakness that surfaces most is the absence of a consistent short term view, poor policy formulation and the unskilled or inexperienced nature of committees that support the policy implementation. This is especially true for renewable energy generation. Once again, conducting a questionnaire with the relevant key role players will shed some light on this driver for energy sustainability.

Major barriers facing renewable energy: When it comes to renewable energy there is a list of barriers provided by Painuly. The list of barriers are summarised and integrated with the South African barriers when it comes to renewable energy application. Some of these barriers could potentially serve as sustainability drivers and will be used when compiling the final list of drivers. A list of barriers can be seen in appendix A.

With a better understanding of sustainability on an international level, and how it correlates to South Africa, it would now be valuable to know and understand what energy sustainability means for South Africa.

2.2.4 Sustainable energy in the South African context

Globally generating energy in a sustainable way is relevant and important; thus also in the South African context. Heavy emphasis has been placed on sustainability through various South African policies, Governmental reports and articles. It is imperative to remember that sustainability has a broad meaning, making it challenging to be clear on what sustainability entails in South Africa's context. Understanding how sustainability is defined, and in what frameworks it is used will help determine the setting in how sustainability in South Africa could be achieved. The following literature focuses on the South African law and the definition of sustainable development according to policies like the IRP2010, National Development Plan (NDP), New Growth Path (NGP) and White Paper on Renewable Energy.

Governmental law

A multitude of South African laws and regulations are in place to provide legitimate grounds for the creation and support of relevant policies, hence giving leverage and authority to programmes like the REIPPP. In terms of energy the Constitution (1996) requires that Government establish a

national energy policy that ensures energy resources are generated and delivered according to the needs of the nation. Further the production and distribution of energy should be sustainable and lead to improvement in the standard of living (RSA, 2003). It is clear that the groundwork for generating sustainable energy in South Africa is in place and it is made possible by relevant laws elaborated by the Energy Regulation Act (RSA, 2006).

The National Environmental Management Act of 1998 (NEM) states that sustainable development is defined as "the integration of social, economic and environmental factors into planning, implementation and decision-making, so as to ensure that development serves present and future generations" (RSA, 1998). The provision of reliable and affordable energy for business and the domestic market underpins everyone's quality of life. The challenge of climate change is recognised in the Act as one of the major environmental threats facing the world today. Implementation of renewable energy would reduce the use of fossil fuels, which would decrease the greenhouse gas emissions and consequently lowers South Africa's impact on climate change (RSA, 1998).

When Governmental policies and reports such as the IRP 2010, NDP, NGP and White Paper was written, it was all created with the nation's law as baseline. South African law for energy was compiled in the Electricity Regulations Act (4 of 2006). Some of the objectives of the Act immediately placed emphasis on the sustainability of energy. These main objectives of the Act included

> "...to achieve the efficient, effective, sustainable and orderly development and operation of electricity supply infrastructure in South Africa; and
> to ensure that the interests and needs of present and future electricity customers and end-users are safeguarded and met, having regard to the governance efficiency, effectiveness and long-term sustainability of the electricity supply" (RSA, 2006:9).

Other objectives in the Act that also contribute to sustainable energy objectives are aspects such as to facilitate investment in electricity supply infrastructure, universal access to electricity, promoting diverse energy sources, and to also promote energy efficiency. It is clear that the South African Government's laws support energy sustainability and serve as basis for future sustainability development such as the implementation of renewable energy schemes.

Governmental sustainable development policies and plans

IRP 2010: According to the IRP 2010 sustainability is linked to achieve a balance between different Governmental objectives which include economic growth, job creation, security of power supply and the sustainable development thereof. These objectives are then strengthened by promoting local industry development during the early stages of new energy generation technologies (DoE, 2011a).

A study commissioned by the National Planning Commission (NPC) and compiled by UCT's Energy Research Centre, claims the energy blueprint for South Africa was outdated and that

energy forecasts were not accurate. Minister Dipuo reacted to these claims, stating that the rationale for the IRP 2010 coming into being before the IEP (Integrated Energy Plan) was a result of the 2008 energy shortages, which had caused a lack of long-term planning. The 20-year plan has been created deliberately so that it has loops for review. Dipuo also said that the IRP 2010 was not outdated, but would be reviewed in line with the IEP. The IRP 2010 places specific emphasis on broadening electricity supply technologies, such as renewable (wind, solar and hydro), in response to both the country's future electricity needs, as well as to reduce its CO_2 emissions (SAnews, 2013a).

From this information some elements of sustainability were covered – the broadening of energy generation technologies and to reduce CO_2 emissions by becoming less fossil fuel dependent. Unfortunately the long-term planning for energy sustainability in the IRP 2010 was based on estimates and proposals, making the policy open for drastic amendments and improvements.

New Growth Path (NGP): The Government has set out a vision for the country and the National Development Plan was the latest in this aspiration. The NGP is one of Government's strategies to pursue this vision. It deals with various aspects relevant to the REIPPP programme and the sustainability thereof (Ebandla, 2010). The main focus of the NGP is the identification and creation of sustainable jobs by developing policy packages covering various sectors and including the renewable energy sector. The NGP's main indicators of success were the number of quality jobs created, the growth of labour intensity, improved equity, achieving environmental outcomes and economy growth. These are some implementation plans that directly or indirectly have an impact on the future implementation of the REIPPP programme (RSA, 2010).

In terms of increasing employment, the Government aimed to allocate their limited capital capacity to activities that maximise the creation of decent jobs. The NGP mentioned that one way of generating new jobs was to take advantage of the potential in green economies. Renewable energy can provide major new opportunities for investment and employment in manufacturing as well as construction. The strategy to achieve these targets entails comprehensive support for energy efficiency and renewable energy as required by the second Integrated Resource Plan (IRP2). This includes appropriate pricing policies combined with programmes to encourage local production (RSA, 2010).

The NGP holds a strong view on sustainability, because it acknowledges that, to achieve the targets set out for infrastructure like new energy generation, a large amount of public investment will be needed. According to the NGP, the IRP2 foresees a near doubling of electricity capacity by 2030 with a 33% new generation cut allocated to renewable energy generation. It is also a key part of the plan to improve economic efficiency and to reduce GHGs. As a carbon intensive country efforts made to control emissions will result in heavy costs, but it could also lay the foundation for major new industries (RSA, 2010).

Local procurement will be strengthened by the founding of new industries to act as providers for renewable energy undertakings. In this procurement of labour-based production, methods will be used and infrastructure will be provided to support the broad-based growth and rising competitiveness linked to a coherent and sustainable strategy development. The NGP's strategic objectives are forged in such a way to achieve socially desirable and sustainable outcomes. This is done by accelerating economic development and ensuring effective regulation of markets (RSA, 2010).

In the NGP critical markers are set out to generate a more inclusive greener economy over the medium to long term. The NGP admits that, on the medium term, the facilitating of growth in sectors that are able to create jobs on a large scale is important, but it should not neglect more advanced industries that are crucial for sustained long-term growth.

The last mentioned ties up with literature regarding market dislocation already provided and elaborated by the WEC; a balance is necessary between creating new jobs and sustaining already created jobs. The Government must then also encourage bigger investment by the private and public sectors to increase employment creating activities like support of the green economy while improving South Africa's core strengths.

Furthermore South African businesses need to do more to find opportunities in the fast growing economies of China, India and Brazil, which was recently promoted by the collaboration of the BRICS countries. For African development it is important to strengthen regional integration on energy. This is linked to improvement of electricity interconnectors and exploring other opportunities for enhancing clean energy across central and southern Africa (RSA, 2010).

In the past the South African Government made management mistakes and the NGP tends to address these issues. In the 2000s bottlenecks and backlogs in logistics, energy infrastructure and lack of skills raised costs across the economy. A particular concern arose from the energy shortages that resulted in weak investment in new generation capacity. This must be addressed to prevent these unnecessary costs and to ensure investment for new generation capacity. The South African Government needs to minimise unnecessary economic sector costs such as unnecessary regulatory requirements and delays, inadequate infrastructure and weak skill development (RSA, 2010).

The Government states that engagement with stakeholder representatives on policy, planning and implementation at national, sector and local levels, is vital to attain coherent and effective strategies. Government must both strengthen its own capacity for leadership engagement and re-design delivery systems to include stakeholder efficiency. According to the NGP the issues experienced by key stakeholders are the developmental state, market, market players and social mobilisation, and dialogue (RSA, 2010).

The developmental state is to minimise cost for business as required to support transformation toward more equitable generation of decent jobs and a green economy. Some of the key economic challenges are to improve the state's efficiency, effectiveness and responsiveness in the face of new opportunities and risks. The state must direct the integration of national, provincial and local policies and collaborate around implementation of development policies and programmes. Key role players for policy formulation include

- The Development Finance Institution (DFI);
- State-Owned Enterprises (SOEs);
- The Government Employees Pension Fund (GEPF) and the Public Investment Corporation (PIC) as crucial investors of savings;
- The South African Reserve Bank ;
- The International Trade Administration Commission (ITAC) and Customs and Excise;
- The competition authorities;
- Regulatory, standard-setting and accreditation bodies including Companies and Intellectual Property Office (CIPRO), National Energy Regulator of South Africa (NERSA) and the Independent Communications Authority of South Africa (ICASA); and
- Science councils, universities and Mintek (RSA, 2010).

According to the NGP successful countries do not resolve the issues on every possible concern but rather learn by creating a continuous feedback loop that enables rapid responses to emerging problems. For the development in China the NGP quotes Deng Xiaoping:

> "... just like crossing a river by groping for the stones beneath the surface. We need to start implementation of key initiatives now, with strong monitoring and evaluation systems that can identify concerns and speedily remedy them as they arise".

The implementation process must ensure the rigorous prioritisation of programmes and policies needed for inclusive, green growth (RSA, 2010).

National Development Plan (NDP): The National Development Plan is a broad strategic framework for South Africa elaborating on the country's vision for 2030. The main aim of the NDP concept was to eliminate poverty and reduce inequality by 2030 (NPC, 2012).

The National Planning Commission (NPC), who compiled the NDP, used the diagnostic report created in June 2011 as input. One of the nine primary challenges was that the South African economy was highly resource intensive (as seen in Figure 7) and that resources were used inefficiently, resulting in critical resource constraints. The NPC stated that South Africa needed to become less resource intensive, but also needed to balance this against job creation, economic growth and energy security. It is clear that the NPC realised that, having a development path that is resource intensive, was unsustainable and South Africa's society and economy needed to create

and choose a more sustainable growth path. The NDP discusses more than just energy sustainability as its objectives stretch over more sectors, like sustainable job creation (NPC, 2011).

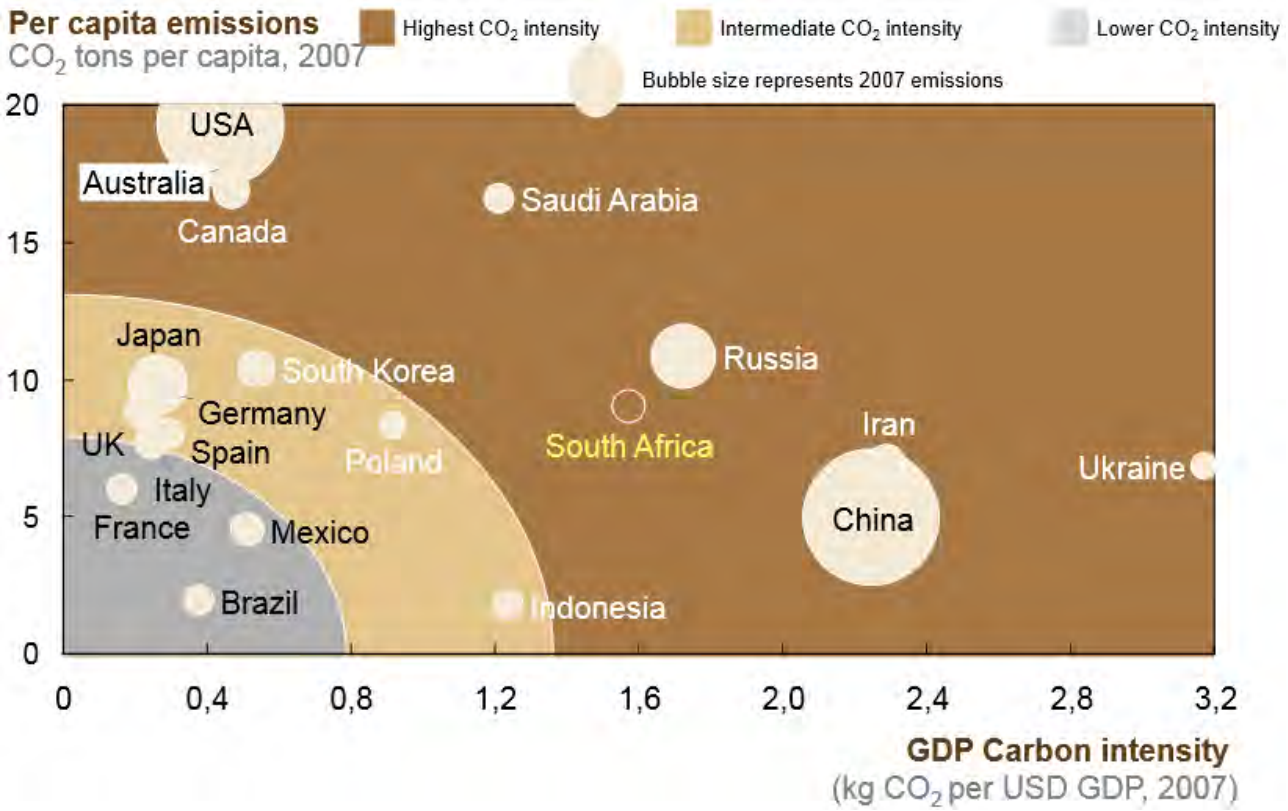


Figure 7: GDP carbon intensity; South Africa 2007 (NPC, 2011)

Increasing exports, reducing the cost of living for low income households, reducing costs of regulatory compliance, making a commitment to public and private procurement, ensuring a higher rate of investments and promoting more efficient and competitive infrastructure are proposals made by the NPC to obtain a sustainable job creation growth environment. These objectives complement the goals set out in the NGP and the drivers that are critical for the sustainability of the REIPPP (NPC, 2012).

To promote sustainable livelihoods, according to the NDP, it is important that individuals or families, irrespective of income, can access services such as quality education, electricity, healthcare and public transport. An approach will be developed to strengthen key services such as commercial transport, energy, telecommunications and water, while ensuring their long-term affordability and sustainability. Improving infrastructure is not only essential for faster economic growth and higher employment, but also to promote inclusive growth, providing citizens with the means to improve their own lives and boost their incomes. The country needs a higher level of capital spending to realise a sustained impact on growth and household services (NPC, 2012).

The NDP proposes critical actions to implement this vision, including creating interventions to ensure environmental sustainability and resilience against future shocks. In the past South Africa

exploited its mineral wealth irrespective of the environmental impact. This must change to protect the natural environment, while allowing the country to benefit from its mineral endowment. The country needs to protect the natural environment in all respects, leaving enough for future generations by extracting mineral wealth in a sustainable manner, reducing GHG emissions and improving energy efficiency. The NDP proposes three measures to protect the country's natural resources, i.e. to develop an environmental management framework, place targeted sections of land and ocean under protection, and create a set of indicators for natural resources, accompanied by publication of annual reports on the identified resources (NPC, 2012).

According to the NDP, laws that govern regulations are often confusing, conflating policy with regulation. Over the short term policies need to protect the natural environment and mitigate the effects of climate change by being applied rapidly and effectively. Over the long-term South Africa can manage the transition to a low carbon economy at a pace consistent with Government's public pledges without harming jobs or competiveness. This can be done by creating realistic, bold strategies and global partnerships (NPC, 2012).

Regarding the provision of electricity the NDP exposed weaknesses related to state-owned companies responsible for power network infrastructure. Correcting such problems require clear institutional arrangements, transparent shareholder compacts, clean lines of accountability and sound financial models to ensure sustainability. The NDP supports the IRP2010 targets by procuring at least 17.8 GW of renewable energy by 2030. This will reduce electricity industry carbon emission from 0.9 kg per kWh to 0.6 kg per kWh. Improving the energy efficiency of mining and mineral processing by 15% by 2030 is also supported, and this might include closing down the most energy-inefficient plants. Objectives set out by the NDP include ensuring that at least 90% of the population should have access to the energy grid with non-grid options available to the rest by 2030 (NPC, 2012).

Actions set out by the NDP are to move Eskom's system operator, planning, power procurement, power purchases and power contracting functions to the independent system and market operator (ISMO). This will be supported by accelerated procurement of independent power producers (IPPs). Carbon price, building standards, vehicle emission standards and municipal regulations must be in place to achieve scale in stimulating renewable energy. Other actions include ensuring that all buildings meet the energy efficiency criteria set out in the South African National Standard 204 (NPC, 2012).

The NDP has been approved and adopted by Government and has elicited strong support from the broader society (SAnews, 2013b). This document aims to achieve a number of goals and reaching these goals in a sustainable manner is just as important. Based on the NDP's content it is important that in the coercion to achieve sustainability, affordability and economic benefits should not be jeopardised. This makes it challenging when energy sustainability needs to be achieved, as there is a cost added to decarbonising of the energy sector. Unfortunately this cost will be passing

on to the consumer. Simultaneously reducing cost of living and decreasing carbon emissions won't be simple and a balanced trade-off needs to be implemented.

The White Paper on renewable energy (WPRE): The White Paper on Renewable Energy is another South African Governmental document that discusses and elaborates on objectives to achieve sustainable energy. The WPRE is based on outcomes of the World Summit on Sustainable Development (WSSD).

> "*Diversify energy supply by developing advanced, cleaner, more efficient, affordable and cost-effective energy technologies, including fossil fuel technologies and renewable energy technologies. With a sense of urgency, substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply, recognising the role of national and voluntary regional targets.*" (RSA, 2003)

From this literature one can see that the view on sustainability dimensions according to the WPRE is different from that of the international version. For South Africa, economy is seen as one of the three main dimensions, instead of energy security.

Further findings expressed in the WPRE will be discussed according to the sustainability profile of a country; that is in terms of energy resource endowment, its economic development stage and policy decisions (Oliver, 2010).

1. Energy resource endowment

The African continent is endowed with large amounts of renewable energy sources and the white paper tends to promote the optimal use of these resources. The White Paper acknowledges that, even though South Africa is richly endowed with renewable energy resources, it has remained largely untapped to date. Renewable energy produced from sustainable natural sources will contribute to sustainable development and sustainable energy. As most of the sources are local and naturally available, security of energy supply is improved and not disrupted by short-term international crises (RSA, 2003).

Wind: Wind energy is utilised when the energy of the wind is harnessed, e.g. to turn a windmill that pumps water or a wind-driven generator to charge batteries on farms without electricity. On a bigger scale large modern wind turbines operate together on "wind farms" to produce electricity for utilities, feeding it into the national grid (RSA, 2003).

Reviewing the history of the South African wind resource studies, one will realise that some estimates made in the past are now outdated. The capacity factor started off with 4% based on Roseanne Diab's early research (Diab, 1995) and increased to a 35% potential according to Mesoscale Wind Atlas (Hagemann, 2008). The first Wind Atlas of South Africa (WASA) entails ongoing research since 2012 and findings of even higher resource measurements are expected (Hagemann, 2013).

Hagemann of G7 renewable energy states that South Africa's wind resources can compete with the top wind markets in the world. China is number one in the wind market with an installed wind capacity target of 75.5 GW and, taking a qualitative comparative look at these two nations' wind maps as seen in Figure 8, it shows that South Africa does have very good wind potential (Hagemann, 2013).

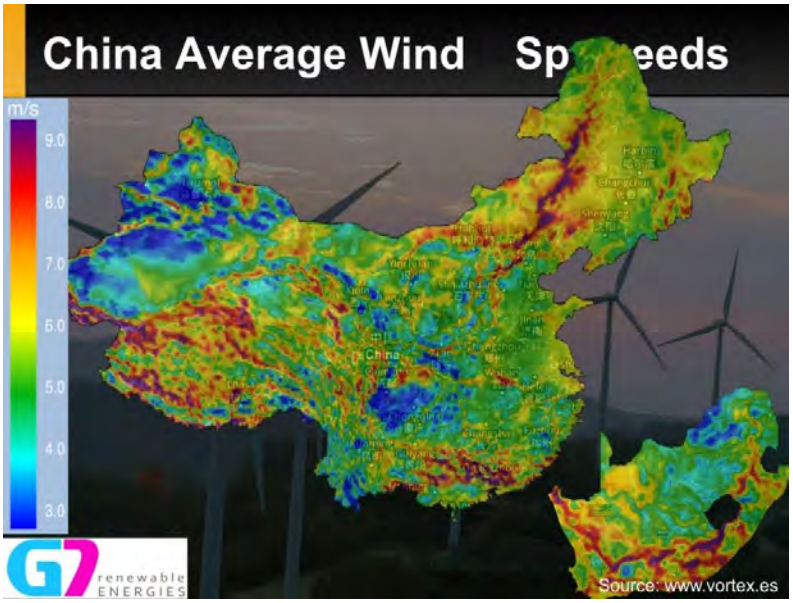


Figure 8: China vs. South Africa: Average wind speeds (Hagemann, 2013)

Wind power potential is generally good along the entire SA coast with some specific coastal areas reaching annual speeds 6 m/s and above, based on estimations made by Rosanne Diab and quoted by the white paper on renewable energy. Moderate wind power potential resides in areas like the Eastern Highveld Plateau, Bushmanland, the Drankensberg foothills in the Eastern Cape and KwaZulu-Natal. Other areas in South Africa have low power potential. As mentioned by the WPRE, based on Diab's calculations, more that 1% of the South African energy supply can come from wind energy. Take note that offshore wind energy was excluded (RSA, 2003).

Looking into the wind capacity factor; the US leads with a 27.6% rate, followed by Canada with 27.5% and Spain with 24.4%. South Africa's average capacity factor for Round 1 of the REIPPP programme projects are 35%, proving once again South Africa's high wind energy potential (Hagemann, 2013). Dr Hagemann calculated South Africa's potential wind energy as seen in Table 2 and his calculations are based on previous research and the following parameters:

- Proximity of roads (minimum secondary);
- Proximity to transmission lines (>=66kV);
- Minimum capacity factor (2 MW Vestas V80);
- Given hub height (60m,80m or 100m); and

- Density of 1 turbine per km^2 (Accounts for siting issues).

Table 2: Potential wind energy based on three scenarios (Hagemann, 2013)

Scenario	Annual Electricity Generation		Capacity
Pessimistic	20.0 TWh	8.7%	6 GW
Realistic	80.5 TWh	35.1%	26 GW
Optimistic	157.2 TWh	68.5%	56 GW

To be able to assign a large section of the South African energy mix to wind, much needed infrastructure is required and the capacity factor needs to be maximised. An annual electricity generation of 35.1% can be achieved provided that the mentioned infrastructure is in place and the REIPPP programme continues its roll-out.

Hagemann compared the total estimated resources with the IRP2010 and realised that the IRP2010 foresees 9.1GW of wind power by 2030; a 3 GW growth since 2008. Furthermore, as long as the competitive framework remains, only sites with capacity factors of 35% and above will realise as this is the most economic and supported options (Hagemann, 2013).

Hagemann's overview on the REIPPP programme is as follows: Round 1 provided 634 MW of wind and construction has already started; Round 2 awarded 563 MW and reached financial closure in 2013; Round 3's deadline was on 19 August 2013, and 653 MW is left to be built by 2016. Most of this capacity is in line with the IRP2010. Bidding prices for Round 1 and 2 were on average R1.15/kWh and R0.89/kWh respectively. This shows the growing competition for wind technology and price competition for further rounds is expected to be intense with even lower tariffs and capacity factors of about 40-45% (Hagemann, 2013).

South Africa has excellent wind resources dispersed geographically over diverse localities. There is enough wind energy to provide for a large section of South Africa's electricity needs. The REIPPP programme provides a solid basis for wind power in SA by keeping costs down and capacity factors high. The cost of wind power is already competitive with new coal and it will reach grid parity by 2016/2017 (Hagemann, 2013).

Solar energy: Solar energy can be used to generate electricity and heat water, which in turn can be used for other purposes. Photovoltaic systems capture the energy in the form of sunlight and convert it directly into electricity. The alternative method of generating electricity is achieved by using the Concentrated Solar Power (CSP) technology. CSP is a method of generating and storing energy by collecting and focusing sunlight with mirrors on a tower, or using parabolic mirror troughs. The intensified heat source can then be used to generate electricity by means of a steam turbine or heat engine (RSA, 2003).

The energy is obtained in the form of solar radiation, usually measured in terms of direct normal irradiance (DNI). This measure of the amount of fuel available to power a CSP is vital and, according to Suri it makes a big difference if a plant has 30% more fuel (Deign, 2012).

The minimum threshold DNI for solar thermal development is generally taken to by 1800 kWh/m^2/year. The father nation of CSP, Spain, has DNI levels ranging from about 2000 to 2100 kWh/m^2/year, while South Africa's Northern Cape Province's DNI rating easily tops 2900 kWh/m^2/year, a 40% increase. Suri stated: "This is very important considering when you are talking about economics" (Deign, 2012).

Jaime Galobart, CEO of Renovalia (a CSP business focusing on Stirling dish technologies) believes that renewable energy technology have to compete with traditional energy plants by selling electricity at the same price, but with better fuel independency and more care for the environment. Renovalia is utilising industrial scale manufacturing plants and increasing the efficiency of their hardware to help decrease the price on their systems. Their current Stirling technology increases cost effectiveness and thus increases returns on the solar assets. It is competing with very low PV prices; hence improving the levelised cost of energy (LCOE) of polycrystalline panels. Once Renovalia's projects in Spain are completed they will expand aggressively into foreign markets, including South Africa (Stancich, 2011).

Hydro Energy: South Africa has a combination of hydro power options including waves, tides, waterfalls and rivers. Karanitsch states that, according to a study made by the DME, South Africa had an installed capacity of 33.92 MW and 69 MW of firmly established small to mini hydro power stations in 2002. A further 94 MW potential exists and should be harnessed under the REIPPP programme (Karanitsch & Hydro, 2011). The Eastern Cape and KwaZulu-Natal are well endowed with all categories of small, i.e. less than 10 MW, hydropower plant options. Currently hydro-electricity is generated by small hydro stations and pumped water storage schemes. A pumped scheme "stores" energy during off peak periods by pumping water, using the available off-peak electricity, up to and storing it in a higher dam, then releasing it back through a turbine that drives an electric generator during peak periods (DoE, 2013b) releasing electricity to the national grid.

Southern Africa is hydro energy rich. South Africa used to import electricity from the Cahora Bassa hydropower station in Mozambique when the energy demand was high. Other countries, such as Zambia, Zimbabwe and Zaire, can also provide hydroelectricity based on their installed hydro power generation capacity. "The Southern African Power Pool (SAPP) allows the free trading of electricity between Southern African Development Community (SADC) member countries". This gives South Africa access to the vast hydropower potential in the countries to the north (DoE, 2013b).

2. Economic development stage

An economy in which modern renewable energy increases its share of power generation, and is able to provide affordable access to energy throughout South Africa, is the overall vision of the Government when it comes to renewable energy. This will help to contribute to sustainable development and ensure environmental conservation (RSA, 2003).

The commitment to energy security through diversification of supply in South Africa has remained one of the White Paper's key goals. This is important since a major portion of the nation's energy expenditure is attained by buying imported fuels (Chakauya *et al.*, 2009). The South African economy, which is highly dependent on income generated from the production, processing, export and consumption of coal, can be paying the price when charged with heavy fines for contributing to climate change (DME, 1998).

One key element of the REIPPP programme is the entrepreneurship and innovativeness of South Africa's industrial and financial sectors. This was done by introducing the Independent Power Producer (IPP) (Eskom, 2013b). Another element of this programme will be the development of appropriate policies and frameworks that would encourage and guide the private sector. However, the white paper admits that having these elements in place will not be enough. Renewable energy development in South Africa is in its pioneering stage, while competing with fossil fuels that are well established and have relatively low costs (RSA, 2003).

According to the White Paper it is clear that renewable energy development will require financial incentives. Unfortunately South Africa's fiscal resources are limited as there are competing high priorities like social and economic programmes, particularly in providing services to historically disadvantaged communities. The financial support cannot come from the Government alone, but from a combination of internal and external funding. For external funding South Africa has already ratified the United Nations Framework Convention on Climate Change (1997) and the Kyoto Protocol (2002), which creates the framework for tapping international funds via the Global Environment Facility (RSA, 2003).

3. Policy decisions

The WPRE substitutes the White Paper on Energy Policy, which highlights the medium to long term potential of renewable energy. The White Paper sets out Government's vision, policy, principles, strategic goals and objectives for enhancing and rolling out renewable energy. The policy recognises that South Africa is mainly dependent on coal-generated electricity, resulting in large quantities of GHG emissions which have a negative impact on the increasing worldwide concern about global climate change (RSA, 2003).

Implementing the White Paper entails changing the basic framework of how energy is produced, sold, traded, transferred and bought. The renewable energy feed-in tariffs (REFIT) announced by

NERSA was the first attempt to address this challenge, but it did not cover much ground as there was little to no interest in the original REFIT rates. The renewable energy bids (REBID) is South Africa's latest initiative and is being hailed as a successful replacement for REFIT. REBID auctions already awarded Power Producer Agreements (PPA's) for 1415 MW of renewable energy capacity (Kernan, 2013). The long-term goal is the establishment of a sustainable renewable energy industry with an equitable BEE share and job market that will be fully sustainable, non-subsidised and an alternative to fossil fuel consumption (RSA, 2003).

It is also the intention of the Government to make South Africa's contribute to the global endeavour to diminish GHG emissions. For this purpose the Government will develop the framework within which the renewable energy industry can operate, grow, and contribute positively to the South African economy and to the global environment (RSA, 2003).

Government has developed a scheme for providing solar photovoltaic systems to households in remote and/or rural areas. According to the development planning division of the Development Bank of South Africa (DBSA) this programme aims to create the foundation for developing a micro renewable energy sector by accelerating the development of the intergovernmental low-cost green energy programme. This is done by taking micro renewables to scale and by establishing creative microfinance support for improving household uptake of the new off-grid technologies (DBSA, 2011).

The Government developed the Integrated Energy Plan (IEP) and this plan recognised the role of renewable energy in South Africa's energy mix. The purpose of the IEP is to find a balance between energy resource supply and demand, taking into consideration safety, health and environmental aspects. The IEP provides a framework within which specific energy development decisions can be made (DME, 2003).

The White Paper states that the South African Government has medium term target of 10 TWh (0.8Mtoe) of renewable energy, contributing to the final energy mix. The strategy that will achieve this target needs to be phased and flexible. It will start off with high potential investments spread across both relatively low cost options, such as biomass-based co-generation, as well as technologies with larger-scale application such as solar water heating, wind and small-scale hydro. This will keep the subsidy requirements controllable when the short-term costs of the competing coal-based power generation are low (RSA, 2003).

In the short-term it is important that South African technologies that are currently available are used and implemented. The local content of equipment needs to be maximised in order to minimise the costs associated with implementation and operation, as well as the promotion of local employment opportunities. The establishment of technology support centres in existing research and development institutions will facilitate the promotion and ongoing development of technology and will assist Government in the certification of systems. The main aim of the policy is to create

the conditions for the development and commercial implementation of renewable technologies (RSA, 2003).

Government will use a phased, managed and partnership approach to renewable energy projects that are well conceived and show the potential to provide acceptable social, environmental and economic returns for all investors and stakeholders (RSA, 2003). This is achieved by the REIPPP programme.

2.3 RENEWABLE ENERGY POTENTIAL

According to the World Bank, to achieve universal access to modern energy services by 2030, the world will need approximately R500 billion every year for new capital investment. That is in addition to the worldwide R4.5 milliard annual investment just to sustain current energy levels. It is true that only a fraction of this investment will be for renewable energy technologies (RET), but this will still account for several tens of billions of Rand on RET sales worldwide and creation of many jobs in the decades to come (WorldBank, 2012). This is a great opportunity for job creation which is essential for South Africa.

2.3.1 RESOURCE ENDOWMENT IN SOUTH AFRICA

Please refer to the last part of section 2.2.4 where South Africa's energy resources endowment was discussed under the WPRE document in detail.

2.4 THE REIPPP PROGRAMME

South Africa has entered the renewable energy arena with its first large scale renewable energy project allocation in 2012. The REIPPP programme is the flagship for these projects and this programme aims on continuing with future renewable energy project roll-outs. The first signed-off 28 projects can be seen in appendix B.

The REIPPP programme was supported by the South African act of Energy Regulation objectives, i.e. to promote diverse energy sources and energy efficiency, promote competitiveness and facilitate a fair balance between the interest of the customers, end users, licensees, investors and the public. (RSA, 2006:10).

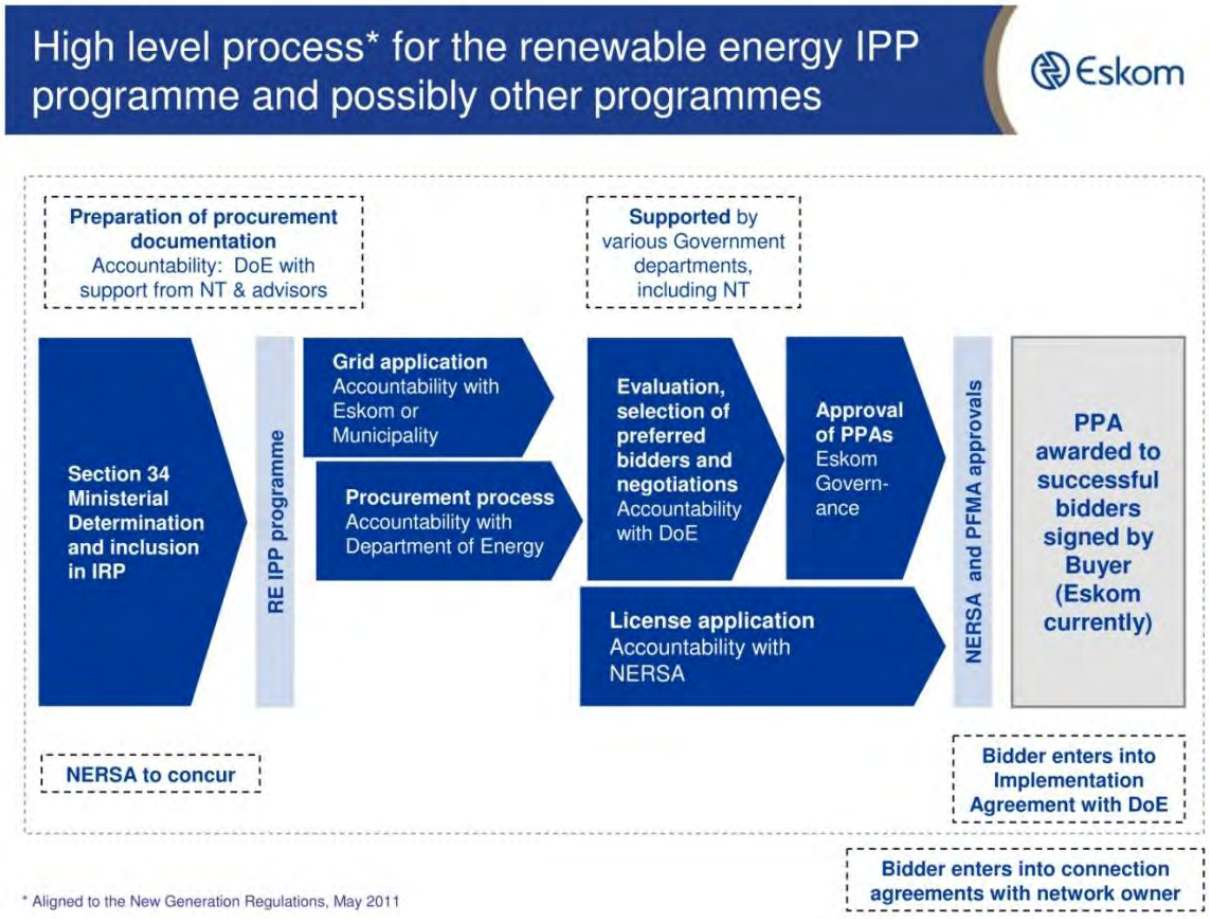


Figure 9: High level process for the REIPPP programme (Greyling, 2012).

Based on Eskom's perspective, a high level process for the REIPPP programme can be seen in Figure 9. The programme is realised by a series of events carried out by various stakeholders. It starts off with the DoE that prepares the procurement documentation with the help of the National Treasury (NT) and advisors. The grid applications are made available by Eskom and the procurement process is initiated by the DoE. After this the bidders are able to submit their bids to the DoE as a potential IPP, and apply for a licence to NERSA. Once the applicants are accepted and chosen as preferred bidders, the PPAs are approved by Eskom and NERSA. Subsequently the NT must provide final approval before PPAs are awarded to the successful bidders (Greyling, 2012).

2.4.1 BIDDING WINDOW AND STAGES

The DoE initiated the REIPPP programme by setting out bidding windows, or rounds, for renewable energy projects to be procured. There are two main concepts investigated to obtain a better understanding of how the programme was implemented.

Bidding window

The bidding windows, as seen in Figure 10, are overarching time frames in which the bidding process was managed. For the REIPPP programme there were three sequential bidding windows over a period of less than 3 years from November 2011 to July 2014. Each window has set out the type of technology with a specified capacity. The reason for the distribution of size and type is to ensure realistic targets were met and a steady flow of investments were made. When the study was conducted there was a target set for 4th round and the possibility for more future windows were good (Cilliers, 2013).

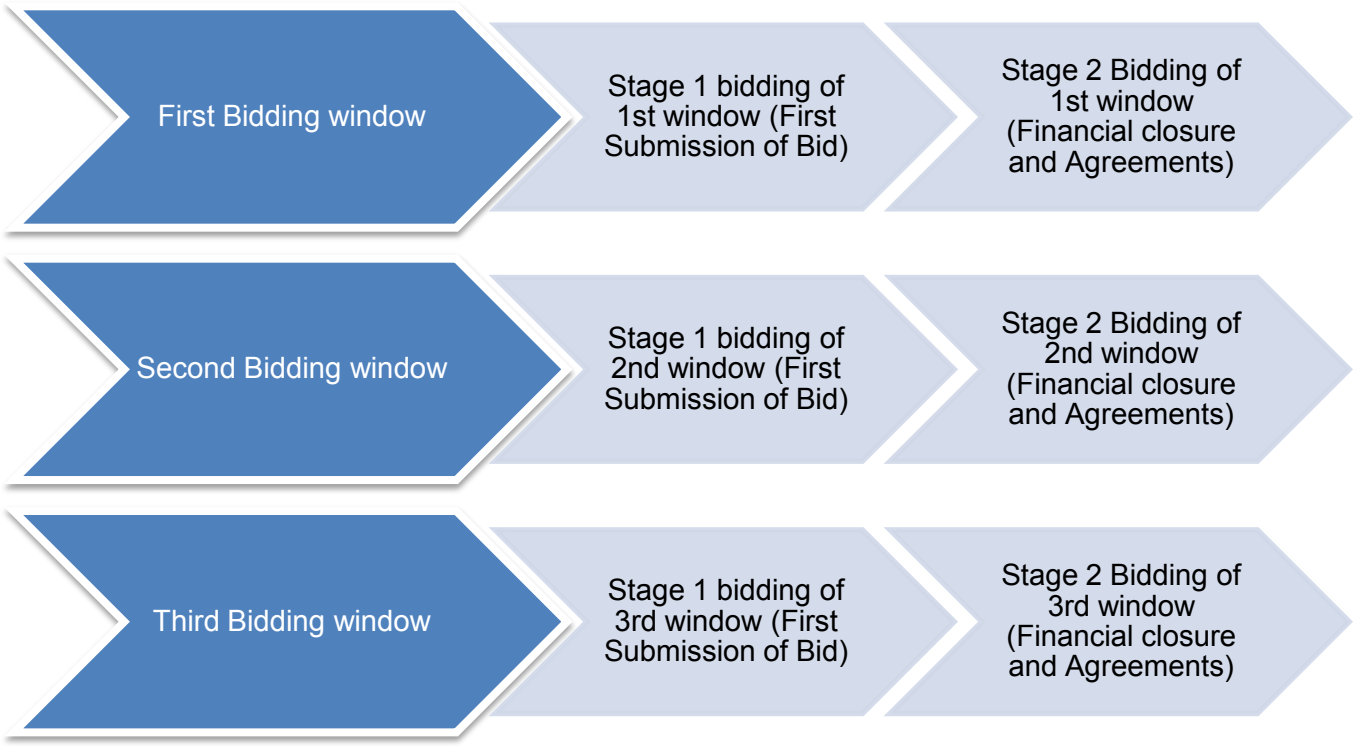


Figure 10: Window and stage outline

Another benefit of implementing the programme in phases was to provide the opportunity to learn and improve on previous bidding windows. The DoE owns the right to increase or decrease the set out capacity, technology or even extend the programme time frame by adding more windows. Allocated MW per technology can be viewed in Table 3

Table 3: Qualified technologies with allocated MW (SANews, 2012) (DoE, 2013a) (EnergyBlog, 2013a)

Qualifying technology for REIPPPP	First Window 28 Projects (1416 MW)	Second Window 19 Projects (1044 MW)	Third Window (1456 MW)	Total MW allocated (3916 MW)	MW Capacity remaining (2908 MW)
Onshore wind	634 MW (8 Projects)	562.5 MW (7 Projects)	787 MW (7 Projects)	1984 MW	1336 MW
Concentrated Solar Power (CSP)	150 MW (2 Projects)	50 MW (1 Project)	200 MW (2 Projects)	400 MW	200 MW
Solar Photovoltaic (PV)	632 MW (18 Projects)	417.1 MW (9 Projects)	435 MW (6 Projects)	1484 MW	1041 MW
Biomass	None	None	16 MW (1 Project)	16 MW	43 MW
Landfill gas	None	None	18 MW (1 project)	18 MW	7 MW
Small Hydro	None	14 MW (2 Projects)	None	14 MW	121 MW
Small Projects	None	None	None	None	100 MW

Stages

Each bidding window has two sequential stages as seen in Figure 10. The first stage is set out to determine if the bidder passes the basic requirements and was appointed as a preferred bidder based on the relevant scorecard; the first window's scorecard was price (70%) and economic development (30%) (Creamer, 2012a). If the bidder qualified and was nominated as preferred bidder, the IPP would go over to stage two. During this stage the bidder needed to reach financial closure and obtain all the necessary agreements, including the PPA, direct-, implementation- and connection agreement. Once all of these requirements were met, the documentation being in place and signed, off the construction phase could commence.

2.5 KEY STAKEHOLDERS OF REIPPP PROGRAMME

Like most other programmes there are implementation agents or key stakeholders that put the programme into action. Sustainability drivers can be obtained and identified from literature, but it is

the stakeholders that will have the best idea of possible drivers. They would be able to comment on identified drivers because they were exposed to the REIPPP environment on a regular basis.

One of the research objectives was to identify the key stakeholders of the REIPPP programme. Stakeholders were identified from literature and they were categorised by the appropriate sectors – Public, Private and Other. Take note that the research focused on key stakeholders of the first window only.

2.5.1 Public sector

The public sector consists of Government's and all public-controlled or public-funded agencies, enterprises and other entities that deliver public programmes, goods or services (IIA, 2011). In the South African context the Governmental departments and state-owned entities like Eskom and DBSA (that were involved in the REIPPP procurement process) was identified and listed below.

National Government

- DoE - (Greyling, 2012)
- National Treasury - (Greyling, 2012)
- NERSA; National Energy Regulator for South Africa - (Greyling, 2012)
- SA-LED; South African Local Economic Development Network – (Krebs, 2012).

State owned Entities

- ESKOM - (Greyling, 2012)
- IDC – (Energize, 2013)
- PIC– (Energize, 2013)
- The Development Bank of Southern Africa (DBSA) – (Energize, 2013).

Local government

Each IPP project had an economic development requirement that needed to be met as discussed at the end of chapter 1. To achieve the obligated development, local communities and businesses needed to be included and involved during the construction, operation and/or maintenance phase of the plant's life cycle. The municipalities of each project were identified from internet sources as illustrated in Figure 11.

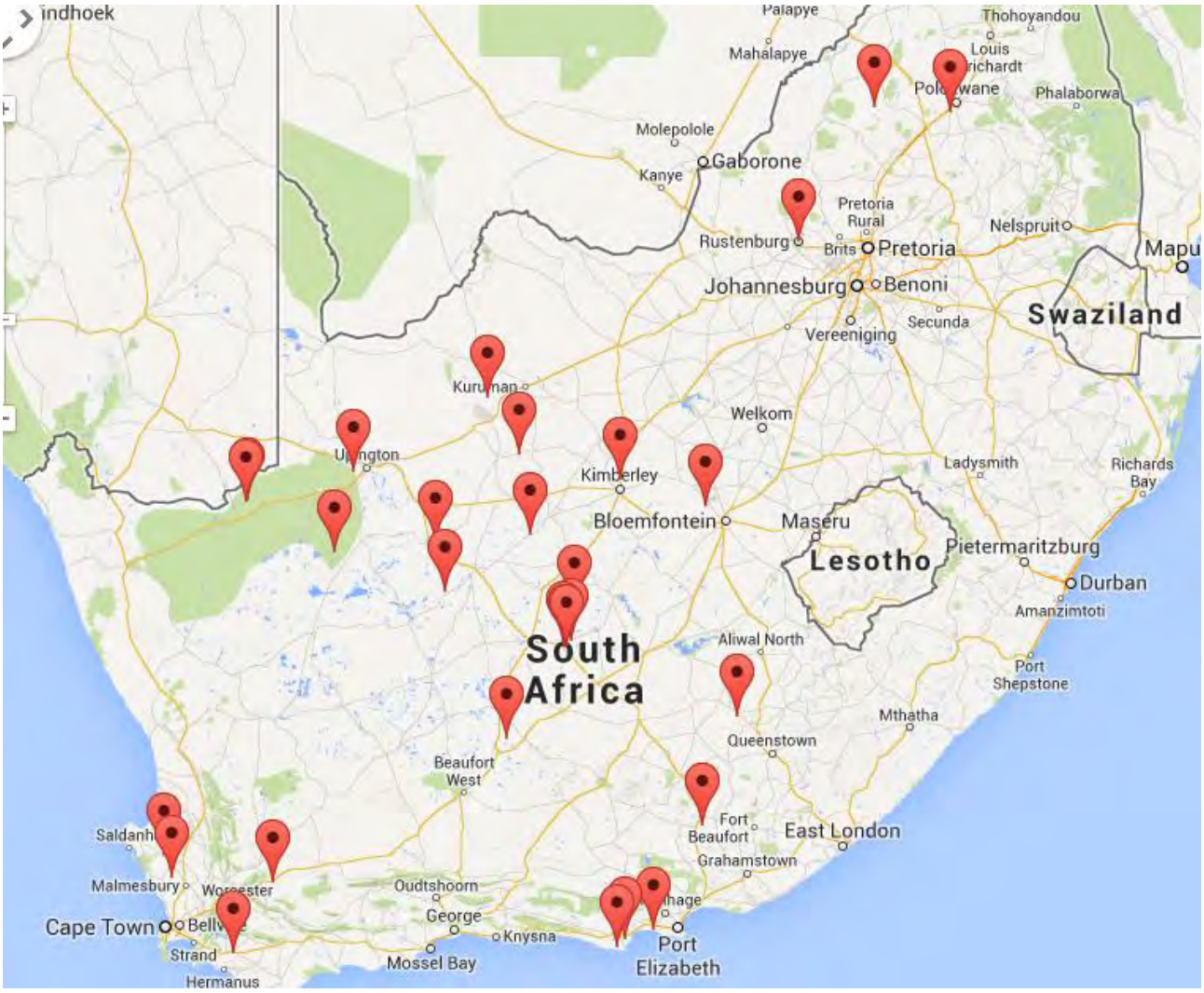


Figure 11: Location of the 1st Window REIPPPP Projects (EnergyBlog, 2013b)

The appropriate municipalities that were involved are listed below. The community representative of each municipality served as a key stakeholder.

- Bluecrane entity – (EnergyBlog, 2013b)
- Breede Valley Municipality – (EnergyBlog, 2013b)
- Gamagara Local municipality – (EnergyBlog, 2013b)
- Hopefield Municipality – (EnergyBlog, 2013b)
- Inkwanca Municipality – (EnergyBlog, 2013b)
- Kai !Garib Municipality – (EnergyBlog, 2013b)
- Khai-Ma Local Municipality – (EnergyBlog, 2013b)
- Kouga Municipality – (EnergyBlog, 2013b)
- Mangaung Metropolitan Municipality – (EnergyBlog, 2013b)
- Municipality of Emthanjeni – (EnergyBlog, 2013b)
- Nelson Mandela Bay Municipality – (EnergyBlog, 2013b)
- Polokwane Municipality – (EnergyBlog, 2013b)

- Renosterburg Municipality – (EnergyBlog, 2013b)
- Rustenburg Municipality – (EnergyBlog, 2013b)
- Siyancuma Municipality – (EnergyBlog, 2013b)
- Siyanda District Municipality – (EnergyBlog, 2013b)
- SiyaThemba Municipality – (EnergyBlog, 2013b)
- Sol Plaatje Municipality – (EnergyBlog, 2013b)
- Swartland Municipality – (EnergyBlog, 2013b)
- Theewaterskloof Municipality – (EnergyBlog, 2013b)
- Tsantsabane Municipality – (EnergyBlog, 2013b)
- Ubuntu Municipality – (EnergyBlog, 2013b)

2.5.2 Private sector

This sector is the part of the national economy that is not under direct state control (Oxford, 2013a). The main private sectoral implementation agents were the IPPs, banks and finance institutions. Some of these entities were local while some were situated overseas.

IPPs

A complete list of the first window participating companies (in the form of development, construction, operation, maintenance and/or subcontracting) and lenders/equity were obtained from an Energize journal.

- 3E renewables – (Energize, 2013)
- ABB Ltd. – (Energize, 2013)
- ACS Cobra– (Energize, 2013)
- Abeinsa- Abengoa – (Energize, 2013)
- Aurecon – (Energize, 2013)
- Basil Read – (Energize, 2013)
- BioTherm Energy – (Energize, 2013)
- Gestamp – (Energize, 2013)
- Globaleq SA – (Energize, 2013)
- Gransolar - (Energize, 2013)
- Group 5 – (Energize, 2013)
- Hatch – (Energize, 2013)
- Iberdrola – (Energize, 2013)
- JUWI Renewable Energy – (Energize, 2013)
- Moncado energy group – (Energize, 2013)
- Mulilo Renewable Energy – (Energize, 2013)
- Nordex – (Energize, 2013)

- Scatec Solar – (Energize, 2013)
- Schneider Electric – (Energize, 2013)
- Siemens – (Energize, 2013)
- Concord Green Energy – (Energize, 2013)
- Murray and Roberts – (Energize, 2013)
- Sinovel Wind – (Energize, 2013)
- Solar reserve – (Energize, 2013)
- Sun Edison – (Energize, 2013)
- Suzlon – (Energize, 2013)
- Tenesol – (Energize, 2013)
- Vestas – (Energize, 2013)
- WBHO – (Energize, 2013)

Banks and finance institutions

- ABSA – (Energize, 2013)
- FMO Finance South Africa– (Energize, 2013)
- Future Growth Asset Management– (Energize, 2013)
- IFC South Africa – (Energize, 2013)
- Investec– (Energize, 2013)
- Kensasi Capital Investment– (Energize, 2013)
- Momentous Technologies – (Energize, 2013)
- Nedbank – (Energize, 2013)
- Old Mutual IDEAS Fund – (Energize, 2013)
- RMB; Rand Merchant Bank – (Energize, 2013)
- Solar Capital – (Energize, 2013)
- Standard Bank– (Energize, 2013)
- Thebe Investment Corporation– (Energize, 2013)

2.5.3 Other including voluntary sector

Stakeholders like suppliers, renewable energy experts, NGOs and research institutes also served as key stakeholders.

- Anthony Conan – Technical advisor
- Arup – Technical Advisor
- Imbewu - Supplier
- Integon – Developer and financier
- Robor(steel) – Supplier

- SAEE; South African Energy Efficiency – NGO
- SANEDI; South African National Energy Development Institute – NGO
- SAPVIA South African Photo Voltaic – NGO
- SAREC; South African Renewable Energy Council – NGO
- SAWEA; South African Wind Energy Association – NGO
- SESSA; Sustainability Energy Society of South Africa – NGO
- SAAEA; South African Alternative Energy Association – NGO
- Stellenbosch centre for renewable and sustainable energy studies – Research institute.

All stakeholders listed above would have the best understanding of the REIPPP programme and will be used for the experiment.

2.6 THEORETICAL UNDERSTANDING AND IDENTIFICATION OF CONTROL DRIVERS

As mentioned in the problem statement, if the drivers (that are critical to the sustainability of the REIPPP) could be identified, a means to control the future sustainability would become available. To better understand how this could be achieved, the theoretical understandings of "control drivers" are discussed.

2.6.1 Drivers concept

Sustainability has three commonly accepted dimensions, i.e. Economy, Environment and Social (ILO, 2012). Each of these dimensions has various aspects that have an impact to the overall sustainability. These aspects are of a measurement and/or describing nature and does not necessarily drive or support sustainability itself (GRI, 2011). One can say that the aspects discussed by GRI are the result of sustainability and not necessarily the cause of sustainability. This is why sustainability aspects that have the ability to drive, influence or impact on the future roll-out of REIPPP projects are selected and subsequently referred to as drivers.

According to the Electronic Oxford Dictionary a *driver* is "a factor which causes a particular phenomenon to happen or develop" (Oxford, 2013b); in this case the phenomenon is sustainability. Drivers are selected from available sustainability aspects and supplemented with drivers obtained from appropriate literature.

2.6.2 Control concept

Identifying drivers that have a large impact on the sustainability of the REIPPP is one thing, but it does not necessarily mean that the specific driver can be controlled or managed. The Oxford Dictionary states that the word *control* means "the power to influence or direct behaviour of the course of events" (Oxford, 2013c). For example, the availability and concentration of primary energy sources like wind and solar would have a significant impact on the sustainability of the

REIPPP, but unfortunately it cannot be altered or controlled due to locality. Effort and time should be spent on the aspects that can be changed.

That is why the author specifies and selects drivers that can be controlled or influenced by management, referred to as “control drivers”. Take note that the concept of “control drivers” was not obtained from literature or theoretically used before; hence the branding was a self-created concept/understanding to convey a research idea.

2.6.3 Sustainability baseline for control drivers

After reviewing a variety of literature it became apparent that there are many ways and views of analysing and implementing frameworks for sustainability. For the purpose of the study, the Global Reporting Guideline (GRG) set out by the Global Reporting Initiative (GRI) will be used as baseline. By using the GRI reporting framework it enables the research to benchmark sustainability performances, demonstrate organisation’s influences on sustainable development and compare performance with other organisations. Not only will this help to ensure the completeness of sustainable control drivers, but also provide a guideline for future reporting on sustainability (GRI, 2011).

The GRG acknowledge the Oxford’s view on sustainability: “To meet the needs of the present without compromising the ability of the future generation to meet their own needs”. In this context the GRG was created by collaborating large network of experts from a diverse range of stakeholders, including business, labour, non-governmental organisations, investors, accountancy and others. These consultations, together with practical experience, have constantly improved the Reporting Framework (RF) since the GRI’s birth in 1997. This multi-stakeholder approach to learning has provided the RF with the widespread credibility (GRI, 2011).

The conceptual high level framework for sustainability, as seen in Figure 12, illustrates the three dimensions of sustainability, i.e. Environment, Economic and Social (Including social equity). These dimensions are relevant and applicable to the sustainability of the REIPPP programme.

GRI’s view on the sustainability dimensions

The economic dimension focuses on the impact made on the economic conditions of its stakeholders and economic systems at local, national and global levels. The economic indicators show the flow of capital between different stakeholders and the main economic impact of the organisation throughout society. Based on literature the organisation’s contribution to the sustainability of a larger economic system is of the utmost importance (GRI, 2011).

The environmental dimension represents the organisation’s impact on living and non-living natural systems, including ecosystems, land, air and water. The indicators for environment can be seen in Figure 12 in the environment section.

The organisational impact on the social systems within which it operates is a sustainability concern. Social performances under the social dimension can also be seen in Figure 12.

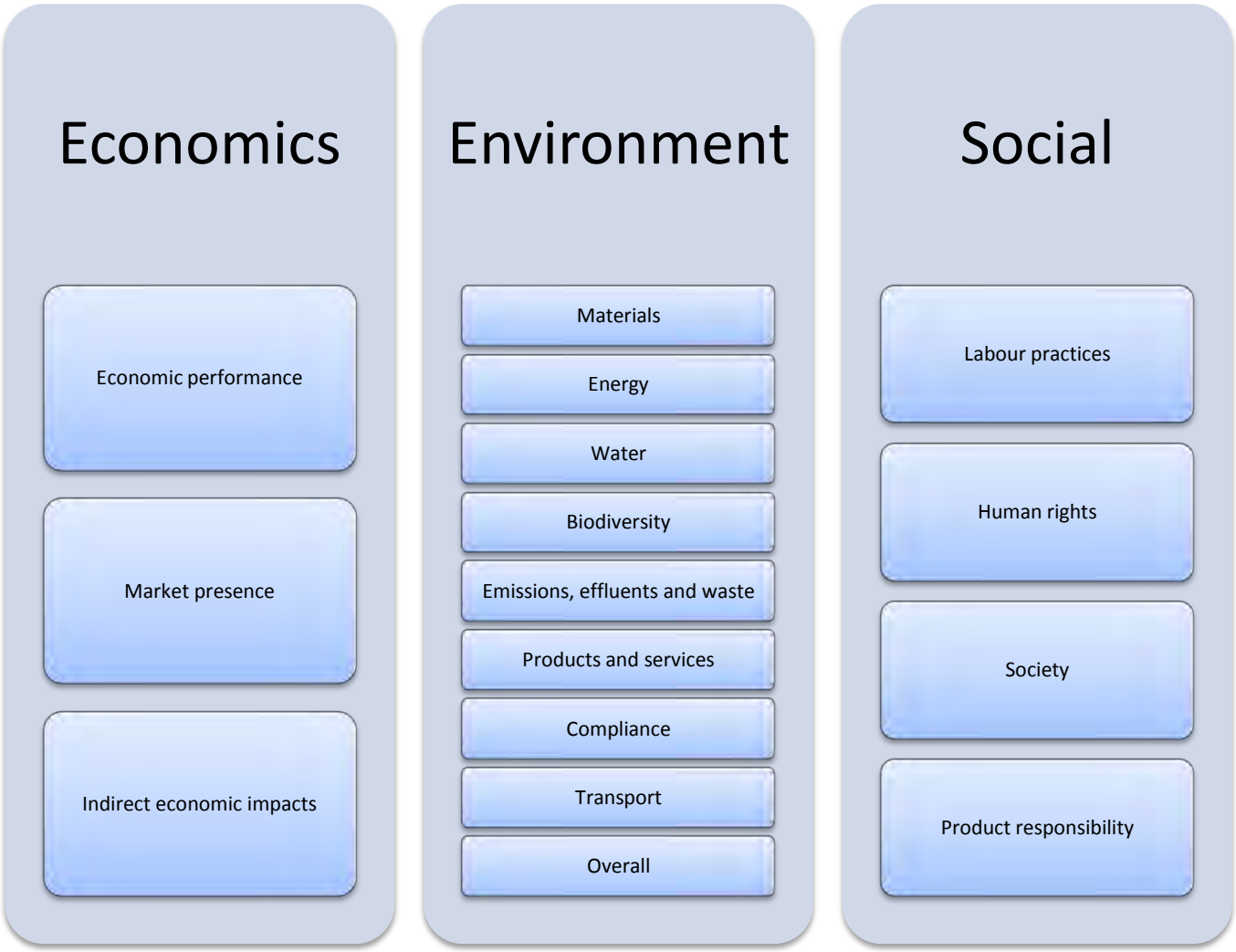


Figure 12: Conceptual high level framework for sustainability (GRI, 2011)

Each of the aspects, as seen in Figure 12, and sub-aspects according to the GRI, are illustrated in appendix C. This framework will be used as baseline and tailored to obtain control drivers critical for the sustainability of the REIPPP programme.

All the information gathered by the literature study was integrated and used to compile a list of control drivers specifically for the REIPPP programme in South Africa. The control drivers address the main focus areas identified in the literature, and are presented in chapter 3. Chapter 3 also discusses the application of the research methodology which includes the research design, data collection method, sampling technique and ethical considerations.

3 RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The research design is a structured plan or strategy which provides the breakdown of various relevant features – from the underlying philosophical assumptions on which the study was based to the research strategy, specifying of the target group, data collection techniques that were used and lastly data analysis that was applied. The author's assumptions, research skills and research practices determined the choice of research design and influence the manner of which data was collected (Nieuwenhuis, 2011:70).

3.2 Philosophy and assumptions

According to the Oxford Dictionary philosophy is "the study of the fundamental nature or knowledge, reality and existence" (Oxford, 2013d).

The author's philosophy was that the current way of life in most areas of our livelihoods is unsustainable and that, if we don't act soon, we may find ourselves in a dire situation, leaving the worst to come for future generations. Generating and utilising energy is one of the pillars of maintaining a society but, unfortunately, as seen in the literature study, our current system does not achieve much when it comes to sustainable energy generation. On the other hand, South Africa recently took a first big step towards supporting and generating sustainable energy with its REIPPP programme. Just like with any other programme, there are inhibitors, issues, challenges and even barriers that need to be overcome so that the full potential, and even future growth of the REIPPP roll-out, can be improved. Drivers that can be controlled and is critical for the sustainability of the programme were identified from literature, but must be supplemented and verified by industry. Once these control drivers have been identified, prioritised and benchmarked by the industry, it should be used to investigate recommendations, guidelines or answers to the most critical control drivers. This is where the use of the research design comes in.

According to the Oxford Dictionary an assumption is a concept that is accepted as true or as certain to happen, without proof (Oxford, 2013e). When it comes to assumptions, the author assumed that the sustainability of the REIPPP is as yet unknown and it will be difficult to determine or measure the sustainability of the programme as most of the partaking projects is in construction or even procurement phase. Another assumption was that the first 28 projects were accepted as the best option when it came to obtaining insight on author identified control drivers. One reason for making the last mentioned choice was because the author viewed the stakeholders involved in the first projects as correspondents that went through the whole process of partaking in the programme, whilst stakeholders of other windows would not necessarily be able to comment on issues relevant to the construction and post-project phase. Only selecting key stakeholders from the first window helped with narrowing down the survey sample and obtaining feedback from

people that were more exposed to the REIPPP programme than stakeholders from the other windows.

3.3 Research strategy – quantitative and qualitative

This study was mainly conducted within the quantitative context and it was used in combination with qualitative research for clarifying, supplemental and supportive purposes. From literature control drivers were identified and these drivers needed to be prioritised. By obtaining a ranking for each driver was a quantitative way of prioritising identified control drivers. Having a qualitative undertone on each quantitative question, gives the respondent the opportunity to provide comments on identified control drivers, to recall or prioritise control drivers that were ruled out by the author and finally give the correspondent the opportunity where he/she can provide their own control drivers. The qualitative research applications helped with the completeness and correctness of identified control drivers as correspondents had the opportunity to correct, amend and/or supplement control drivers.

The qualitative research continued in the last part of the experiment where the top five critical control drivers were selected for interviews. The top five drivers were selected based on their priority value given by the industry and the interviews would be held with high level key stakeholders. The interview would gather qualitative information on each driver. Only the top five prioritised control drivers would be investigated as these drivers are the top issues at hand and the interview time is limited. The purpose of collecting the interview information is to address the last research objective: to provide recommendations on how sustainability of the REIPPP programme could be promoted or improved.

Quantitative research is defined as a systematic process that uses the numerical data of a selected sample or population regarding a particular issue. The findings are then generalized to the entire population. This research is also more structured than qualitative research as the elements of the research process, i.e. objective, design and sample questions, can be planned (Maree & Pietersen, 2011:145).

The qualitative research process seeks to determine the extent of a problem and is used to quantify variations of a phenomenon, situation, problem or issue. (Kumar, 2005:12). More attention is given to the extent of the problem than the depth of the information. Qualitative research is defined by Nieuwenhuis (2011:51) as a method of research that focuses on social and cultural context imbedded in the research process. This is accompanied with behavioural actions and emphasizes the “who” and “why” questions of research. This type of research observes and interacts with people or systems in their natural environment in order to study them. Qualitative research focuses on the meanings and interpretations of the participants. Emphasis is placed on the quality and the depth of the information and not the scope of information provided (Nieuwenhuis, 2011:51).

Identified controlling drivers which influence the sustainability of the REIPPP, needed to be identified and prioritised. The author decided to make use of a combination of quantitative and qualitative research methods to achieve this. This implied that every question had two sections. In the first section it established which controlling drivers would exert impact worth mentioning, and it would investigate to what degree the correspondent as entity had control of those drivers. The second section is a “Please comment if unable to rate” option, giving the respondent the opportunity to provide a qualitative input if he/she was unable to rate.

In this study the quantitative research method was used by providing correspondents with a list of controlling drivers and then, by making use of a scale of 1:10, giving them opportunity to indicate what the impact worth mentioning of each controlling driver was during the time of research. To obtain an encompassing overview of the impact of controlling drivers on the sustainability of the REIPPP programme, participants will firstly be given opportunity to prioritise controlling drivers according to scale, and then express their own opinions on these aspects, should they feel so inclined. In this manner one ensures that the participants are at ease and that they also have opportunity to communicate their opinions clearly.

3.4 Non-experimental design

A non-experimental research design is employed in descriptive studies where the selected participants will be measured at a given time for all relevant variables. Consequently there will be no degree of manipulation involved (Maree & Pietersen, 2011:152). In non-experimental research the researcher also investigates a specific phenomenon/situation that crops up and intends to establish what its source is, or what caused it. Thus the effect is firstly investigated to try, in this manner, to establish what the cause is. Consequently the researcher connects the cause to the outcome (Kumar, 2005:100).

In this study the author will make use of non-experimental research. Sustainability is an integrated characteristic of the REIPPPP, consisting of many aspects of such sustainability. To help ensure sustainability it is necessary to make certain that REIPPPP functions optimally. The question which crops up was: What could be done to promote the sustainability of future renewable programmes? One of the ways of supporting the future sustainability is to find a means to control the future sustainability of the programme by identifying and prioritising controlling drivers because, although various controlling drivers are known, it has not been fully summarised and prioritised. Correspondents will thus have the opportunity to allot merit to the controlling drivers already identified and have the opportunities to add their own. The correspondents are authorities in the renewable field and for the purpose of the study they have to provide feedback from their own perspective.

3.5 Participant selection

In this study the author focused on key stakeholders involved in the REIPPP's first round/window as research participants. The participants were able to complete a questionnaire at their ease and in their own time. A number of 85 key role players were approached. They each received an electronic questionnaire which they completed by answering questions. The key stakeholders represented different sectors namely, inter alia, the Government, NGOs, consulting groups, IPPs and also involved local municipalities, committed banks, Eskom and others. See Appendix D to view the full list of key stakeholders contacted in the research.

Random sampling can be defined as the process used to select a portion of the population for study purposes. For this study the researcher made use of non-probability and purposive random sampling because the researcher, from knowledge gained from literature studies, already knew who the key role players were and that they could provide the best applicable information. The number of participants was determined beforehand by studying the required statistics (Rugg & Petre, 2007:68). Purposive random sampling thus refers to participants who are selected because they have a specific characteristic required for the study. Random sampling is done in this manner with the specific purpose of collecting maximum and the most enriching information for research purposes (Nieuwenhuis, 2011:79).

In this study the author made use of one of the probability random sampling methods, namely purposive random sampling. In purposive random sampling the researcher is aware that inherent variations may surface amongst the participants. Consequently the researcher endeavours to lower the inherent variations by beforehand selecting the participants (Lynn, 2002:189). In this study applicable literature was used in order to identify the key role players and then to approach them only. The participants were selected with a specific aim, namely to identify, supplement, amend and prioritise the critical control drivers.

3.6 Surveys and questionnaires

Surveys are defined as the assessing of the present situation, opinions, convictions and attitudes by distributing questionnaires to or doing interviews with a predetermined population (Maree & Pietersen 2011:155). Questionnaires are thus seen as a specific type of survey or research tool. Questionnaires refer to a list of preconceived questions. These questions may be answered orally or through a tick list giving a choice between different answers. Participants may complete these lists personally, or the researcher may put the questions directly and fill in the answers (Rugg & Petre, 2007:142).

The researcher distanced him/herself to ensure that the dynamics of the environment was not influenced. The necessary planning was undertaken beforehand to determine what the

questionnaire should entail. That was the time in which the questionnaire had to be completed, the order of the questions, the wording of and the type of questions to be asked and other aspects.

The questionnaire, as seen in Appendix E, was distributed electronically to participants. It required that it should be user-friendly. This meant the questionnaires had to be easy to read and also to be clearly understood. It should also contain questions relevant to the research aim. The questionnaire contained 40 questions to ensure that participants would be able to complete it in approximately 20 minutes. The time required to complete the questionnaire was determined beforehand by a control group. Questions were presented in such a form that it did not confuse participants (Maree & Pietersen 2011:160). A succinct explanation of the questionnaire content was given telephonically and by e-mail to participants.

There are different types of questions that could be asked in the questionnaire. These included open and closed questions. Open questions refer to questions which leave space for explanation, while closed questions give a number of answers to the question and the participant then has to select the most relevant option (Maree & Pietersen, 2011:161). The questionnaire distributed for this study would mostly make use of closed questions. The only opportunity participants would have for comment would be to questions where the participants mentioned that they could not give judgement on controlling drivers; when they wanted to add additional controlling drivers; and/or wanted to make general comments at the end. The type of closed questions asked was of rank order.

The advantages of closed questions are that they are quick and easy to answer; they simplify coding and make it easier; and also make it easier to reply to sensitive questions (Maree & Pietersen, 2011). The disadvantages of closed questions are that participants may want to give answers that are not provided for in one of the choice options; also that they may answer questions without really having any knowledge on the subject concerned. As the time for finalisation of the study was limited, it was functional to mainly make use of closed questions.

3.7 Questionnaire design

The questionnaire was designed following the design process as seen in Figure 13. The important process blocks were discussed in detail. The questionnaire started off with biographical questions followed by questions dealing with participants' personal view of sustainability. Rating and/or commenting on provided control drivers was the third part of the survey, which finally ended with questions dealing with alternative or self-proposed control drivers.

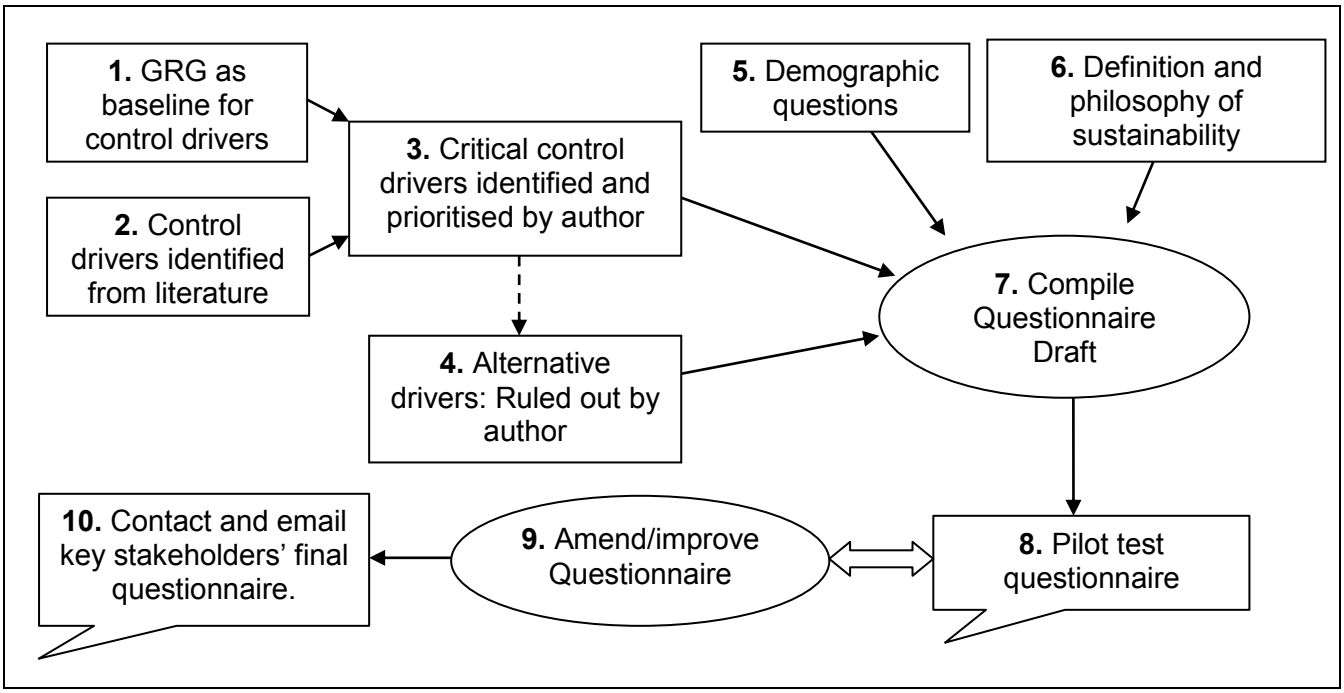


Figure 13: Questionnaire design process

In the beginning the questions were easy to answer, followed by the more challenging questions. Questions with the same theme were grouped together. The terminology used in the questionnaires was not unknown to the participants. Questions were clear and unambiguous by avoiding leading, common knowledge and hypothetical questions.

To successfully identify and accurately prioritise control drivers critical to the sustainability of the REIPPP programme the author needed to design an appropriate research tool. This was done by creating a non-experimental questionnaire. The questionnaire design was created in phases.

(1) The first phase was to use the GRI for sustainability framework as a baseline to identify control drivers as seen in appendix F and discussed in section 3.7.1. These drivers were selected based on outcomes of the REIPPP stated by the DoE's official website and documents.

(2) The second phase was identifying all critical control drivers from literature and can be perused in Appendix G.

(3) In the third phase, the control drivers from the GRI framework and literature were pooled together as critical control drivers as seen in table 4 and discussed in section 3.7.2.

(4) Control drivers ruled out by the author, but which still had some merit based on literature and the control driver baseline, were grouped together. These alternative drivers were included in the questionnaire and the respondents had the opportunity to provide their rating on the alternative drivers selected by the respondents.

(5) Demographic questions included age, gender, race, sector situated in, years of experience in renewable energy, qualification, occupation and current position. Sector and years of experience in the renewable energy field were asked for correlation purposes, while the rest was for context/qualitative analysis purposes.

(6) Definitions and personal philosophies on sustainability (as discussed in chapter 2) were asked to put respondent feedback into perspective and obtain a feel for what the general view on sustainability was.

(7) From the critical drivers (3), alternative drivers (4), the selected biography questions (5), and definition and philosophy of sustainability an electronic questionnaire draft was compiled. The questionnaire appears in Appendix E.

(8) A control group helped with pilot testing. Two professors in engineering, two post-graduate engineering students and four final year students volunteered to do a pilot test on the questionnaire.

(9) Comments, suggestions and critique were received from this control group and amendments/improvements were made accordingly.

(10) Finally key stakeholders were contacted to confirm willingness to participate (discussed in section 3.9.3) and this were followed by an email with a link to the electronic survey.

3.7.1 BASELINE FOR CONTROL DRIVERS

From the literature the GRI framework provided a baseline of sustainability aspects relevant to the energy sector. Aspects that can be seen as drivers were selected and used as the basis for control drivers. These drivers were selected based on the importance and relevance of the expected REIPPP outcomes discussed on the official REIPPP website and the DoE's latest annual performance and strategic planning documents; the following are the steps that were followed for the first phase. Take note that the summarised key outcomes are discussed first:

1. Obtain the key outcomes and deliverables for the REIPPP programme set out according to the renewable IPP's official website and the DoE's strategic planning and performance documents.
2. Summarise the key outcomes and deliverables; numbering was used for referencing purposes.
3. Evaluate and tailor each sustainability aspect in the GRI framework according to the key outcomes and allocate a number as seen in Appendix F.
4. Aspects irrelevant to renewable energy projects or which did not induce a significant impact on the sustainability of the programme, were amended or removed.

5. Finally sustainability drivers identified from the GRI framework were merged with drivers obtained from other literature.

Summarised key outcomes

The following outcomes/deliverables received most emphasis and hence the GRI framework aspects would be adapted according to these summarised outcomes/deliverables.

1. Current and future energy demand and access needs to be addressed.
2. Fight climate change by utilising the renewable energy potential.
3. Socio-economic benefits for the public, especially job creation, skills and community development.
4. Localisation and stimulation of renewable energy industry to help grow SA economy sustainably.
5. Correct the past by inclusion and participation of the youth, women and the previously disadvantaged.
6. Liberate the energy industry and diversify energy mix to help ensure energy infrastructure that is efficient, competitive and responsive.
7. Protect environment sustainably by utilising the renewable energy potential.
8. Governance that will contribute to the overall sustainability in the South African context; for example in general corruption is a big challenge and labour rights can be used to prevent employees from providing essential services.

The summarised key outcomes/deliverables was obtained from official websites and documentation as seen in the sections below. Take note of the correlation between the numbering above and the numbering in brackets next to each outcome.

Key outcomes for REIPPP programme

Main outcomes and/or deliverables of the REIPPP programme according to official REIPPPP website of DoE (DoE, 2012b).

- High levels of renewable energy potential that needs to be harvested. (2)
- Future energy demand: 3725 MW must be part of the mix according to IRP (1&2).
- Socio-economic and environmentally sustainable growth (3&4).
- Stimulate renewable industry in South Africa (4).
- Creation of job opportunities, local content, skills and community development is essential ingredients of REIPPP programme economic development model (3&4).
- Localisation needs constant emphasis (4).
- Inclusion and participation of women, youth and the disabled is a weakness that the DoE need to address in this programme (5).
- To help grow the economy (4).

Main outcomes and/or deliverable of the REIPPP programme according to Strategic plan of DoE (DoE, 2012c):

- Decent employment through inclusive economic growth: IPP is intended to promote sustainable growth, job creation and the renewable energy industry in rural areas (3&5).
- An efficient, competitive and responsive economic infrastructure network: Infrastructure must be robust, responsive and reliable (6).
- Environmental assets and natural resources that are well protected and continually enhanced: The DoE's Contribution towards Government's climate change targets will be a significant one (2).
- Provide electricity to schools and clinics; a long and healthy life for all South Africans (1).
- Electrification of rural areas to support sustainable livelihoods (1).
- Vision 2014: Sustainable energy sector with universal access for all (1).
- Vision 2025: Energy mix having 30% clean energy by 2025 (2&6).

Main outcomes and/or deliverables of the REIPPP programme according to Annual Performance Plan 2013/2014 (DoE, 2013c).

- 42% target of new-built capacity has been allocated to renewable energy by IRP (2&6).
- Energy efficiency interventions play a major role (5).
- Diversify energy mix (6).
- Reduce country's carbon footprint (2).
- Reduce national energy intensity by becoming more energy efficient (1&6).
- Electrification of 540 000 households by 2014/15 (1).
- Support needed for municipalities facing serious electricity provision challenges (1&6).

3.7.2 Critical control drivers prioritised

After consulting a variety of literature multiple control drivers were identified. Each of these drivers were carefully selected, composed and assigned to an over-arching critical control driver. This was done by categorising all the relevant and important drivers obtained from the GRI framework and from the latest literature. This can be perused in appendix G.

As seen in Table 4: Critical control drivers prioritised: Each critical driver was awarded a value of between 1 and 10 by the author for level of impact and for the level of controllability. These values were then multiplied to obtain a [†]prioritising value. The critical control drivers were prioritised according to its ranked value and categorised into the three sustainability dimensions: Economic, Environment and Social, as seen in Table 4. The values were awarded and control drivers consequently prioritised based on the author's interpretation and background obtained from literature. The top eight control drivers of each dimension were chosen as critical control drivers. Control drivers that did not reach the top 8 drivers critical for the sustainability of the REIPPP were

ruled out by the author as seen in table 4. These control drivers will be presented to the key stake holders as alternative control drivers. In the respondent's view, if an alternative control driver should receive a higher priority than those proposed by the researcher, he/she could select and rank those alternative drivers.

Table 4: Critical control drivers prioritised

Economic	
Critical control driver (Top 8)	**†Priority Value**
Funding for the Renewable Energy Independent Power Producer Procurement Programme	[9, 8 = 72]
Materialisation of the Independent System Market Operator (ISMO)	[9, 7 = 63]
General decrease of feed-in tariffs (FIT) for renewable energy technology over the programme period.	[8, 7 = 56]
Greater dialogue for the REI4P between Government, Eskom, IPPs, financiers and industry during programme period.	[7, 8 = 56]
Upgrade of and connection on transmission network/system	[9, 6 = 54]
Current Governmental implementation of REI4P process	[9, 6 = 54]
Partnerships and consolidation of both local and foreign companies to promote local manufacturing of international standardised renewable energy products	[9, 5 = 45]
Governmental policies regarding the future of renewable energy implementation during the REI4P period.	[9, 5 = 45]
Economic drivers ruled out by author (below 45 Priority Value)	
Amendments of latest REI4P documentation requirements	[7, 6 = 42]
Development and implementation of nuclear power generation in South Africa	[7, 6 = 42]
Targeted research to develop good practice recommendations	[5, 7 = 35]
Full scale Implementation of fracking for shale gas in South Africa	[8, 4 = 32]
Implementation of cost effective energy storage facilities	[6, 5 = 30]
Enabling legislation for renewable energy in South Africa	[7, 4 = 28]
Global renewable energy growth forecast	[8, 3 = 24]
Future electricity demand projection	[8,3 = 24]

SA moving to base load IPP procurement plan	[7,3 = 21]
Environment	
Critical control driver (All drivers)	†**Priority Value**
South African policy to address climate change by reducing GHG.	[9, 7 = 63]
Effect on water sources during IPPs plant lifetime	[8, 8 = 64]
Emissions, effluents and waste due construction phase of IPP plants	[7, 9 = 63]
Protection and enhancement of biodiversity	[7, 8 = 56]
Current South African transport and logistics infrastructure for renewable energy	[6, 7 = 42]
Volume and weight of materials used by IPPs during construction phase	[4, 8 = 32]
Social	
Critical control driver (Top 8)	†**Priority Value**
Development of a representative community platform to collaborate on community benefits issues	[9, 8 = 72]
Current labour relations and restrictive regulations between IPPs and South African local workforce	[10,6 = 60]
Engagement of IPPs with policymakers (DoE, DTI, DBSA and IDC) to reform the bidding requirements and consequently provide better support for the community benefit process	[8, 7 = 56]
Employment and employment practices by IPPs	[8, 7 = 56]
Future price increase of electricity, especially for the general public	[9, 6 = 54]
Diversity and equal opportunity for jobs and equity	[7, 7 = 49]
Local communities having access to electricity generated by IPP plants	[8, 6 = 48]
Workforce training and education	[8, 5 = 40]
Social drivers ruled out by author (Less than 40 Priority Value)	
Increasing localisation demands and its associated threshold decrease	[8, 4 = 32]

Crime and theft: Direct and indirect losses due to high cable and electricity theft	[7, 3 = 21]
Materialisation of small scale renewables	[3, 6 = 18]
Corruption and fraud on key stakeholder level	[8, 2 = 16]

Take note that the period of the implementation of these drivers were during the implementation REIPPP programme and during the lifetime of each IPP plant. All of these drivers were in the South African context and are applied or influenced by the appropriate key stakeholder linked to the IPPs.

† [*Impact value x Controllability value = Priority value].*

3.8 Follow-up interview questions

Once the feedback was obtained from the survey questionnaire, the data processed and the control drivers prioritised by the industry, a follow-up interview questionnaire was designed.

The list of prioritised control drivers served as a means to control the sustainability of the REIPPP programme. With the list of prioritised control drivers as measurement tool, verification of this tool was done by compiling a list of questions about the control drivers most critical to the sustainability of the REIPPP programme. Using Pareto's 80/20 theory only the top 20% of all the control drivers were applicable as critical (Goergescu-Roegen, 1935). The top 5 drivers were chosen by the author for an in depth question interview. The interview questions appear in Appendix I.

It was envisaged that the interview would obtain insight and guidance on the top five control drivers. Applying and taking the interviewees' responses into account, it could potentially promote the sustainability of the REIPPP programme. Key stakeholders included in this interview were:

- **Eskom** – Mr Adila Marengo (Programme Manager for REIPPP);
- **DoE** – Mr Maduna Ngobeni (Project Manager of the REIPPP programme);
- **IDC** – Mr Piet Badenhorst (Senior Account Manager);
- **Nedbank Capital**– Mr Dinesh Jugmohan (Energy Project Finance);
- **ABB South Africa** – Mr Tony Duarte (Sales Manager Renewables); and
- **NERSA** – Dr Andile Gxasheka (Renewable Energy Specialist).

The stakeholders were chosen based on their role in the REIPPP programme and on their understanding or experience of the programme. Each interview was electronically recorded to

ensure that the stakeholder's message was conveyed correctly. Recorded interviews were transcribed by the author and can be seen in the results of chapter 4.

3.9 Criteria for quality

3.9.1 Reliability and validity

The concept of reliability is connected to the research instrument used during the study. A research instrument is seen as reliable when the degree of accuracy and precision of the measurements are high. Factors influencing the reliability of the research instrument are the following: How the questions are formulated as well as stated; the experimental setup; the respondent's state of mind, the nature of the interaction between researcher and respondent; and finally the regression effect of the instrument (Kumar, 2005:156,157). Validity is defined as the degree to which the researcher obtains the measurement he or she wishes to obtain (Smith, 1991:106). Validity is also further defined as the ability of the instrument to make a specific measurement for which it was designed for (Kumar, 2005:153).

Researchers have determined that the validity could be increased by application of the following:

Data should be relevant to the subject and should be able to answer the research question stated. Reliability can also be increased by obtaining various objective insights into the data. Data collected by researchers concerns their opinion regarding the managing driving forces of sustainability; this data is essential to determine the crucial managing forces and the prioritisation thereof, thus allowing the data to be applied in answering the research question. Various companies were approached and consulted to prevent a biased perspective, allowing a viable broad perspective of current events in the country.

3.9.2 Ethics

It is the researchers' responsibility to act ethically during each and every study conducted. Ethics regards the moral as well as responsible conduct of the researcher to the various participants. The first aspect of ethics is that the researcher should obtain consent from the department of engineering (Hinckley, 2005:306).

The second aspect regarding ethics has a direct link between the researcher and participants and is comprised of the following fundamentals: Informed consent, confidentiality and anonymity, anonymity of participants, willingness of participants, honesty, risks, and taking fragile populations into consideration. These principles ensure the ethical conduct in regards to the participants.

3.9.3 Informed consent and willingness of participants

The key stake holders were telephonically contacted by the researcher to obtain their consent for their participation of the study. When they consented to participate in the study an email was sent, informing them of the study aims, as well as how the study would be conducted. It was made clear

that the study was completely voluntary and that at the participants reserved the right to withdraw from the study at any time. As soon as the consent was given, information provided could then be utilised by the researcher for the purposes of the study.

3.9.4 Protection against harm

It is the researcher's responsibility to ensure that the participants do not encounter any harm during the study. This would be made possible through the honesty of the researcher and taking the participant's human rights into account. No deception by the researcher would be tolerated; thus the study aim would be made known to the participants prior to the conducting thereof. All participants would be informed of the findings after completion of the study. All participants would also be treated fairly and equally; no discrimination of any sort would be tolerated.

3.9.5 Confidentiality and anonymity

Regarding the aspects mentioned above the following was to be considered: The researcher would allocate a number to each participant ensuring that question responses were linked to business rather than participants. Feedback of information gathered during the study would also be given in this manner to ensure the anonymity of the participant's identity. The questions asked during the questionnaire should focus on the study and should not deviate from the stated aim. Questionnaires given during the study would be discarded once the study is completed. No results would be shared with a third party or any other participants unless the withholding of information would influence other participants or third parties negatively.

3.10 Data collection

Data collection refers to the systematic gathering of data for a specific purpose. Different methods are applied to collect this data, which may include questionnaires, interviews, observation, existing documents and electronic components. This process usually takes place before analysis of the data (Kumar 2005:118).

In this research data was collected by making use of a questionnaire. The questionnaire was generated on fluid surveys and the NWU was responsible for the survey programming. The author had to email the link of the electronic questionnaire to all identified key stakeholders. Final output data was provided in Excel format, which was personally used for data analysis and delegated to the Statistical Department for statistical analysis.

3.11 Conclusion

This chapter presented the research strategy used in this study. The author's philosophy and assumptions were discussed, followed by the research quantitative strategy used in the form of a survey technique with a questionnaire as research tool. This was supported by literature review.

Participants were chosen using the purposive sampling method as the research required input and feedback from key stake holders that were involved in the first 28 projects of the REIPPP's first window. Using purposive sampling ensures that correspondents were suitable and able to provide valuable information.

Top five control drivers where then selected from the control drivers prioritised by the industry for interviews with high level stakeholders. The data collections helped to improve the author's understanding of control drivers which were essential to promote the sustainability of the REIPPP programme. Chapter four presents the analysis and discussion of results obtained from the questionnaire and interview.

4 RESULTS

4.1 Introduction

Chapter 4 started with a description of the sample profiles followed by the personal philosophy regarding the sustainability thereof. The quantitative and qualitative data regarding control drivers was presented and analysed. All the control drivers were ranked according to the priority value calculated from impact and controllability rating obtained from industry. The analysed data was followed by statistical analysis where feedback by different sectors and different levels of experience was compared. Chapter 4 was then concluded by an overall interpretation of the control driver results, the final integrated and prioritised control drivers and the summarised interview outputs.

Please take note that the final dissertation was statistically analysed by the Statistical Consultation Services and their letter of approval appears before the table of contents.

4.2 Responses to questionnaire

The non-probability and purposive random sampling process (as discussed in section 3.5) was used to identify the key stakeholders below. The questionnaire was distributed to each of these stakeholders (see section 2.5 for full stakeholder details):

- Four Governmental entities involved in the REIPPP;
- Thirty two IPPs (Construction, Operation and/or Maintenance) of the first window;
- Sixteen Banks involved in Window 1;
- Seven renewable or alternative energy associations/organisations;
- Twenty two municipalities involved in Window 1; and
- Other partaking stakeholders like suppliers, SESSA department of University of Stellenbosch, and experts in the renewable energy field.

The survey was provided to the target population via email and Table 5 below represents the response rate achieved.

Table 5: Response rate to questionnaire

Details	Count	Percentage
Distributed questionnaires	85	100%
Received questionnaires	39	46%
Sub division of 46% received questionnaires		

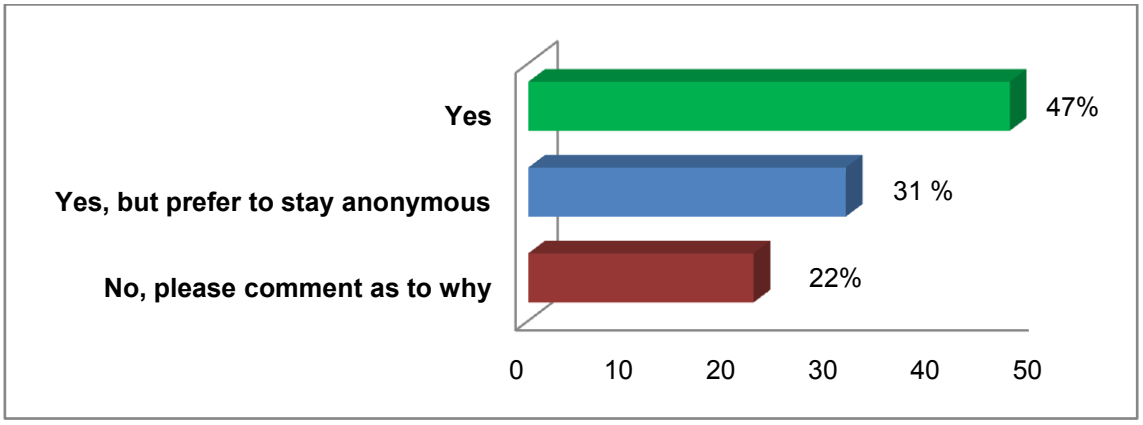
Incomplete questionnaires	7	18%
Rejected questionnaires	7	18%
Analysed and complete questionnaires	**25**	**64%**

The target populations were reminded to complete the questionnaire by sending them follow-up emails. Correspondents that were not personally spoken to initially due to unavailability or no direct access reasons were contacted and reminded of the survey telephonically. A total of 38 responses were received over a period of 8 days, hence representing 46% of the target group. Unfortunately, of these responses received 14 were incomplete or rejected due to time constraints, confidentiality concerns and network problems experienced during the feedback period.

4.2.1 Willingness to respond on questionnaire

The first part of the questionnaire provided the cover letter and requested "willingness to participate in a research" question. The response to this introductory question, as seen in Table 6 below, was used to distinguish between those who wanted to take the time to fill in the survey, who wanted to participate but stay anonymous, and those who didn't want to participate given they provided reasons for them opting out.

Table 6: Willing to participate in research



The 15 (47%) who selected yes agreed to be referred to in the research, while the 10 (31%) who chose the second option would stay anonymous in this document. The 7 (22%) who selected "no" commented that they would not be able to partake in the survey due to time constraints, current work load, confidentiality issues and/or network issues. Please note that from here to the end only

the completed 25 inputs were used for further interpretation. To ensure that information is comparable and uniform the author decided to work with complete inputs rather than half answers.

4.2.2 Demographic information of respondents

Question 1 of the questionnaire provided explanatory background of the research and collected the demographic data of the correspondents. Demographic information includes age, gender, race, sector in which operational, renewable energy experience in years, qualification, occupation and current position.

Age group classification

Age grouping of correspondents was chosen in question 1.1 and the age distribution of the correspondents can be seen in Table 7.

Table 7: Age distributions for question 1.1

Age group	Count	Percentage
≤29	3	12%
30 – 39	10	40%
40 – 49	5	20%
50 – 59	5	20%
60+	2	8%
Total	**25**	**100%**

Gender of respondents

Table 8 depicts the output on question 1.2 – gender of the correspondents in this research.

Table 8: Gender distribution

Response	Chart	Percentage	Count
Male		88%	22
Female		12%	3
	Total Responses		25

From the 25 correspondents almost 90% were male with only three (12%) female. Males outnumber their female counterparts 7:1 and the ratio shows that the stakeholders of the REIPPP are predominately male.

Racial group classification

Table 9 presents the race distribution of the participating respondents obtained from question 1.3.

Table 9: Race distribution

Response	Chart	Percentage	Count
Asian		4%	1
Black		20%	5
Coloured		0%	0
Indian		4%	1
White		64%	16
Other, please specify...		8%	2
	Total Responses		25

The majority of the correspondents were white. 84% of the population group is represented by White (64%) and Black (20%). The other 16% include Asian, Indian and other. The other was Coloured and European.

Sectoral group classification

In Table 10 the relevant sectors represented and obtained from question 1.4 was illustrated. Taking into account that the other specified sector (4%) was a public entity, i.e. municipality, the bulk of the correspondents were from the private sector (64%) while the rest (32 + 4 = 36%) were public sector.

Table 10: Sectoral division

Response	Chart	Percentage	Count
Private		64%	16
Public		32%	8
Voluntary		0%	0
Other, please specify...		4%	1
	Total Responses		25

Experience in years in the renewable energy field

The experience in years in the renewable energy field data fed into question 1.5 is presented in Table 11. Only 24% of the population group has 6 or more years' experience while the larger part of the population (68%) had between 1-5 years of renewable energy experience.

Table 11: Years' experience distribution

Response	Chart	Percentage	Count
None		4%	1
<1		4%	1
1		16%	4
2		8%	2
3		12%	3
4		12%	3
5		20%	5
6		8%	2
7		8%	2
8		0%	0
9		0%	0
10+		8%	2
	Total Responses		25

Highest academic qualification achieved by respondents

The qualifications obtained by the survey respondents in reply to Question 1.6 is presented in Table 12 and illustrated in Figure 14.

Table 12: Qualification distribution

Qualification	Number	Percentage
< Grade 12	0	0%
Grade 12	1	4%
Diploma	3	12%
Degree	12	48%
Post-graduate degree	8	32%
Not indicated	1	4%
Total	**25**	**100%**

The larger section of the respondents (80%) had a degree or post-graduate degree. The other 20% was sub divided in diplomas and G12 certificates. Only one person did not want to indicate the level of qualification he/she had.

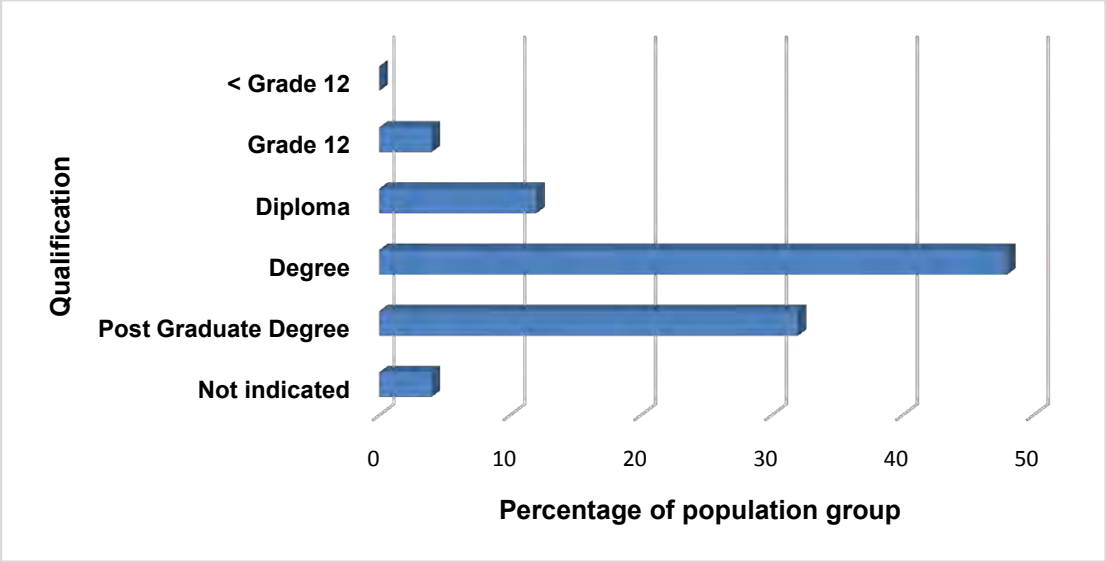


Figure 14: Qualification distribution: Visual representation

Current occupations and position of respondents

The respondents held various occupations and occupied a range of positions. This was provided by question 1.7 and 1.8. When it comes to occupation, the bulk of the correspondents were engineers, investment bankers, managers, developers and directors as seen in Table 13.

Table 13: Occupation distribution

Occupation	Number	Percentage
Engineer	6	24%
Investment banker	3	12%
Manager	3	12%
Developer	2	8%
Director	2	8%
Contractor	1	4%
Coordinator	1	4%
Counsellor	1	4%
Economist	1	4%
Manufacturer	1	4%
Ombudsman	1	4%
Renewable Energy Specialist	1	4%
Scientist	1	4%
Town Planner	1	4%
Total	**25**	**100%**

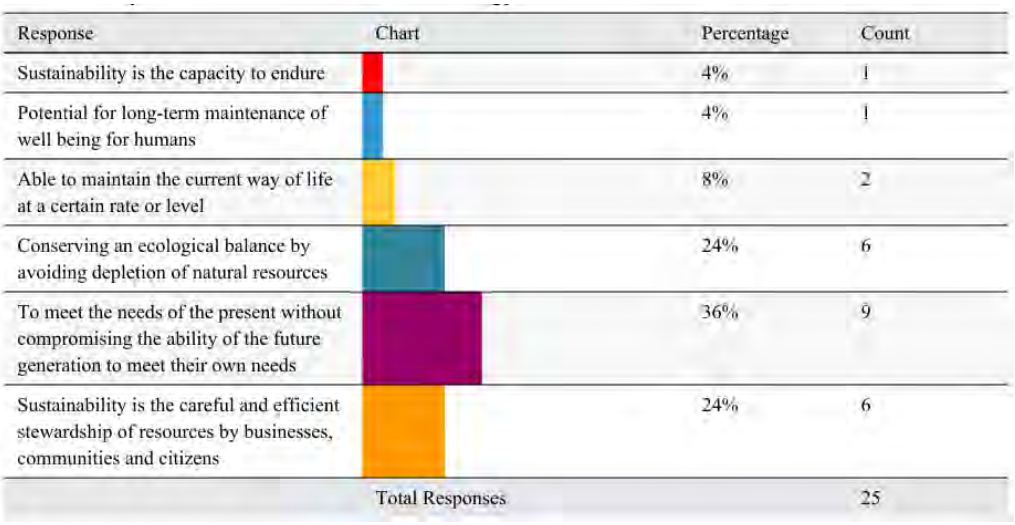
The larger section of the respondents (50%) held high work positions, i.e. managers, directors and associates of managers. The other 50% is subdivided into various other positions which help provide a diversified and even bottom-up input.

Table 14: Work position distribution

Current position	Number	Percentage
Manager	10	40%
Director	3	12%
Associate	2	8%
Head of technical services	1	4%
Investment Analyst	1	4%
Local Economic Development Officer	1	4%
Ombudsman	1	4%
Principal Consultant	1	4%
Professor	1	4%
Renewable Energy Specialist	1	4%
Town Planner	1	4%
Transaction Coordinator	1	4%
Ward Councillor	1	4%
Total	**25**	**100%**

4.2.3 Respondent's personal definition and philosophy of sustainability

To put the correspondents feedback into perspective their definition and philosophy of



Response	Chart	Percentage	Count
Sustainability is the capacity to endure		4%	1
Potential for long-term maintenance of well being for humans		4%	1
Able to maintain the current way of life at a certain rate or level		8%	2
Conserving an ecological balance by avoiding depletion of natural resources		24%	6
To meet the needs of the present without compromising the ability of the future generation to meet their own needs		36%	9
Sustainability is the careful and efficient stewardship of resources by businesses, communities and citizens		24%	6
	Total Responses		25

Figure 15: Respondents' definition of sustainability

Sustainability was tested. The respondents were given 6 academic definitions of sustainability in question 2.1 and they had to select the option that best suited their own definition of sustainability.

The larger section of the correspondents' definition of sustainability, as seen in Figure 15 above, was between three definitions namely "*Conserving an ecological balance by avoiding depletion of natural resources*", "*Sustainability is the careful and efficient stewardship of resources by business, communities and citizens*" (both 24%), with the largest section (36%) allocated to the definition of "*To meet the needs of the present without compromising the ability of the future generation to meet their own needs*". The other 16% of the correspondents were distributed between the other three provided definitions of sustainability.

Response	Chart	Percentage	Count
Presently not relevant and necessary		0%	0
People, profits and economy should come first, sustainability second.		0%	0
Good idea, but it is an ideal not easy to achieve in practice.		4%	1
Sustainability has some significance and should be achieved to some extent		24%	6
Critically necessary and relevant; all businesses and projects should be aligned with sustainability objectives		68%	17
Other, please specify...		4%	1
	Total Responses		25

Figure 16: Respondent's philosophy on sustainability

Most of the correspondent's (92%) philosophy on sustainability, as seen in Figure 16, was between two concepts, i.e. "*Sustainability has some significance and should be achieved to some extent*" (24%) and "*Critically necessary and relevant; all businesses and projects should be aligned with sustainability objectives*" (68%). The rest was divided into two other philosophies i.e. "*Good idea, but it is an ideal not easy to achieve*" and another person gave his/her own philosophy on sustainability: "*The production of energy in South Africa should be opened up to all in a normal competitive market and not be government controlled as is the current scenario*".

4.3 Presentation of results: Quantitative and qualitative

Question 3 and 4 of the questionnaire presented the core section of the research, i.e. the identification and rating of provided control drivers. Initially the respondents needed to rate the level of impact and controllability of control drivers critical for the sustainability of the REIPPP programme. Thereafter the respondents were given the opportunity to select control drivers ruled out by the author and subsequently rank them. If the respondent were opinionated that there were other control drivers critical to the sustainability of the REIPPP programme and were not mentioned at all, he/she could qualitatively provide their own drivers which needed to be rated the same as before. Obtaining rating values on all control drivers (provided, alternative and self-suggested) made it possible to compare them quantitatively.

4.3.1 Quantitative: Rating on impact and controllability of provided control drivers

The respondents rated each control driver using a 1 to 10 point scale for impact and controllability. The 1 to 10 point scale was used for all control drivers and the mean rating for impact and controllability was calculated from output as seen in appendix H. Mean values can be seen in table

15. The priority value is calculated as discussed in chapter 3 and the control drivers were ranked accordingly.

Table 15: Prioritised critical control drivers based on respondent rating

Nr	Control drivers rated by respondents	Impact Mean	Control Mean	*Priority value
Economic				
C1.1	Funding for the renewable energy Independent Power Producer Procurement Programme (REIPPPP)	7.96	5.50	**43.77**
C1.2	Partnerships and consolidation of both local and foreign companies to promote local manufacturing of international standardised renewable energy products	6.88	5.48	**37.70**
C1.3	Greater dialogue between Government, Eskom, Independent Power Producers (IPPs), financiers and industry during REIPPP programme period	7.08	5.29	**37.48**
C1.4	Governmental policies regarding the future of renewable energy implementation during the REIPPP programme period	8.12	4.48	**36.38**
C1.5	Current Governmental implementation of REIPPP processes	7.29	4.67	**34.03**
C1.6	General decrease of feed-in tariffs (FiT) for renewable energy technology over the REIPPP programme period	6.43	4.70	**30.22**
C1.7	Upgrade of and new connections on transmission network/system	7.54	3.83	**28.91**
C1.8	Materialisation of the independent system market operator (ISMO)	6.23	3.38	**23.21**
Environment				
C2.1	Protection and enhancement of biodiversity	6.21	4.83	**30.01**
C2.2	Emissions, effluents and waste due to construction phase of IPP plants	4.72	6.09	**28.91**
C2.3	Effect on water sources during IPPs plant lifetime	4.91	5.77	**28.36**
C2.4	South African policy to address climate change by reducing greenhouse gases (GHG)	6.61	4.09	**27.04**
C2.5	Volume and weight of materials used by IPPs during construction phase	5.13	4.88	**24.98**
C2.6	Current South African transport and logistics infrastructure for renewable energy	5.79	4.29	**24.68**
Social				
C3.1	Workforce training and education	6.88	5.74	**39.46**
C3.2	Employment and employment practices by IPPs	6.35	5.39	**34.22**
C3.3	Development of a representative community platform to collaborate on community benefits issues	6.46	5.08	**32.83**
C3.4	Current labour relations and restrictive regulations between IPPs and South African local workforce	6.42	4.71	**30.21**
C3.5	Future price increase of electricity, especially for the general public	7.96	4.26	**29.64**

C3.6	Engagement of IPPs with policymakers (DoE, DTI, DBSA and IDC) to reform the bidding requirements and consequently provide better support for the community benefit process	6.54	4.46	**29.16**
C3.7	Diversity and equal opportunity for jobs and equity	5.61	4.96	**27.80**
C3.8	Local communities having access to electricity generated by IPP plants	4.65	4.04	**18.81**

**Priority value = Impact (mean) value x Controllability (mean) value.*

4.3.2 Qualitative: Comments on provided control drivers

The results are discussed by sustainability dimensions as provided below. Take note that only the language and spelling was corrected; the content of the feedback was left unchanged.

Economic dimension

The qualitative feedback obtained in terms of the economic dimension was very specific. According to Mr Malgas, the deputy director, corporate businesses, of the Ubuntu Municipality, the Government made it possible for the implementation of renewable energy but companies and contractors do not care.

On the other hand Mr Jakob Basson, a technical assistant manager of Siyathemba Municipality, states that the Government policy needed to be expanded during the REIPPP programme period. Mr Basson also stated that the huge financial guarantees were at the expense of economic growth and that the upgrade and new grid connection is too slow to accommodate the new developments. Mr Basson continued to say that the implementation of the REIPPP was not properly planned and that, when it came to funding for the programme, it was difficult for South African businesses to enter the renewable energy industry.

Mr Antony Corin, Director of SlimSun Pty. Ltd., commented on the decrease of FiT as irrelevant when it came to the economic dimension.

Environment Dimension

Mr Jakob Basson mentioned that waste management was a problem for municipalities. He also stated that, when it came to the logistics and transport infrastructure, South African business was not ready and there was a risk for humans. Mr Basson also voiced his concern on damage to plant species.

Dr Andile Gxasheka, a renewable energy specialist for NERSA, said that in his own professional opinion the transport and logistics infrastructure for renewable energy was out of NERSA's mandate and that emission, effluent and waste of IPP plants was beyond NERSA's control. Water affected during IPP plant lifetime was also beyond NERSA's control and the impact of policies regarding GHG all depended on the specific Government policy.

Social Dimension

Mr Jakob Basson stated that there was very little training and lack of proper planning when it came to the workforce and training driver and that there existed skill shortages when it came to the diversity and equal opportunity aspect. Dr Gxasheka stated that the workforce training and education depended on the IPP economic/social development obligations made with DoE. According to Mr Basson, when it came to employment and employment practices, the IPPs did not comply with their bidding requirements and there was little involvement by especially the treasury when policies for local development were created.

On the other aspects, Mr Basson was opinionated that NERSA should manage the aspect of electricity and access to local communities. Dr Gxasheka stated that, for some projects, new power lines would reach areas with rural communities and therefore should assist in providing power to nearby communities. Ms Thepiso Mufamadi, Investment analyst of the Public Investment Corporation (PIC), commented that electricity access of the local communities, and diversity and equal opportunities, was not yet measureable and that according to her, the projects were too premature to provide a rating in this research.

4.3.3 Quantitative: Alternative drivers selected and rated by correspondents

Control drivers that were ruled out based on their priority value calculated by the author, were provided to respondents in question 4 of the questionnaire. If the respondent believed that one or more of the alternative drivers should receive higher priority than those presented in question 3, he/she would select the alternative drivers and provide a rating in a similar fashion as the drivers in question 3. The number of chosen alternative control drivers can be seen in table 16 below.

Selected alternative drivers

The alternative drivers that were highly suggested by the population group (40% or more) were "*Enabling legislation for renewable energy in South Africa*" (63%), "*Future electricity demand*" (53%), "*Implementation of cost effective energy storage"* (43%) and "*Government's preference of renewable energy technology*" (43%). Drivers that were suggested by approximately one third of the population group were "*Increasing localisation demands and its associated threshold decrease*" (33%), "*Development and implementation of nuclear power generation in South Africa*" and "*Amendments of latest REIPPP documentation requirements*". The rest of the alternative drivers selected were 27% and below.

Table 16: Alternative drivers selected by correspondents

Response	Chart	Percentage	Count
Increasing localisation demands and its associated threshold decrease		33%	10
Crime and theft: Direct and indirect losses due to high cable and electricity theft		23%	7
Materialisation of small scale renewables		27%	8
Corruption and fraud on key stakeholder level for REIPPP		23%	7
Amendments of latest REIPPP documentation requirements		30%	9
Development and implementation of nuclear power generation in South Africa		33%	10
Targeted research to develop good practice recommendations for REIPPP		17%	5
Full scale Implementation of shale gas mining (fracking) in South Africa		13%	4
Implementation of cost effective energy storage facilities		43%	13
Enabling legislation for renewable energy in South Africa		63%	19
Global renewable energy growth forecast		17%	5
Future electricity demand projection		53%	16
SA moving to base load IPP procurement plan		20%	6
Addressing source measurement issues for wind and sun		20%	6
Successful output performance of first IPPs like Kalkbult		7%	2
Governments preference of renewable energy technology		43%	13
None		3%	1
	Total Responses		30

Alternative driver ratings for impact and controllability

As discussed in chapter 3, the alternative drivers are the control drivers ruled out by the author and were presented to be selected and ranked by the correspondents in question 3 of the questionnaire. Alternative drivers were prioritised according the calculated priority value as seen in Table 17 (Priority value = Impact mean value x Controllability Mean value).

Table 17: Prioritised alternative control drivers based on respondent rating

Nr.	Alternative Control Drivers selected and rated by respondents	Impact Mean	Control Mean	Priority Value
A1	Targeted research to develop good practice recommendations for REIPPP – *Economic*	7.40	7.20	**53.28**

A2	Successful output performance of first IPPs like Kalkbult	9.00	5.50	**49.50**
A3	Full-scale implementation of shale gas mining (fracking) in South Africa – *Economic*	6.67	7.33	**48.89**
A4	Development and implementation of nuclear power generation in South Africa – *Economic*	7.63	6.28	**47.85**
A5	Implementation of cost effective energy storage facilities – *Economic*	9.00	5.18	**46.64**
A6	Materialisation of small scale renewables – *Economic*	7.88	5.63	**44.30**
A7	Addressing source measurement issues for wind and sun – *Economic*	6.67	6.00	**40.00**
A8	Enabling legislation for renewable energy in South Africa – *Economic*	8.50	4.44	**37.72**
A9	Government's preference of renewable energy technology – Economic	8.08	4.58	**37.04**
A10	Crime and theft: Direct and indirect losses due to high cable and electricity theft – *Social*	7.40	4.80	**35.52**
A11	Increasing localisation demands and its associated threshold decrease - *Economic*	7.11	4.78	**33.98**
A12	Future electricity demand projection – *Economic*	8.23	4.00	**32.92**
A13	Amendments of latest REIPPP documentation requirements – *Economic*	7.33	4.44	**32.56**
A14	Corruption and fraud on key stakeholder level for REIPPP - *Social*	7.80	3.20	**24.96**
A15	SA moving to base load IPP procurement plan – *Economic*	7.33	3.17	**23.22**
A16	Global renewable energy growth forecast – *Economic*	6.75	3.00	**20.25**

Take note that the number of respondents who selected and rated the alternative drivers, as seen in Table 17, was not the same number as Table 15. The average number of respondent input for the provided control drivers was 23, while the number of respondents selecting and ranking alternative drivers ranged between 2 and 16; shown in the number of selection column of Table 18: Alternative control drivers ranked according to number of respondent selections. The reason for the variation was because the respondent had the opportunity to personally select alternative control drivers, which was not the case with the provided control drivers.

Table 18: Alternative control drivers ranked according to number of respondent selections

Nr.	Alternative Control Drivers	Priority Value	Number of selection
A8↑	Enabling legislation for renewable energy in South Africa	37.72	**16**
A12↑	Future electricity demand projection	32.92	**13**
A9↑	Government's preference of renewable energy technology	37.04	**12**
A5↑	Implementation of cost effective energy storage facilities	46.64	**11**
A11↑	Increasing localisation demands and its associated threshold decrease	33.98	**9**
A13↑	Amendments of latest REIPPP documentation requirements	32.56	**9**
A4↓	Development and implementation of nuclear power generation	47.85	**8**

	in South Africa		
A6↓	Materialisation of small scale renewables	44.30	**8**
A15↑	SA moving to base load IPP procurement plan	23.22	**6**
A1↓	Targeted research to develop good practice recommendations for REIPPP	53.28	**5**
A10↓	Crime and theft: Direct and indirect losses due to high cable and electricity theft	35.52	**5**
A14↑	Corruption and fraud on key stakeholder level for REIPPP" Please rate	24.96	**5**
A16↑	Global renewable energy growth forecast	20.25	**4**
A3↓	Full scale Implementation of shale gas mining (fracking) in South Africa	48.89	**3**
A7↓	Addressing source measurement issues for wind and sun	40.00	**3**
A2↓	Successful output performance of first IPPs like Kalkbult	49.50	**2**

**Symbol meaning: ↑/↓ means the alternative driver moved up/down from table 17 based on the number of selection.*

To account for the difference in number of respondents a weighted average was used to determine the correct priority value of each alternative driver. The highest number of alternative driver selection was 16 respondents. That means the priority value of each alternative driver was multiplied with x/16 and ranked according to the new priority value as seen in Table 19.

x = number of alternative driver selection.

Table 19: Alternative drivers ranked according to the weighted average

Nr.	Alternative Control Driver	Priority Value	Count of Selection	New Priority Value
A8↑	Enabling legislation for renewable energy in South Africa	37.72	**16**	37.72
A5↑	Implementation of cost effective energy storage facilities	46.64	**11**	32.065
A9↑	Government's preference of renewable energy technology	37.04	**12**	27.78
A12↑	Future electricity demand projection	32.92	**13**	26.7475
A4↓	Development and implementation of nuclear power generation in South Africa	47.85	**8**	23.925
A6↓	Materialisation of small scale renewables	44.3	**8**	22.15
A11↑	Increasing localisation demands and its associated threshold decrease	33.98	**9**	19.1138
A13↑	Amendments of latest REIPPP documentation requirements	32.56	**9**	18.315
A1↓	Targeted research to develop good practice	53.28	**5**	16.65

	recommendations for REIPPP			
A10↓	Crime and theft: Direct and indirect losses due to high cable and electricity theft	35.52	**5**	11.1
A3↓	Full scale Implementation of shale gas mining (fracking) in South Africa	48.89	**3**	9.16688
A15↑	SA moving to base load IPP procurement plan	23.22	**6**	8.7075
A14↑	Corruption and fraud on key stakeholder level for REIPPP") Please rate	24.96	**5**	7.8
A7↓	Addressing source measurement issues for wind and sun	40	**3**	7.5
A2↓	Successful output performance of first IPPs like Kalkbult	49.5	**2**	6.1875
A16↑	Global renewable energy growth forecast	20.25	**4**	5.0625

When comparing the priority values of the alternative vs. provided control drivers there are 6 drivers (A1-A6) that have a higher priority value than highest value in section 4.3.1 (i.e. C1.1) and no alternative driver has a lower priority value than the lowest priority value of section 4.3.1 (i.e. C3.8). Most of the alternative drivers were economic drivers, with only two (A10 & A14) social.

Unlike with the input rate on provided control drivers in question 3 of the questionnaire and presented in 4.3.1, the number of inputs on the alternative drivers differs. Respondents only needed to rate an alternative control driver if he/she selected the driver. The number of selection can be seen in Table 18 and the alternative control drivers were ranked accordingly.

Ranking the alternative drivers according to the number of selection as seen in Table 18, depicts a different sequence than in Table 17. Most of the lower ranked alternative drivers in table 17 shifted up, while the rest, i.e. A1, A2, A3, A4. A6 and A7 shifted down.

One reason for drivers shifting down could be that the alternative drivers selected by a lower number of respondents were assigned too unrealistic high impact and controllability values; values that could have decreased and/or normalised if other respondents were to rank these alternative drivers as well. On the other hand, if the ranking of the few respondents was accurate, this could indicate that a stakeholder who did not select and ranked these drivers was not fully aware of the true implication of other control drivers. However, the proposed way to compare the control drivers quantitatively was to use the priority value.

4.3.4 Qualitative and quantitative: Self-suggested drivers provided by correspondents

After the respondents rated the provided control drivers, selected and rated alternative drivers that were ruled out by the author, the respondents were given the opportunity to formulate their own self-defined drivers as seen in Table 20. This assisted towards completeness and as the

correspondents deal with these drivers directly, areas were covered that were not mentioned by the author.

Table 20: List of self-suggested control drivers provided by respondents

Nr.	Self-suggested control drivers	Impact Mean	Control Mean	*Priority value
S1	Unbundling of Eskom	10	5	**50**
S2	Contribution to upgrade of bulk services towards local municipalities	7	6	**42**
S3	Certainty of MW allocation per technology per year in IRP	10	3	**30**
S4	Availability of land with development permits	9	3	**27**
S5	Municipal level acceptance for Nett Metering for residential and small businesses to encourage small scale renewables	9	3	**27**
S6	Availability of skilled labour and machinery	7	3	**21**
S7	Availability and equal access to grid	9	2	**18**
S8	Abundance of input resources	4	4	**16**
S9	Timeline to authorisation of EIA and appeals process	8	2	**16**
S10	Ratio of preferred bidders to bidders in subsequent rounds of REIPPPP	16	2	**16**
S11	Impact on Birds and bats during operational phase	6	2	**12**
S12	Demand for power in new developing areas	5	2	**10**
S13	The rate of return on IPP project	10	1	**10**
S14	REIPPP bidding windows	10	1	**10**

The priority value of each driver was calculated based on the correspondent's rating. There was only one suggested control driver that had a higher priority value than the highest value in section 4.3.1 and 8 (i.e. S7-S14) of the self-suggested control drivers that had a lower priority value than the drivers presented in section 4.3.1. The priority values of the self-suggested drivers were used in chapter 5 for comparison purposes.

**Priority Value = Level of impact x level of controllability.*

4.3.5 Qualitative: General results

During the research various relevant general qualitative research inputs were obtained. Some were obtained from the questionnaire, while others were obtained from telephonic discussions. These inputs are covered in this section.

Telephone feedback with stakeholders

The author spent more than 66 hours on the telephone to obtain email addresses, confirm email delivery and to follow up on requests. From the telephonic discussions a small section of the municipalities did not know about the IPP projects in their area, while those who knew about their existence did not know much about the project or what their role should be in terms of the economic development. A few municipalities or community representatives expressed their direct concern and even disappointment when it came to the IPPs municipality/community involvement. Initial meetings between communities and IPPs resulted in fruitless direct community benefits, promises made were not met and involvement of municipalities in some cases was limited to only a few meetings.

One respondent from the Western Cape area stated that the development agencies in Western Cape does not necessarily follow the same policies and procedures as in the rest of the nation and that their input would most probably differ from that of the rest of the respondents. The reason for this statement was due to the Western Cape provincial Government policies and regulations, which was put in place by the Democratic Alliance (DA). The other 8 provinces were controlled by the same political party – the African National Congress (ANC).

A number of correspondents were interested in the author's research and requested feedback on the final results.

Additional comments: From the questionnaire

The final question of the questionnaire provided the respondent the opportunity to provide any additional information that could be helpful and relevant to the research. The following statements were made.

"*The developers* [IPPs] *all enter into socio-economic programs, e.g. providing clinics, sports fields, school, crèches etc. for the benefit of the local community. If a Local Authority does not have sufficient bulk services this cannot be developed. Rather get them to contribute to the upgrade of bulk services, then the whole community will benefit.*" – Town and Regional Planner of Kouga Municipality, Mr Danie Rautenbach.

"Sorry, but do not have enough time to apply my mind to the questionnaire for the time allowed to complete. [I] would be prepared to assist, but workload too much to complete in an objective way." – Development manager of Blue Crane Development Agency, Mr Nico Lombart.

4.4 Statistical analysis

The total research population (N) were individuals involved in the REIPPP programme with the key stakeholders as the sample group. Large enough samples tend towards normality, i.e. the sampling distribution of the mean/average is more or less normally distributed. Non-parametric

tests and methods were used in this study as most of the distributions are unknown and not normally distributed. Non-parametric methods are more robust methods for analysing data in terms of violating assumptions such as normality and homogeneity (Levine *et al.*, 2008).

Take note of the lack of data due to a low input as only 25 questionnaires were completed, which made it difficult to do a full-scale statistical analysis. There were various reasons for the low input, including the limited sample size, confidentiality reasons and time constraints.

Only some statistical analyses were done for reliability and correlation purposes. There may be reliability and correlation to some extent, but it should be interpreted in the limited data context. Original statistical processed information can be viewed in Appendix K.

4.4.1 Sectoral group variance (t-test)

T-test's effect size

The t-test and ANOVA is two variance analyses techniques used to assess whether the means of a group differ from one another. The t-test compares two groups while ANOVA examines three or more groups.

All the feedback can be categorised into two sectors; i.e. Private and Public. The t-test was used to determine if there was a significant difference between the Private and Public views on the sustainability impact of control drivers. One of the reasons for this comparison was because the business goals and objectives of each sector were different. The private sector is profit-driven while the public sector aims at delivering a service which should benefit the general public (Lanchman, 1985:671).

Questions were grouped according to the three main sustainability dimensions and the effect size value for the t-test calculated. The t-test's effect size indicates whether or not the difference between two groups' means was large enough to have practical meaning or statistical significance. Effect size ranking is as follows (Statwing, 2013):

- 0.2 small effect
- 0.5 medium effect
- 0.8 large effect

Table 21: Effect size between Private and Public sector

Sustainability dimension	Sector	N	Effect size values
Economy	Private	16	0.52
	Public	9	
Environment	Private	16	0.34

	Public	8	
Social	Private	16	0.45
	Public	8	

The effect size for each dimension is medium to small. Economy (0.52) and social (0.45) presents a medium and small-to-medium effect respectively, while environment (0.34) lies between small to medium.

Statistical significance

Similar to the effect size, the statistical significance was calculated. This helped determine whether or not the difference between two groups' means most likely reflects a "real" difference in the population from which the two groups were sampled (Statwing, 2013) (Trichim, 2006).

A p-value smaller than 0.05 indicates significant difference between groups and calculated p-values can be seen in Table 22. These values were calculated with equal variances assumed and not-assumed.

Table 22: Statistical significance p-values

Sustainability dimension	Variances assumed	p-value
Economy	Equal variances assumed	.080
	Equal variances not assumed	.171
Environment	Equal variances assumed	.352
	Equal variances not assumed	.408
Social	Equal variances assumed	.193
	Equal variances not assumed	.276

According to the p-values from the statistical analysis, as presented in Table 22, one can see that there was no significance difference between the private and public sector. The closest p-value to 0.05 was economy (0.08) for equal variance assumed. Take note that the above mentioned output did not necessarily mean there was no variance, but can be pointed out due to the small sample size.

4.4.2 Years of experience in renewable energy correlation (t-test)

T-test's effect size

Another two groups that were compared, were the 6 individuals that were renewable energy experienced (≥5 years' experience) vs. the 19 lower experienced (<5 years).

Table 23: Effect size between experienced and low experienced

Sustainability dimension	Years' experience	N	Effect size values
Economy	<5	19	0.30
	≥5	6	
Environment	<5	19	0.11
	≥5	5	
Social	<5	19	0.03
	≥5	5	

Only on the economy dimension (0.3) a small-to-medium effect value were obtained while the rest were less that 0.2 and consequently insignificant.

Statistical significance

For the experienced vs. low experienced groups all statistical significance p-values were way above 0.05, as seen in table 22. No real difference in the population was expected, but once again this can be due to the small sample size.

Table 24: Statistical significance p-values

Sustainability dimension	Variances assumed	p-value
Economy	Equal variances assumed	.496
	Equal variances not assumed	.534
Environment	Equal variances assumed	.734
	Equal variances not assumed	.815
Social	Equal variances assumed	.960
	Equal variances not assumed	.961

4.4.3 Cronbach's alpha (α): Reliability of provided control drivers

Cronbach's alpha was used to determine the reliability of the answered questionnaire. Values between 0 and 1 were returned and a value of 0.8 is generally accepted as the minimum when it comes to cognitive tests like intelligence tests. A cut-off of 0.6 can be used for ability and personal opinion tests. Grouping the answers according to these dimensions was verified by analysing the Cronbach's alpha value where the minimum cut-off of 0.6 was used (Field, 2009). The Cronbach's alpha value was calculated for all three sustainability dimensions and each driver was individually tested for reliability.

Economy dimension's Cronbach's alpha

The average Cronbach's alpha value of the economy dimension was 0.758 and this was for 8 economy control driver questions. Excluding each item from the economy dimension the Cronbach

value was also calculated. From Table 25 one can see that the Cronbach value will decrease for any question removed, which indicates that these questions have a good internal reliability.

Table 25: Cronbach's value if specific economic control driver was removed

Questions from economy dimension	Mean Impact	Std. Deviation	Cronbach's alpha if item deleted
1.1	8.120	1.9218	.683
1.2	6.880	1.9000	.736
1.3	7.542	2.0426	.725
1.4	7.292	2.3121	.715
1.5	7.083	1.8396	.739
1.6	6.435	2.1068	.776
1.7	6.227	1.7977	.760
1.8	7.958	2.1765	.718

Environment dimension's Cronbach's alpha

The environment Cronbach's alpha value was 0.632 and could reach the highest value of 0.667 if the driver of 2.2 was removed. For all other control drivers in Table 26 except 2.6 an alpha value lower than 0.6 will be attained, which means a lower reliability will be achieved. The reliability of environment's drivers was lower than that of economy, but was still acceptable as the values were above the minimum 0.6.

Table 26: Cronbach's value if specific environment control driver was removed

Questions from environment dimension	Mean Impact	Standard Deviation	Cronbach's alpha if Item Deleted
2.1	5.125	2.0917	.575
2.2	5.792	1.9106	.667
2.3	6.208	2.2454	.494
2.4	4.750	2.1315	.568
2.5	4.913	2.5922	.571
2.6	6.609	2.2711	.625

Environment dimension's Cronbach's alpha

A Cronbach value of 0.689 was obtained for the social dimension, but the internal reliability could be increased to 0.739 if driver 3.4 was removed. If each driver was excluded individually, all other

drivers except driver 3.3 would reach a value above 0.6. Only 3.6 would provide a higher value (0.699) than the running number of 0.689, while the rest (minus 3.4) would give lower than the current Cronbach's alpha value.

Table 27: Cronbach's value if specific social control driver was removed

Questions from social dimension	Mean Impact	Std. Deviation	Cronbach's alpha if Item Deleted
3.1	6.875	2.5076	.658
3.2	4.864	2.4358	.684
3.3	5.609	2.2103	.568
3.4	6.957	2.5669	.739
3.5	6.348	1.7992	.645
3.6	6.542	1.9556	.699
3.7	6.417	2.2826	.639
3.8	6.458	2.4668	.614

4.5 Interpretation of results

4.5.1 Gender and racial distribution of respondents

As discussed in chapter 3, section 0, the Government set out to increase the opportunities for black people and women in general with the REIPPP programme. From the survey only 12% of the sample group was female and the majority (64%) of the group was white. This could be due to the larger section of the sample group (more than 80%) that was 30 years or older and benefited from the past, having had the opportunity to study for a degree or post-graduate degree.

4.5.2 Sectoral group correlation; Public vs. Private

The response rate from the private sector (64%) was higher that the public sector, which could indicate one of two things. Firstly, the private sector was much more enthusiastic to participate in the research. Secondly the private sector plays a larger role when it comes to the REIPPP programme. Since the majority of the IPPs, lenders, developers and equity holders were from the private sector (Energize, 2013), this was to be expected.

Statistically there seem to be a small to medium significant difference between the feedback obtained from the public and private sectors.

- On environment only a small variance exist which showed that both public and private was on the same page when it came to the environment dimension. Almost 70% of both public and private saw sustainability as critically necessary, verifying the small variance.

- On the economy and social dimensions there existed a medium and small-to-medium significant difference respectively. As mentioned before, the difference could be due to their difference in goals and would consequently interpret and prioritise economy and/or social aspects differently.

- Further statistical analysis showed that, even though there were small to medium significant differences; the differences would most likely not reflect a real difference in the population.

4.5.3 Experience correlation between ≥5 vs. <5 years

Responded experience diversely ranges from 1 to 10, with the largest section in the middle (20%). The author believed that the input provided from the experienced (≥5 years) could be different from the lower-experienced (>5 year). If this was the case, the insights obtained from the more experienced individuals would weigh more in reliability than the lower experienced section of the sample group.

Statistically there was little to no significant difference between the lower-experienced and experienced groups. Economy is the only dimension of sustainability that has a small significant difference, but the rest is well below the minimum. Based on this statistical analysis, the outputs of the two groups were not interpreted separately.

4.5.4 Qualification, occupation and current position

It is interesting to note that the lion's share of the key stakeholder respondents attained a degree or post-graduate degree (80%), and that the larger section of the sample group size attained engineering, managers and/or director positions. The rest of the sample group consisted of individuals with diverse occupations and positions which can be interpreted that broad stakeholder involvement was necessary for the successful implementation of a Government programme.

4.5.5 Prioritised control drivers

To obtain and present the final prioritised control drivers, processing and integration of all the suggested control drivers were necessary. The provided control drivers, as seen in Table 15, were used as baseline. High-ranked alternative drivers were added to the provided control drivers and can be seen in Table 28 below. Self-suggested drivers were added or integrated with other relevant drivers. A legend is provided to ease interpretation:

Provided control drivers
Alternative control drivers
Self-suggested control drivers

Table 28: Prioritised control drivers

Economic				
NR	**Critical control driver**	**Impact Mean**	**Controllability Mean**	**Priority value**
C1.1	Funding for the renewable energy independent power producer procurement programme (REIPPPP)	7.96	5.5	**43.77**
A8	Enabling legislation for renewable energy in South Africa	8.5	4.44	**37.72**
C1.2	Partnerships and consolidation of both local and foreign companies to promote local manufacturing of international standardised renewable energy products	6.88	5.48	**37.7**
C1.3	Greater dialogue between Government, Eskom, Independent Power Producers (IPPs), financiers and industry during REIPPP programme period	7.08	5.29	**37.48**
C1.4	Governmental policies regarding the future of renewable energy implementation during the REIPPP programme period	8.12	4.48	**36.38**
C1.5	Current Governmental implementation of REIPPP processes	7.29	4.67	**34.03**
A5	Implementation of cost-effective energy storage facilities	9	5.18	**32.07**
C1.6	General decrease of feed in tariffs (FiT) for renewable energy technology over the REIPPP programme period	6.43	4.7	**30.22**
C1.7	Upgrade of and new connections on transmission network/system	7.54	3.83	**28.91**
A9	Government's preference of renewable energy technology	8.08	4.58	**27.78**
A12	Future electricity demand projection – *Economic*	8.23	4	**26.75**
A4	Development and implementation of nuclear power generation in South Africa	7.63	6.28	**23.93**
C1.8	Materialisation of the independent system market operator (ISMO)	6.23	3.38	**23.21**
A6	Materialisation of small scale renewables	7.88	5.63	**22.15**
A11	Increasing localisation demands and its associated threshold decrease - *Economic*	7.11	4.78	**19.11**
A13	Amendments of latest REIPPP documentation requirements – *Economic*	7.33	4.44	**18.32**
A1	Targeted research to develop good practice recommendations for REIPPP – *Economic*	7.4	7.2	16.65
A3	Full-scale Implementation of shale gas mining (fracking) in South Africa – *Economic*	6.67	7.33	**9.17**
A15	SA moving to base load IPP procurement plan – *Economic*	7.33	3.17	**8.71**
A7	Addressing source measurement issues for wind and sun – *Economic*	6.67	6	**7.5**
A2	Successful output performance of first IPPs like Kalkbult	9	5.5	**6.19**
A16	Global renewable energy growth forecast – *Economic*	6.75	3	**5.06**

Environment				
NR	**Critical control driver**	**Impact Mean**	**Controllability Mean**	**Priority value**
C2.1	Protection and enhancement of biodiversity	6.21	4.83	**30.01**
C2.2	Emissions, effluents and waste due to construction phase of IPP plants	4.72	6.09	**28.91**
C2.3	Effect on water sources during IPPs plant lifetime	4.91	5.77	**28.36**
C2.4	South African policy to address climate change by reducing greenhouse gases (GHG)	6.61	4.09	**27.04**
C2.5	Volume and weight of materials used by IPPs during construction phase	5.13	4.88	**24.98**
C2.6	Current South African transport and logistics infrastructure for renewable energy	5.79	4.29	**24.68**
S4 & S8	Availability of economical renewable energy resources and appropriate land	6.5	3.5	**22.75**
Social				
NR	**Critical control driver**	**Impact Mean**	**Controllability Mean**	**Priority value**
C3.1	Workforce training and education	6.88	5.74	**39.46**
C3.2	Employment and employment practices by IPPs	6.35	5.39	**34.22**
C3.3	Development of a representative community platform to collaborate on community benefits issues	6.46	5.08	**32.83**
C3.4	Current labour relations and restrictive regulations between IPPs and South African local workforce	6.42	4.71	**30.21**
C3.5	Future price increase of electricity especially for the general public	7.96	4.26	**29.64**
C3.6	Engagement of IPPs with policymakers (DoE, DTI, DBSA and IDC) to reform the bidding requirements and consequently provide better support for the community benefit process	6.54	4.46	**29.16**
C3.7	Diversity and equal opportunity for jobs and equity	5.61	4.96	**27.8**
C3.8	Local communities having access to electricity generated by IPP plants	4.65	4.04	**18.81**
A10	Crime and theft: Direct and indirect losses due to high cable and electricity theft – *Social*	7.4	4.8	**11.1**
A14	Corruption and fraud on key stakeholder level for REIPPP - *Social*	7.8	3.2	**7.8**

Integration of alternative drivers

Using the priority value as a measurement tool, the provided and alternative control drivers could be integrated as seen above in Table 28. Some of these added alternative drivers (A1, A2, A3, A7,

A10, A14 and A16) were selected by less than a 1/3 of the sample group. Alternative drivers should be interpreted within the last mentioned context.

Integration of self-suggested drivers

Most of the self-suggested drivers could be integrated or divided up into drivers already mentioned by the author.

Self-suggested drivers S4 and S8 were merged as one driver and added to the prioritised control drivers. The integration of the rest was based on relevance and/or could be resolved by already mentioned drivers. The integration of each self-suggested driver was as follows:

S1 – Unbundling of Eskom

A15: SA moving to base load IPP procurement plan.

C1.8: Materialisation of the independent system market operator (ISMO).

S2 – Contribution to upgrade of bulk services towards local municipalities

C3.2: Development of a representative community platform to collaborate on community benefits issues.

C3.6: Engagement of IPPs with policymakers (DoE, DTI, DBSA and IDC) to reform the bidding requirements and consequently provide better support for the community benefit process.

S3 – Certainty of MW allocation per technology per year in IRP

C1.4: Governmental policies regarding the future of renewable energy implementation during the REIPPP programme period.

S5 – Municipal level acceptance for Nett Metering for residential and small businesses to encourage small scale renewables

A6: Materialisation of small scale renewables.

S6 – Availability of skilled labour and machinery

C3.1: Workforce training and education.

C3.2: Employment and employment practices by IPPs.

S7 – Availability and equal access to grid

C1.7: Upgrade of and new connections on transmission network/system.

C1.8: Materialisation of the independent system market operator (ISMO).

S9 – Time-line to authorisation of EIA and appeals process

C1.5: Current Governmental implementation of REIPPP processes.

A8: Enabling legislation for renewable energy in South Africa.

A13: Amendments of latest REIPPP documentation requirements.

S10 – Ratio of preferred bidders to bidders in subsequent rounds of REIPPPP

C1.5: Current Governmental implementation of REIPPP processes.

A13: Amendments of latest REIPPP documentation requirements.

S11 – Impact on birds and bats during operation phase

C2.1: Protection and enhancement of biodiversity.

S12 – Demand for power in new developing areas

A12: Future electricity demand projection.

S13 – The rate of return on IPP project

C1.1: Funding for the renewable energy Independent Power Producer Procurement Programme (REIPPPP).

A2: Successful output performance of first IPPs like Kalkbult.

S14 – REIPPP bidding windows

C1.5: Current Governmental implementation of REIPPP processes.

Self-suggested driver **S4 "Availability of land with development permits"** and **S8 "Abundance of input resources"** were merged to: "***Availability of economical renewable energy resources and appropriate land***". The last mentioned driver covers the availability of appropriate land and the high renewable energy potential South Africa has. The priority value was 22.75; obtained from the mean values allocated by the respondents on S4 and S8. This self-suggested driver was more environmental orientated and allocated as such.

4.5.6 Reliability of provided control drivers

The reliability of the grouped questions was good and acceptable as discussed in Section 4.4.3. Cronbach's values were calculated for each sustainability dimension and each aspect/question was individually tested. In general the alpha value was above minimum and the internal reliability value can be increased by removing/replacing some of the sustainability aspects/questions.

4.5.7 Follow-up interview

A list of interview questions were compiled with the top five critical control drivers. These questions were set out to elicit information on what needed to be done to promote the sustainability of the

REIPPP programme. The following is the list of answers per critical control driver (see Appendix I for follow up interview questionnaire).

Take note, even though Eskom as buyer and ABB as IPP had the opportunity to take part in the interview, they unfortunately did not. Eskom was of the view that the DoE would provide the answers to the interview questions and ABB never finalised a meeting in spite of multiple follow-up calls and email requests. Dr Marengo's answers were based on his personal opinion and do not necessarily represents the view of NERSA.

I. Funding for the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)
Status quo • *Local financial market is big enough* to support the REIPPP programme to a certain extent - **DoE** (Ngobeni, 2014). Based on the target set out by the IRP 2010 and small modular cost of renewable energy plants *funding in the near future will not be a problem*; even from outside of South Africa funding will be available - **IDC** (Badenhorst, 2014). • *Simplified PPP structure and financial documentation was used* for the REIPPP projects which served as a good baseline and provided the necessary credit history when it comes to partnering with the South African Government –**Nedbank Capital** (Jugmohan, 2014). • *Debt of large banks can be sold to provide more funding for future projects.* After a renewable energy IPP plant is de-risked, the debt to that plant can be sold to pension or bond financiers (Badenhorst, 2014). Debt can be redistributed, because it is made possible by the REIPPP documentation and banks like Nedbank are very strict in terms of their project requirements and documentation (Jugmohan, 2014). • *Financiers are much more lenient on payback* when it comes to green energy funding. The reason is due to the goodwill and ideal of green renewable energy generation (Jugmohan, 2014). • *There is no issue with a willing off-taker within the foreseeable future*. When it comes to the off-taker within the REIPPP programme a willing buyer/willing concept was achieved. Eskom will serve as off-taker as long as the IRP 2010 provides for renewable energy capacity. Of the total energy generation 30% must come from the private sector (IPPs) and Eskom will provide the balance (Ngobeni, 2014). With the increasing need for electricity we have in South Africa, obtaining a willing off-taker would not be a problem (Jugmohan, 2014). • *Slim to no chance of collusion between IPPs* as there are just too many developers. CSP is

about the only technology that could have a too high FiT, but this is due to low competition and their storage capability (Badenhorst, 2014).

Recommendations

- *Local currency should be used for funding* as far as possible. Government wants to protect the South African economy from electricity price rise due to the volatility of the ZAR. The increase of fuel prices serves as a good example (Ngobeni, 2014).

- *Creative means of foreign funding should be investigated* as the DoE would like to fund other energy programmes in the future. At the same time Government would like to protect the consumer from electricity price increase due to foreign investment. (Ngobeni, 2014).

- *A balance between making a profit and achieving the optimum benefit for the South African community* must be maintained. As long as this balance is achieved funding will be made available (Jugmohan, 2014).

- *Competition between IPPs is necessary* as it forces the IPPs to keep their FiT low or at least market-related. By having competition the DoE's complex responsibility of determining the FiT was addressed. Very low FiTs were achieved by window 3; even comparison to international tariffs (Jugmohan, 2014) (Ngobeni, 2014). Competition keep the FiT market related and participants honest (Badenhorst, 2014).

- *Limit MW capacity per technology per window* to synthetically decrease need and increase supply. This also puts pressure on competitors to bring down their FiT even more – Rand Merchant Bank (**RMB)** (Zinman, 2014).

- *As long there is no form of ISMO, Government must play their part to ensure there will be off-takers* (Jugmohan, 2014) (Marengo, 2014). With an ISMO IPPs will participate as the financial potential is large enough, even with no guaranteed off-taker (Badenhorst, 2014).

- *Monitoring and reporting of successful IPPs* in terms of performance and adhering to social development obligations. If IPPs perform very well, funding for more projects can be motivated and potentially made available (Marengo, 2014).

- *Government as procurer needs to stay in touch with banks* to be informed about their fund availability and when they would reach their funding cap. If one of the 5 systemic banks were to be in trouble the indirect effect it will have on the economy would be undesirable (Jugmohan, 2014).

- *Good communication between Government and local banks.* Local banks that would like to

redistribute their debt need to communicate it through to the procurer (Jugmohan, 2014).

- *Municipalities and/or energy intensive businesses could serve as off-takers.* Unfortunately there are many challenges and barriers to overcome like municipalities' current revenue structure and not being able to trade electricity on a national level (Ngobeni, 2014). Once again an ISMO is needed to address some of these issues.

- *FiT should continuously be benchmarked with international prices* (Marengo, 2014).

- *FiT should match the availability of renewable energy*. The cost over the contract period should be levelised to some extent (Marengo, 2014).

II. Workforce training and education

Status quo

- *IPPs should take the lead on the training and educating* of *the workforce* as they have the skills, technology and understanding of their project/products (Ngobeni, 2014).

- *Community trusts can be used for funding training or further education.* Trustees will take the lead on how the funds will be utilised and education could be one of them (Jugmohan, 2014).

- *Training and education is not being measured according to any specifications*, but rather if the IPPs financially invested in the training/education of local workforce (Ngobeni, 2014).

- *Much more local content could have been achieved* in the past windows, but Government rather gave preference to bids with better prices. The minimum local content will be achieved if it's only a requirement over the whole project (Badenhorst, 2014).

- *Current training and education not necessarily that unique or dedicated*, but rather an expansion of already developed skills. Training done is more an extension of what engineers, technicians and builders already know (Badenhorst, 2014).

Recommendations

- *The DoE must stipulate in more detail what is to be expected in terms of training and education*. Not to wait until the projects are over (Jugmohan, 2014). The *training and practical experience should be in line with the relevant project* to ensure that individuals receive the necessary skills (Marengo, 2014).

- *The higher education institutes should play a bigger role*, ensuring good quality training

content, that skill is well developed and taken further. It's not the DoE's mandate to investigate the level of quality training, but rather the higher education institutes. IPPs can then finance such training or post-training. (Ngobeni, 2014).

- *Government needs to commit to renewable energy* and the industry will develop itself around the commitment. By legislating the renewable energy planned targets in the IRP 2010 alone will automatically create a market and consequently put the industry in a position where it wants to invest in renewable energy training or education. For now there is no certainty for renewable energy on the long term and that is the main reason why the private sector doesn't invest in training or educating local people (Badenhorst, 2014).

- *Not too much pressure should be placed on IPPs* when it comes to training and education. The DoE agrees that training and/or educating workforce is not part of their main business profile and that is why IPPs should rather focus on what they are supposed to do (Ngobeni, 2014).

- *Training content/modules should be accredited or registered by the SETAs.* (Ngobeni, 2014). Putting the workforce through training just for the sake of training is not ideal. A form of recognised certification indicating that the person is qualified will serve as a successful outcome when it comes to training and education (Jugmohan, 2014).

- *Investigate if training and education requirements are acceptable and realistic* (Jugmohan, 2014).

- *Municipalities and LEDs should see to it that their people are trained or educated.* In cases where this is not achieved the community should place pressure on management of the last mentioned to correct it.

- *Small IPPs could achieve more training and education than large IPPs*. Large IPPs and their main workforce come from overseas while small upcoming businesses are from South Africa. These small to medium businesses can provide more local content in the form of training and education, but cannot participate because the DoE expects the same FiT as with the large IPPs (Badenhorst, 2014).

- *Keep the programme a rolling programme* as people trained and used in the first project can now be used in the next. In contrast, if all the projects were completed in a very short period, there would not be enough time to effectively train people and provide jobs over an extended period in a sustainable way (Ngobeni, 2014). The only way to retain education is to ensure the REIPPP programme is a long term programme. Some skills developed by IPP training can be used in other sectors, but when it comes to retaining specific skills and

achieving a professional level of expertise there must be future renewable energy projects (Badenhorst, 2014).

- *Competent trained people should also work abroad* as Mr Ngobeni is led to believe that the whole of Africa is going to play a pivotal role when it comes to the renewable energy space (Ngobeni, 2014).

- *Training and education should be applicable and useful in other sectors* as people could be utilised in other types of industries as well. CSP and PV is very much construction orientated, while construction and maintenance of Wind is very specialised (Jugmohan, 2014).

- *Let the worker unions identify the people that should work for a specific project.* That way one would take the emotion out of identifying people and the training/education will not only be retained to a specific project, but retained within the greater programme (Jugmohan, 2014).

- *Create internal database of individuals involved in the previous projects.* These people should be used in subsequent REIPPP projects.

III. Enabling legislation for renewable energy in South Africa

Status quo

- *The DoE has no intention to change the enabling legislation*, but would like to improve on what is available. The DoE believes that *the current model is the correct and best model for rolling out the REIPPP programme* (Ngobeni, 2014).

- *Legislation for small IPP and rooftop application is not where it could be*, but the DoE is taking a phase approach to resolve it. First focus and priority will be on the large IPPs, lessons learned will then be taken to small IPPs and then consequently to rooftop or less than 1MW application. Small IPPs and rooftop applications are much more complex than large IPPs (Ngobeni, 2014).

- *The current monopoly structure of Eskom is not the best for the REIPPP programme*. It is not ideal that the Government do the procurement of renewable energy while Eskom is a main energy player. The last mentioned was a given and the DoE had to work with the status quo (Ngobeni, 2014).

- *The DoE envisage a structure where everyone can participate freely and interact in a way*

to provide competitive prices (ISMO) (Ngobeni, 2014).

Recommendations

- *Grid stability and small renewable energy impact studies are needed*. Much is to be investigated and be made known before DoE can officially support or even role out rooftop application (Ngobeni, 2014).

- *Communication and good will attitude between the main stakeholders* like the banks, Government and IPPs. That way legislation could be improved without inhibiting the expected programme objectives.

- *On the short to medium term Government must support and be involved in the renewable energy role out.* The reason is because legislation is very much politically driven and would not change that easily (Badenhorst, 2014).

- *Government should commit to renewable energy* going forward (Marengo, 2014).

- *Make sure the consumers can afford renewable energy in the long term* and this can be done by proper future planning and investigating all possible risks (Marengo, 2014).

- *The benefits and good performance of renewable energy application should be made public.* That way the consumers, politicians and decision makers could be informed about why South Africa should use or support renewable energy.

- *An ISMO could resolve the subsidies issue,* currently experienced by the DoE since the unbundling of the energy sector. The operator should serve as an independent buyer that will be transparent with its finance and infrastructure. Making sure that the consumers do not pay more than what is necessary (Ngobeni, 2014).

- *The ISMO needs to be realised or Government need to commit to renewable energy* by having a percentage of its energy generation from renewables as policy or even law (Badenhorst, 2014). An ISMO will ensure that every player is treated the same when it comes to grid connections, curtailments and other relevant aspects (Marengo, 2014).

- *Standardise projects and agreements for small IPP application.* At this stage Government wants small IPPs to bid the same way as large IPPs did, which is not possible due to the large procurement/bidding cost. The IDC and DoE suggest compiling a standard agreement for EPCs that would stipulate how the design should be for the plant. Standardising the projects would make it much cheaper (Badenhorst, 2014).

IV. Partnerships and consolidation of both local and foreign companies to promote local manufacturing of international standardised renewable energy products

Status quo

- *Local manufacturing for renewable energy components is held back* due to future market uncertainty. Government needs to commit to renewable energy to create certainty (Badenhorst, 2014).
- *Care is taken not to over increase local requirements* Local content requirements are investigated by the DoE continuously, but they are mindful of the supply and demand situation. Local content requirements are determined in a way so that it does not give monopoly to the local suppliers. Some slack is given to obtain both overseas and local materials, but there need to be sound competition do drive the cost of components down. (Ngobeni, 2014).

Recommendations

- *The DTI should give export credits to local manufactured renewable energy components* to stimulate the industry (Badenhorst, 2014) (Marengo, 2014).
- *Companies interested in manufacturing should have recent local experience* so that they will know what is best for South Africa (Jugmohan, 2014)
- *Market certainty in the long term will help increase manufacturing capacity.* Certainty for long term profit is needed when it comes to financing (Jugmohan, 2014). There needs to be a market for 7 years or more before there is enough reason to put up a manufacturing plant. Already the IDC was approached by companies that would like to put up manufacturing plants, but discontinued due to market uncertainty (Badenhorst, 2014). The DoE needs to make sure the REIPPP programme does continue to give certainty and confidence that there will be a need and a market in the future (Ngobeni, 2014).
- *Tax or credit incentive for foreign companies should be provided* until the companies are well established. That way investment can be encouraged during the early years of a new industry (Marengo, 2014).
- *On the long run small IPPs, rooftop application and non-South African programmes also serve as a market outside of the REIPPP programme.* According to the DoE the future need will not be limited to the REIPPP programme as the demand/need will be diversified to other application. Countries in Southern Africa would most probably buy components from South Africa as they don't have enough need to put up their own manufacturing plants and as it is most economical to them to buy from South Africa (Ngobeni, 2014).

- *Suggest having a joint venture of 50/50* as a skew structure could be challenging in the long run; with main investors reluctant to share or transfer corporate knowledge (Jugmohan, 2014).
- *Limit interference and increase enabling environment for forming partnerships*. The less interference and prerequisites the better for the partnerships or consolidation. Both partners will need each other based on what they can bring to the table and this should be done in an enabling environment, rather than a prescribing one. The enabling environment can be achieved by making it easy for the people to come in and don't expect them to adhere to unnecessary laws and regulation. There were IPPs that withdrew in the past, because they wanted a share larger than 40% and the DoE declined their offer. This will cause the foreign investors to stay away as they would like to have control over their intellectual property and investment. The end result would be less competition which could impact all stakeholders of the REIPPP programme negatively.

V. Greater dialogue between Government, Eskom, Independent Power Producers (IPPs), financiers and industry during the REIPPP programme period

Status quo

- *Outside the RFP documentation Government has question and answer sessions or bidders' conferences* and they release official responses referred to as official briefing and clarification notes. These responses are distributed to the stakeholders or registered members, giving clarification on ambiguous requirements (Jugmohan, 2014). There were opportunities to submit requests; this helped to improve the programme going forward. The DoE was obligated to response in writing on all requests and if changes are made then reasons for changes are given through the appropriate channels. So far the current dialogue systems have worked very well (Ngobeni, 2014).
- *In window 1 and 2 there were some form of frustration*, but over time this was resolved. Recent bad communication however was the DoE's delay to announce more preferred bidders after round 3. The reason for the delay was because of the upcoming election, but according to Mr Badenhorst this is very bad for the DoE (Badenhorst, 2014).
- *The communication or dialogue will be of a bureaucracy type* and this will not change. Worldwide where Government needs to be involved politics will play a role and this is not something non-Governmental stakeholders can change or even control (Badenhorst, 2014).
- *A number of conferences and seminars take place annually* by various renewable energy association (SAWEA, SAPVIA etc.), but these are mostly separate and for specific

renewable energy technologies; not necessarily covering all technologies at once.

Recommendations

- *As Procurer the DoE should take lead on the dialogue platform* (Marengo, 2014). The current platform is sufficient and working. The necessary interactions are there and it is open to relevant stakeholders; most of the IPPs are involved in these discussions. The only thing that the DoE does not want to do is to negotiate the procurement document at hand as this could take years to resolve. DoE listen, take points and by using their own judgement they respond or act accordingly. The DoE has no obligation to implement specific requests (Ngobeni, 2014).

- *Let a board of representatives take lead to achieve greater dialogue if Government could not.* The board should consist of representatives from the sponsors, debt funders and EPC contractors (Jugmohan, 2014).

- *Industry bodies and energy associations should have the mandate to give feedback to the DoE.* Industry bodies does a very good job at discussing and addressing both technical and regulation issues. The Southern Africa Solar Thermal and Electricity Association (SASTELA) for example convinced the DoE that they (with their CSP plants) were not that expensive with their FiT if they were to supply on peak periods. If it was not for the association, it would not have happened (Badenhorst, 2014).

Comments or suggestions to help improve the sustainability of the REIPP programme

The one thing that could make the REIPPP programme unsustainable it's the price of electricity. In South Africa electricity is one of the main drivers of the economy. If electricity is too expensive it will constrain the economy. That is why local funding is preferred to prevent foreign influence on electricity price and why the DoE gives preference to low and smaller FiTs. At the end of the day, the FiT will determine what the consumer will pay for electricity (Ngobeni, 2014).

Government should have a third short listing criteria; project location that has no other project within close proximity should receive preference. That way the benefits could be brought to more South African communities, rather than having all of the projects only benefitting one or two small communities. This should be looked at in spite of less performance (Jugmohan, 2014).

For the IDC the whole industry should benefit from the programme. The REIPPP programme is successful and it is driven well, but the IDC want to see more emphasis placed on local content. Local content requirements can be made more specific, like to components of a plant, than having the requirements over the larger scope of the project (Badenhorst, 2014).

From the results it was apparent that all of the research objectives were achieved and/or answered. The prioritised control drivers were also verified during the interview as not one of the high level key stakeholders wanted to add something that was not covered in the prioritised control drivers. Two of them stated that the list of control drivers was correct and made sense. See Appendix J for full transcribed interviews.

By doing what was planned, analysing the data collected, summarising the results and finding the expected answers the research process could be completed. Insights were obtained, deductions were made and these outputs were all concluded in chapter 5.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions from investigation and analysis

Almost 70% of the respondents agreed in the questionnaire that sustainability was critically necessary and that all businesses and projects should be aligned with sustainability objectives. If the percentage of response was a real representation of the population group, achieving sustainability through the REIPPP programme could be pursued much easier.

Now that the sustainability control drivers have been identified and prioritised, stakeholders can materialise their view of sustainability as stated above by focusing on these drivers. As Mr Ngobeni said in his interview, not all issues or problems (drivers) could be attended to at the same time, and for that same reason only the top five control drivers, critical for the sustainability, were investigated in depth (Ngobeni, 2014). Interview questions based on the top five control drivers were answered by high level key stakeholders like the DoE, IDC, NERSA, Nedbank Capital and Eskom. From the questionnaire and interview a few insights were obtained and concluded here:

5.1.1 Questionnaire

Racial transformation: When it came to racial transformation and equal job opportunities, the DoE set out targets to be reached. On management or key stakeholder level the racial representation did not reflect Government's ideal. As most of the key stakeholders' positions were in the private sector and were filled by people with the necessary skills and experience, training and educating more black people and women in particular could serve as a possible solution. In the initial stages the IPPs' possibly focused on empowering workforce for construction, operation and maintenance. Over time some of these people would be viable candidates to take over appropriate management positions as they have a better understanding of the energy plant.

Government's commitment: Even though the bulk of the questionnaire feedback and role players of the REIPPP programme were from the private sector, the Government should not stand or hold back on their input. Their commitment and contribution is crucially necessary. The success and future sustainability of the REIPPP programme is dependent on Government's participation. When the prioritised control drivers were reviewed (seen in Table 28), one can see that control drivers like C1.5, A8 and A9 are highly ranked impact-wise, but have a very low controllability mean because mainly Government could influence these drivers. If the REIPPP programme is to be sustained, the Government has a large role to play to address and/or support applicable control drivers.

5.1.2 Interview

Realisation of an ISMO: If the ISMO were to be realised, a few of DoE's future REIPPP programme challenges could be resolved. Mr Ngobeni stated that there would not be enough

funding from DoE going forward, which means that they could in future financially de-commit themselves from the REIPPP programme. The ISMO could then take over the procurer and off-taker role, which DoE is financing currently. One of the reasons why the DoE wants to discontinue funding is so that they will be able to fund other forms of energy programmes.

Another challenge at hand for the DoE is the subsidising of the energy sector since the unbundling of Eskom. Once again the ISMO could manage the complex task of allocating subsides as all forms of electricity generation could be sold to the ISMO. If Government were to promote a certain technology, then the rules between competitors should be adapted accordingly. One way would be to provide a form of subsidy to green energy generation, or giving preference to green energy usage before using other forms of energy like coal.

ISMO should not only trade in electricity, but also co-ordinate renewable IPPs according to specific loads. The full potential of a renewable energy source could then be achieved because it is tailor-made to a specific load and could be placed as close as possible to the consumer (Jugmohan, 2014).

Both ISMO and Eskom Generation could be Government-owned, but each entity needs to be managed independently and should not have any conflict of interest (Badenhorst, 2014). Municipalities could also serve as off-takers, but an ISMO will still be needed to prevent different price structures (Ngobeni, 2014).

If Government does not want to make a strong commitment to renewable energy, but the market would be a free market driven by entities like the ISMO, then there will be future renewable energy projects as there will be a future electricity need which the ISMO could cater for (Badenhorst, 2014).

Banks play an important role: When it comes to ensuring that IPPs are up to standard banks have their own checks and balances in place. Financiers have a team that would look into IPP project documentation from all perspectives including financial, legal, technical and environmental. When it comes to the procurement of renewable energy projects (big or small) it is important to have the same level of guidance and strict admission requirements. The author is left to believe that one of the main reasons why the selected IPPs were successful was because the financiers sieved out the best from the best and they gave guidance to the IPPs to succeed in the bidding.

Training and education: In spite of the training and educating workforce driver to be listed second, from the interviews it was clear that there were no specific requirements when it came to the training and educating of the workforce. The DoE's current measurement of training and education were based on financing of education and the employment rate of educated individuals. The RFP should stipulate what should be achieved in terms of education and training as the ambiguous requirements give the IPPs free reins to do what fits those best and not necessarily that which is best for the local community or for South Africa.

Training or education should be recognised and qualifications obtained should preferably be accredited or have some form of international value. That way such a qualification could be used elsewhere in the world. Recognition could be achieved by having training content approved by SETAS or similar.

To take training or education further there needs to be some form of co-ordination between the IPPs and the Higher Education institutes (Ngobeni, 2014). Unfortunately training undertaken to date is not unique or dedicated, but rather an expansion on other already developed skills (Badenhorst, 2014).

Making use of the worker unions, or keeping track of all trained people in a central database, would help retain the training and education received in previous projects. IPPs could then obtain and identify local workforce for future projects.

Government commitment to renewable energy: The full potential and benefits of having renewable energy as part of South Africa's energy mix could not be achieved if Government does not commit to renewable energy. Local manufacturing for renewable energy components is held back due to uncertainty of the future market (Badenhorst, 2014). At this stage the IRP 2010 is held as the baseline to work from but is only a planning document, it is not law or Government policy.

Government can commit to renewable energy by sorting out its energy policy or committing to the REIPPP programme. They have no other choice if they want to see the renewable energy roll-out to be sustained (Badenhorst, 2014).

Levelised project cost: Making project cost even based on the availability of renewable energy resources, could promote having projects closer to the energy intensive areas. Most IPPs prefer the low hanging fruits in areas with the best renewable energy resources and vast open spaces, but these areas are unfortunately situated far away from energy intensive businesses and residential areas (Marengo, 2014).

Creative ways of funding: Foreign funding could be investigated, but it should be done in a creative way so that the country and its consumers are not to be exposed to high electricity prices due to the volatility of the ZAR.

Economy dependent on energy access: As stated in the introduction and literature the economy is dependent on access to energy. Mr Ngobeni verified this statement by saying that, if the price of electricity is too high, it would damage the economy. That is why it is important for the DoE and Government to achieve a price for renewable energy that is sustainable as the South African economy is dependent on the accessibility of electricity.

Environmental dimension control drivers: When the top five prioritised control drivers were selected, not one of the top five fell under the environmental dimension. At first interpretation the possible reason could be that key stakeholders are in general not bothered about the environment

as it does not result in direct benefits. On the other hand the control drivers from the Economic and Social Dimensions have so much direct and indirect incentives that stakeholders would be ignorant to not react on it. The current view on environment also explains why the people from the past neglected the environment so much. The low esteem for environment is not something new, but a culture that was passed on; taking the large basket of resources South Africa has for granted. An environmental culture and consciousness needs to be developed and promoted in our energy sector.

The REIPPP programme that has stringent environmental requirements and environmental law in place, may also give the bidders the confidence to see the environmental drivers as a non-priority. The DoE expected a full Environmental Impact Assessment (EIA) as pre-requisite, banks such as the IDC had their own environmental requirements and both the DoE and finance institutions would send out an audit team to see of the IPP bidders adhered to environmental laws or requirements. South Africa has very good legislation concerning the environment; the important requirement is however to apply it and adhere to it during the energy plant's whole lifecycle.

Conflicting interests

From the interview with the different interviewees it became clear that there were conflicting preferences. Mr Jugmohan suggested rather having the lowest FiT possible other than supporting small IPP companies with high FiT as the consumers would bear the burden for a higher FiT. Mr Badenhorst, however, suggested that the small IPPs should be given the requested higher FiT. Not only would it resolve most of the issues of why small IPP companies cannot participate in the REIPPP programme, but Government would be supporting small to medium businesses and it is these businesses that can provide the maximum benefit for the communities and achieve large local content. The suggestion would be to choose large IPPs based on lowest FiTs, but provide a larger FiT for smaller IPPs. Smaller IPPs must then compensate for their higher FiT by providing more community benefits and increased local content.

From literature it was apparent that Government gave preference to bidders with high local content during Window 1. Mr Badenhorst agreed that the first round selected bidders had high local content, but preference for high local content bidders shifted away to bidders with better FiTs in round 2 and 3. It would seem that, as long as the minimum local content requirement was attained, Government was more concerned about the FiT than requiring a further increase in local content. Mr Badenhorst stated that bidders with a high local content were chosen in Window 1, but were not selected in subsequent windows due to their higher FiTs. The bidders were under the impression that Government gave preference to high content projects and that is why they bid accordingly. Unfortunately having a high local content project has an impact on the FiT. Government or the future procurer needs to achieve a sound balance between the local content benefit and the FiT. The last mentioned balance should be sustainable and not only benefit a few for a short period.

From the list of prioritised control drivers and the interview one can see that the social and economic dimension received much more attention and emphases than the environmental. If the environmental drivers were sorted out and applied a balanced sustainability approach from the programme would be achieved. If not, some of the energy and time should be shifted from the other two dimensions to environment to achieve a balanced sustainability.

5.2 Achievement of research objectives

The main aim of this research was to identify and prioritise control drivers that could influence the long-term sustainability of the REIPPP programme in South Africa. Secondary research objectives that were set to ensure a structured and logical approach to achieving the main aim were:

1. **To determine who the key stakeholders of the REIPP programme were:**

Section 2.5 of chapter 2 discussed and referenced the REIPPP programme's identified key stakeholders from Window 1.

2. **To identify those drivers, critical for the sustainability of the REIPP Programme, relevant to the South African situation:**

Control drivers were obtained from literature and compiled by the author. Control drivers were grouped as "provided" and "alternative drivers" based on their priority value. Self-suggested drivers obtained from the questionnaire were added to the list or integrated with relevant control drivers.

3. **To prioritise the sustainability control drivers according to their impact on the REIPP programme:**

Control drivers obtained from literature were rated by the researcher according their estimated level of impact on the REIPPP programme. A priority value was calculated and used to divide the drivers into two groups – provided control drivers and alternative control drivers. In a questionnaire the industry respondents had the opportunity to rank the provided and alternative control drivers. Finally correspondents had the opportunity to present their own suggested control drivers. All these drivers were integrated, merged and ranked according to their priority value. The priority value was calculated based on the respondents' rating in terms of level of impact on the REIPPP programme and controllability. A final prioritised control driver list can be seen in Table 28.

4. **To provide recommendations on how sustainability of the REIPPP programme could be promoted or improved**:

Questions about the top 5 prioritised control drivers, critical for the sustainability of the REIPPP programme, were used in an interview with high level key stakeholders. Their summarised response and recommendations were given in section 4.5.7 with author recommendations in the concluding chapter 5.

The final output of this research could have been validated by presenting the concluding results and outcomes to renewable energy associations, renewable energy related conferences or even request high level stakeholders to state if they would implement some of the suggested recommendations.

5.3 The sustainability of the REIPPP programme

From this research there are two main questions that could be answered to a certain extent. Is the REIPPP programme sustainable?; and: What can be done to promote the sustainability of the programme? Sustainability control drivers were identified, benchmarked by the industry and the top five prioritised control drivers were investigated with high level key stakeholders.

Based on the findings and investigation the author is left to believe that the REIPPP programme has a good chance to be sustainable, but more can be done to improve and control the future sustainability of the REIPPP programme. This includes the realisation of an ISMO, convincing Government to commit to renewable energy and keeping the average FiT for renewables as low or market-related as possible. There are many other tweaks that could control the programme's sustainability, including finding creative ways to utilise foreign funding, stipulating and co-ordinating training and education requirements, and supporting small-scale renewable energy application. Some of these changes are small and can be addressed internally within the procurement process with the upcoming windows. Other changes take support and commitment from the highest level of authority. One can only hope that these last mentioned entities will see and seize the opportunity.

5.4 Research recommendations

To obtain a much more complete, accurate and statistical valuable research output the author proposes that the questionnaire should be amended according to the final prioritised control drivers and then re-distributed to the same stakeholders. The author considered to implement the re-distribution, as obtaining a more refined input could help with the verification of prioritised control drivers.

During the research it was apparent that confidentiality issues prevailed and that some key stakeholders required an in-depth background to be able to participate in the questionnaire. The confidentiality issues resulted in multiple incomplete questionnaires as stakeholders stopped to participate in the survey. A possible solution would be to compile an official formal letter that explains the confidentiality application, provide a broader description of the study, what the data will be used for and that information provided would be treated anonymously if requested.

The questionnaire could have been better utilised to identify the key stakeholders that has the largest influence (level of controllability) on each control driver. Specific control drivers could then be directed to these individuals or entities in the form of an interview or even to inform them to address the issue.

With the interview it would have been ideal to include an IPP especially on the training and education subject. ABB was the first price option as they were the bidder with the most projects in Window 1, but an alternative IPP should have been identified and included in the interview.

Investigation and better understanding of the ISMO would have been helpful and valuable as it is a topic that was continuously brought up in both the questionnaire and interview. This would give better context to the research outputs.

Here is a list of possible research topics

- What are the checks and balances for a good quality renewable energy plant? The reason for this question is because financiers were expecting and enforcing stringent requirements to ensure the bidders project would succeed and operate as it should. The concern comes in when projects are expedited without having this level of guidance or screening.

- How should the ISMO be structured? The ISMO could play a vital role in the sustainability of the REIPPP programme, but how should it work, what authority should it have, what other functions should it have other than off-taker?

- What are the minimum inputs necessary to achieve a successful programme like the REIPPP? Government did an excellent job at compiling the REIPPP programme documentation, but a large amount of money, time and effort was invested. For any other energy programme or structure like the ISMO the same should be done to ensure success.

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Availability of reference sources

When the author embarked in 2012 on researching the subject of this dissertation very few sources of information were available in printed book format, probably because the subject firstly deals with a programme specific to South Africa, and secondly, because the subject covers a wide range of aspects. For that reason information had to be collected from a variety of sources on the internet – newspaper and periodical reports and articles, conference records, speeches, official statements.

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APPENDICES

APPENDIX A: MAJOR BARRIERS WITH SOUTH AFRICAN INTEGRATED BARRIERS (PAINULY, 2001:79)

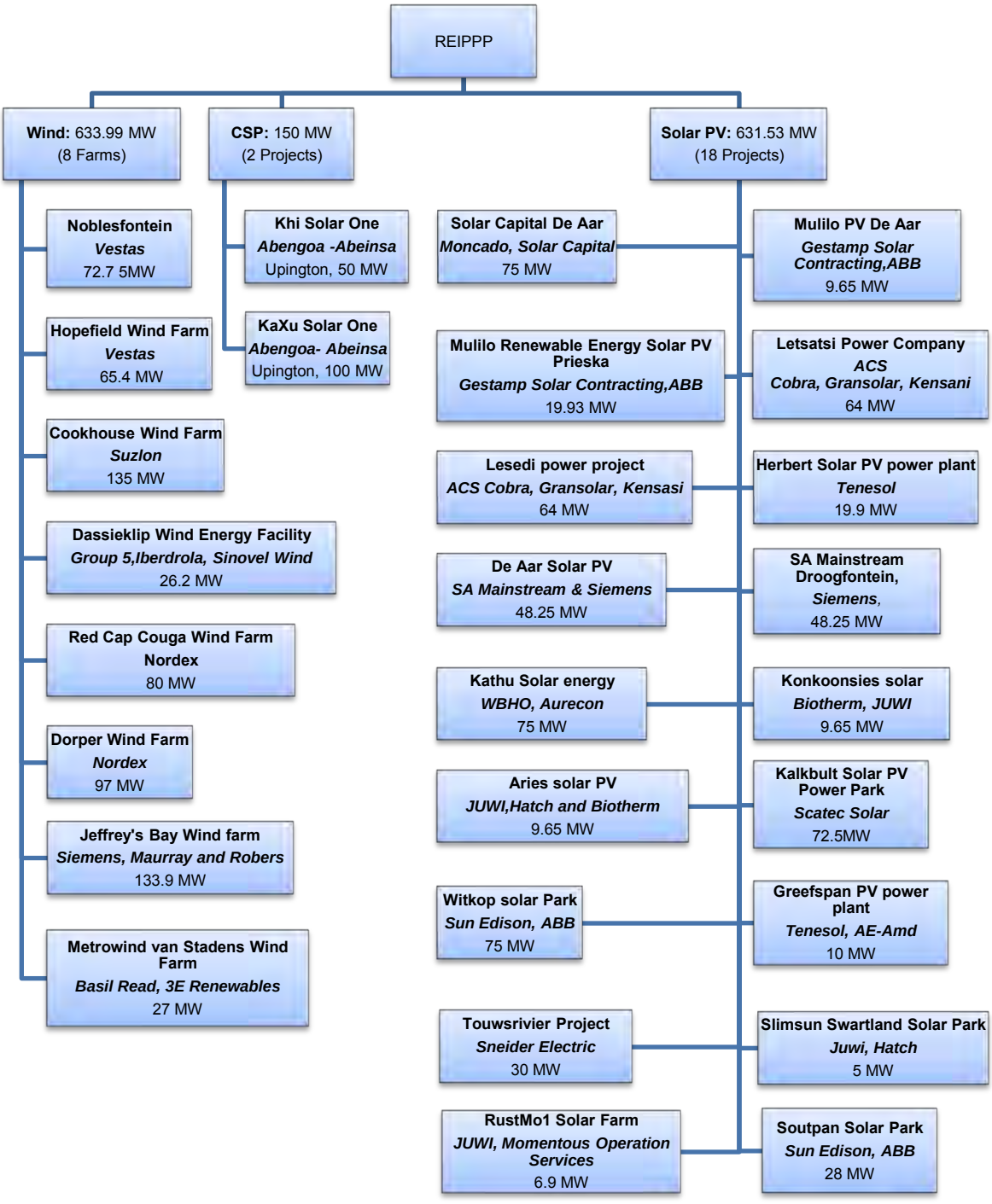
Table 29: Major Barriers with South African integrated barriers for renewable energy (Painuly, 2001:79)

Barrier Category	Barriers	Remarks
1. Market failure or imperfection	Highly controlled energy sector [Supported by White Paper]	May lead to lack of investment in renewable energy.
	Lack of information and awareness [Supported by White Paper]	It increases uncertainty and hence costs. In South Africa there is a lack of consumer awareness on benefits and opportunities of renewable energy (RSA, 2003).
	Restricted access to technology	Technology must be outsourced and hence at high cost
	Lack of competition [Supported by the NDP, (NPC, 2012)]	Product cost increase
	High transaction cost	Economic viability of the project may be affected
	Missing market infrastructure [Supported by White Paper, (RSA, 2003)]	Cost of product increases for customer
	High investment requirements [Supported by White Paper]	This acts as an entry barrier for entrepreneurial businesses. Implementation of renewable energy technologies needs significant initial investment and may need support for long periods before obtaining return on investment (RSA, 2003).
2. Market Distortions	Favour to conventional energy [Supported by White Paper, (RSA, 2003)]	This affects the competitiveness of RE. The current South African economic and social system of energy services is based on centralised development around conventional sources (RSA, 2003)
	Taxes on RET	Cost RE energy increases
	Non-consideration of externatilities	Cost of conventional energy is less than what it should be. Currently this is the case, but cost will increase with carbon tax and future infrastructure upgrade (Seccombe, 2013).
	Trade barriers	Cost of RET increase due to high taxes on RET imports
3. Economic and financial	Economically not viable [Supported by White Paper, (RSA, 2003)]	Cost reduction for RE needed
	High discount rates [Supported by White Paper, (RSA, 2003)]	Incentives may be needed in the pioneering stage

	High cost of capital [Supported by White Paper, (RSA, 2003)]	Affects economic viability. Most renewables remain expensive compared to conventional energy that supplies to the bulk of the urban areas or major industries (RSA, 2003).
	Market size small	Economy of scale cannot be reached
	Lack of access to capital	Competition and market efficiency may suffer
	Lack of access to credit to consumers	It may reduce market size
	High up-front capital costs for investors	Capital costs may also go up due to increased risk perception.
	Lack of financial institutions to support RETs [Supported by White Paper, (RSA, 2003)]	Supply of RE products may suffer
4. Institutional	Lack of institutions/mechanisms to disseminate information	It leads to non-availability of information with producers as well as consumers
	Lack of a legal/regulatory framework [Supported by White Paper]	Renewable energy producers may face market/ economic/ financial barriers without this. Financial, legal and organisational barriers need to be addressed to successfully implement renewable energy technologies and develop markets (RSA, 2003).
	Problems in realising financial incentives [Supported by White Paper, (RSA, 2003)]	This may be due to red tape leading to economic/ financial barriers
	Unstable macro-economic environment	This may increase risk and uncertainty for new investments. Only products with low payback period may be acceptable.
	Lack of involvement of stakeholders in decision making [Supported by the NDP, (NPC, 2012)]	This can result in misplaced priorities
	Lack of R&D culture [Supported by White Paper, (RSA, 2003)]	This may make adaptation of technology difficult.
	Lack of private sector participation [Supported by the NDP, (NPC, 2012)]	Lack of competition and inefficiency possibly due to this
	Lack of professional institutions	Producers' problems and views on barriers cannot reach the policy makers effectively.
5. Technical	Lack of standard and codes and certifications	Product quality and product acceptability is affected. Purchase and commercial risk increases, as also negative perception about technology.
	Lack of skilled personnel/training facilities [Supported by the NDP and white paper, (NPC, 2012) and (RSA, 2003)]	This can be a constraint for producers
	Lack of O&M facilities	This can affect product acceptance.

	Lack of entrepreneurs	May lead to lack of competition and supply constraints.
	System constraints [Supported by White Paper]	Market cannot be realised by producers. In South Africa there is a lack of non-discriminatory open access to key energy infrastructure such as the national electricity grid and other (RSA, 2003).
	Product not reliable	Market size may get affected.
6. Social, cultural and behavioural	Lack of consumer acceptance of the product [Supported by White Paper, (RSA, 2003)]	Market size becomes small
	Lack of social acceptance for some RETs	Affects market size – gas from urban waste for cooking may not be acceptable to a sizeable segment.
7. Other Barriers	Uncertain governmental policies [Supported by White Paper, (RSA, 2003)]	It creates uncertainty and results in lack of confidence. May also increase cost of project.
	Environmental	Environmental damages/ pollution may be unacceptable.
	High risk perception for RETs	It increases cost of capital (high financial risk) as well as discount rate of producer.
	Lack of infrastructure	RETs such as wind may need strong infrastructure development such as roads, grid connectivity

APPENDIX B: FIRST WINDOW IPP PROJECT LAYOUT (ENERGIZE, 2013)



APPENDIX C: ASPECTS OF SUSTAINABILITY ACCORDING TO GRI FRAMEWORK

Table 30: Aspects of Sustainability dimensions (GRI, 2011)

Sustainability dimension	Aspects of dimension	
	Aspects	**Sub-aspects**
Economics		
	Economic performance	
		Value generated and distributed
		Risk or opportunities due to climate change
		Coverage on defined benefit plan obligations.
		Significant financing from government
	Market presence	
		Range of ratios of standard entry levy wage
		Policy, practices and local content
		Local hiring for workforce and senior management
	Indirect economic impacts	
		Infrastructure investment and services impact on public
		Significant indirect economic impacts, including the extend of impacts
Environmental	**Aspects**	**Sub-aspects**
	Materials	
		Used by weight or volume
		Percentage recycled input materials
	Energy	
		Direct energy consumption
		Indirect energy consumption
		Conservation and efficiency improvements
		Using renewable energy options
		Achieving reductions in consumption
	Water	
		Total water use
		Water sources significantly affected by water use
		Water recycled and reused

	Biodiversity	
		Location and size of used land
		Impact on biodiversity protected areas
		Habitats protected and restored
		Managing impact on biodiversity
		Number of rare species in areas affected
	Emissions, effluents and waste	
		Total GHG emissions
		Other indirect GHG emissions
		Reduction in GHG achieved
		Emission of ozone depleting substance.
		NO,SO and other air emissions
		Total water discharge
		Total waste
		Total number of spills
		Weight of hazardous waste
	Products and services	
		Mitigation of environmental impact
		Reclamation of packaging materials
	Compliance	
		Total fines for non-compliance with environmental laws and regulations
	Transport	
		Environmental impact of transport
	Overall	
		Total environmental expenditure and investment
Social	**Aspects**	**Sub-aspects**
	Labour practices and decent work	
		Employment
		Labour/management relations
		Occupational health and safety
		Training and education
		Diversity and equal opportunity

		Equal remuneration for women and men
	Human rights	
		Investment and procurement practices
		Non-discrimination
		Freedom of association and collective bargaining
		Child labour
		Forced and compulsory labour
		Security practices
		Indigenous rights
		Assessment
		Remediation
	Society	
		Local communities
		Corruption
		Public policy
		Anti-competitive behaviour
		Compliance
	Product responsibility	
		Customer health and safety
		Product and service labelling
		Marketing communication
		Customer privacy
		Compliance

APPENDIX D: KEY STAKEHOLDER CONTROL LIST

		Green: Received, Yellow: Incomplete response, Grey-blue: Response received
Government	**DoE**	No response to date
	ESKOM	No response to date
	National Treasury	No response to date
	NERSA	Received response and complete
	SA-LED	No response to date
Local government	**Bluecrane Entity**	Received response and complete
	Breede Valley Municipality	Received response and complete
	Gamagara Local Municipality	No response to date
	Hopefield Municipality	No response to date
	Inkwanca Municipality	No response to date
	Kai !Garib Municipality	No response to date
	Khai-Ma Local Municipality	No response to date
	Kouga Municipality	Received response and complete
	Manguang Metropolitan Municipality	No response to date
	Municipality of Emthanjeni	No response to date
	Nelson Mandela Bay Municipality	Received response **but incomplete**
	Polokwane Municipality	No response to date
	Renosterburg Municipality	No response to date
	Rustenburg Municipality	No response to date
	Siyancuma Municipality	No response to date
	Siyanda district municipality	Received response **but incomplete**
	SiyaThemba Municipality	No response to date
	Sol Plaatje Municipality	Received response and complete
	Swartland Municipality	No response to date
	Theewaterskloof Municipality	Received response and complete
	Tsantsabane Municipality	No response to date
	Ubuntu Municipality	Received response and complete
Banks	**ABSA**	No response to date
	FMO finance south Africa	Received response and complete
	Futuregrowth Asset Management	No response to date
	IDC	Received response **but incomplete**
	IFC South Africa	No response to date
	Investec	Received response **but incomplete**
	Kensani EPC	No response to date
	Momentous Operation Services	No response to date
	Nedbank	No response to date
	Old Mutual	No response to date
	PIC	No response to date

	RMB	No response to date
	Solar Capital	Received response and complete
	Standard Bank	No response to date
	The Development Bank of Southern Africa (DBSA)	No response to date
	Thebe Investment Corporation	No response to date
IPP	**3E Renewables**	No response to date
	ABB	No response to date
	Abeinsa	No response to date
	Aurecon	No response to date
	Basil Read	No response to date
	BioTherm Energy	Received response and complete
	Gestamp	Received response and complete
	Group 5	Received response **but incomplete**
	Hatch	Received response and complete
	Iberdrola	No response to date
	JUWI	No response to date
	Moncado	No response to date
	Mulilo	No response to date
	Nordex	No response to date
	Scatec Solar	No response to date
	Schneider Electric	Received response **but incomplete**
	Siemens	Received response and complete
	Concor	No response to date
	Murray and Roberts	No response to date
	Sinovel	Received response and complete
	Solar Reserve	No response to date
	Sun Edison	No response to date
	Suzlon	No response to date
	Tenesol	No response to date
	Vestas	Received response and complete
	WBHO	Received response and complete
Others	**ACS Cobra**	No response to date
	Anthony Corrin	No response to date
	Arup	Received response and complete
	Globaleq SA	No response to date
	Gransolar	No response to date
	Imbewu	No response to date
	Integon	No response to date
	Ncoci	No response to date
	Robor(steel)	No response to date
	SAEE	Received response and complete
	SANEDI	No response to date

	SAPVIA	No response to date
	SAREC	No response to date
	SAWEA	No response to date
	SESSA	Received response and complete
	South African Alternative Energy Assosiation	No response to date
	Stellenbosh Centre for Renewable and Sustainable Energy Studies	No response to date

APPENDIX E: QUESTIONNAIRE WITH COVER LETTER

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOMKAMPUS

Questionnaire for key stakeholders of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

0%

Dear Sir or Madam

I am a post graduate student at North West University (NWU), currently busy with my M.Eng. in Management and Development with Prof. JIJ Fick as my study leader. The sustainability of the Renewable Energy Independent Power Producer Programme (REIPPP) is the subject of my master's degree dissertation. It is envisages that the results of this study will be beneficial in the sense that it can help find a means to control the future sustainability of the renewables programme and its parented projects. The key programme stakeholders (Eskom, NERSA, NT, etc.) and preferred bidders of the first 28 projects during the first window were identified to assist with this investigation.

You are kindly requested to complete the electronic questionnaire and it will require about 10-15 minutes of your time. All responses will be treated strictly confidential. Will you kindly submit the complete questionnaire as soon as possible, at the latest by 29 November? Participation in the study is voluntary and if you prefer not to participate please indicate this on the first page of the questionnaire or forward this email back to me.

Your contribution in finding a means to control the sustainability of the REIPPP programme is highly appreciated. The results of this study will be made available to you on request.

If you need any assistance, please contact Faure van Schalkwyk at (+27)72 445 4002 or alternatively mail me to faure.v.s@gmail.com

Yours sincerely
Faure van Schalkwyk

Name and surname of correspondent:

Please state entity/stakeholder that the correspondent represents: (for example Eskom, Siemens or ABSA)

Willing to participate in research?

- ◯ Yes
- ◯ Yes, but prefer to stay anonymous
- ◯ No, please comment as to why...

Next

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOMKAMPUS

Questionnaire for key stakeholders of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

Background

One of the key values of the REIPPP programme is sustainability; the goal of sustainability is inherited and supported by various governmental documents like the National Development Plan (NDP), Integrated Resource Plan (IRP 2010) and National Growth Path (NGP). Currently it is too early to tell if the REIPPP programme is or will be sustainable. To find a means to control the sustainability of the programme, the control drivers that are critical for the sustainability of the programme needs to be identified and prioritised. In conjunction with the identified drivers, determining the level of controllability (influence, manageability, impact) each stakeholder has on the control driver, would also reveal to what extend the driver can be addressed or supported. This questionnaire is set out to achieve just that.

1. Biograpical Questions:

1.1 Age:

1.2 Gender:

- Male
- Female

1.3 Race:

- Asian
- Black
- Coloured
- Indian
- White
- Other

1.4 Nationality

- African (Non South African)
- American
- Asian
- Australian
- European

- South African
- Other

1.5 Sector:

- Private
- Public
- Voluntary

1.6 Years experience in renewable energy field:

1.7 Occupation:

1.8 Current position:

1.9 Qualification:

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NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOMKAMPUS

Questionnaire for key stakeholders of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

2. Personal view on sustainability

2.1 Please choose one of the following definitions which best represents your view on sustainability in the context of renewable energy

- (◎) Sustainability is the capacity to endure
- ( ) Potential for long-term maintenance of well being for humans
- ( ) Able to maintain the current way of life at a certain rate or level
- ( ) Conserving an ecological balance by avoiding depletion of natural resources
- ( ) To meet the needs of the present without compromising the ability of the future generation to meet their own needs
- ( ) Sustainability is the careful and efficient stewardship of resources by businesses, communities and citizens

2.2 What is your personal philosophy on sustainability when it comes to the REIPPP programme?

- (◎) Presently not relevant and necessary
- ( ) People, profits and economy should come first, sustainability second.
- ( ) Good idea, but it is an ideal not easy to achieve in practice.
- ( ) Sustainability has some significance and should be achieved to some extent
- ( ) Critically necessary and relevant; all businesses and projects should be aligned with sustainability objectives
- ( ) Other

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3. Sustainability control drivers

A list of control drivers are categorised into the three dimensions of sustainability; i.e. Economy, environment and social. To prioritise the sustainability drivers, the correspondent needs to indicate the level of impact each driver has on the REIPPP by ranking it between 1 and 10. In the same fashion, the correspondent also needs to indicate the level of controllability their entity has over that specific driver. If the correspondent can't or don't want to give a ranking for whatever reason, he/she can alternatively provide a short motivation for not being able or willing to rank the control driver. Please answer all questions.

Definitions

Impact: The effect or influence the provided driver has on the sustainability of the REIPPP.

Controllability: The ability to have the necessary power, authority, and/or responsibility to influence or manage the provided drivers. This is from the correspondent's or represented entity's perspective and position, not in general.

(1 = very low and 10 = very high)

3.1 Please rate 'Economic' control drivers

	Impact	Controllability	Please comment if unable to rate
Governmental policies regarding the future of renewable energy implementation during the REIPPP programme period	Impact Indicate lev	Controllability Indicate level	Please comment if unable to rate
Partnerships and consolidation of both local and foreign companies to promote local manufacturing of international standardised renewable energy products	Impact Indicate lev	Controllability Indicate level	Please comment if unable to rate
Upgrade of and new connections on transmission network/system	Impact Indicate lev	Controllability Indicate level	Please comment if unable to rate
Current governmental implementation of REIPPP processes	Impact Indicate lev	Controllability Indicate level	Please comment if unable to rate
Greater dialogue between government, Eskom, Independent Power Producers (IPPs), financiers and industry during REIPPP programme period	Impact Indicate lev	Controllability Indicate level	Please comment if unable to rate
General decrease of feed in tariffs (FIT) for renewable energy technology over the REIPPP programme period	Impact Indicate lev	Controllability Indicate level	Please comment if unable to rate
Materialisation of the Independent System Market Operator (iSMO)	Impact Indicate lev	Controllability Indicate level	Please comment if unable to rate
Funding for the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)	Impact Indicate lev	Controllability Indicate level	Please comment if unable to rate

3.2 Please rate 'Environmental' control drivers

	Impact	Controllability	Please comment if unable to rate
Volume and weight of materials used by IPPs during construction phase	Indicate lev	Indicate level	
Current South African transport and logistics infrastructure for renewable energy	Indicate lev	Indicate level	
Protection and enhancement of biodiversity	Indicate lev	Indicate level	
Emissions, effluents and waste due construction phase of IPP plants	Indicate lev	Indicate level	
Effect on water sources during IPPs plant lifetime	Indicate lev	Indicate level	
South African policy to address climate change by reducing green house gases (GHG)	Indicate lev	Indicate level	

3.3 Please rate 'Social' control drivers

	Impact	Controllability	Please comment if unable to rate
	Impact	**Controllability**	**Please comment if unable to rate**
Workforce training and education	Indicate lev	Indicate level	
	Impact	**Controllability**	**Please comment if unable to rate**
Local communities having access to electricity generated by IPP plants	Indicate lev	Indicate level	
	Impact	**Controllability**	**Please comment if unable to rate**
Diversity and equal opportunity for jobs and equity	Indicate lev	Indicate level	
	Impact	**Controllability**	**Please comment if unable to rate**
Future price increase of electricity especially for the general public	Indicate lev	Indicate level	
	Impact	**Controllability**	**Please comment if unable to rate**
Employment and employment practices by IPPs	Indicate lev	Indicate level	
	Impact	**Controllability**	**Please comment if unable to rate**
Engagement of IPPs with policymakers (DoE, DTI, DBSA and IDC) to reform the bidding requirements and consequently provide better support for the community benefit process	Indicate lev	Indicate level	
	Impact	**Controllability**	**Please comment if unable to rate**
Current labour relations and restrictive regulations between IPPs and South African local workforce	Indicate lev	Indicate level	
	Impact	**Controllability**	**Please comment if unable to rate**
Development of a representative community platform to collaborate on community benefits issues	Indicate lev	Indicate level	

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4. Alternative control drivers critical for the sustainability of the REIPPP

Here is a list of alternative control drivers. If you feel that some of these drivers should receive higher priority than those already provided in the questionnaire, please select and subsequently rank them. If you want to add a control driver that is not mentioned at all, but is still critical to the sustainability of the REIPPP, please don't hesitate to add them in the end.

Please select critical control drivers:

- [ ] Increasing localisation demands and its associated threshold decrease
- [ ] Crime and theft: Direct and indirect losses due to high cable and electricity theft
- [ ] Materialisation of small scale renewables
- [ ] Corruption and fraud on key stakeholder level for REIPPP
- [ ] Amendments of latest REIPPP documentation requirements
- [ ] Development and implementation of nuclear power generation in South Africa
- [ ] Targeted research to develop good practice recommendations for REIPPP
- [ ] Full scale Implementation of shale gas mining (fracking) in South Africa
- [ ] Implementation of cost effective energy storage facilities
- [ ] Enabling legislation for renewable energy in South Africa
- [ ] Global renewable energy growth forecast
- [ ] Future electricity demand projection
- [ ] SA moving to base load IPP procurement plan
- [ ] Addressing source measurement issues for wind and sun
- [ ] Successful output performance of first IPPs like Kalkbult
- [ ] Governments preference of renewable energy technology
- [ ] None

Questionnaire for key stakeholders of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

4. Alternative control drivers critical for the sustainability of the REIPPP

The control drivers that is critical to the sustainability of the REIPPP are selected and provided based on findings made in the research. If according to your professional opinion there are other control drivers that is not mentioned, please feel free to add and rate them

Please provide and rate self suggested control drivers, if applicable:

	Control driver name	Impact	Controllabili
Alternative driver 1	Control driver name	Impact	Controllabili
		—	—
Alternative driver 2	Control driver name	Impact	Controllabili
		—	—
Alternative driver 3	Control driver name	Impact	Controllabili
		—	—
Alternative driver 4	Control driver name	Impact	Controllabili
		—	—
Alternative driver 5	Control driver name	Impact	Controllabili
		—	—

Any additional comments?

APPENDIX F: TAILORED SUSTAINABILITY ASPECTS FROM GRI FRAMEWORK

Economic Dimension		
Aspect Question	**Revised aspect**	**Nr**
Direct economic value generated	1. Direct economic value generated for the public due to local content requirements during the operation and maintenance phase.	4
Positive implications due to climate change	2. Economic benefits for the REIPPP programme due to governmental climate change policies.	2
Obligations of coverage and defined benefit plans: The type of retirement plan chosen has implications for both employees and employers. On the other hand, a properly funded pension plan can help attract and maintain a stable workforce and support financial planning on the part of the employer.	3. Economic obligations of coverage and defined benefit plans made by REIPPPP management to help maintain a stable workforce during construction phase. *Not such a large impact on sustainability.*	3
Significant financing from government	3. Significant financing from government for the REIPPP programme during the bidding process.	6
Market presence		
Comparison of standard entry levy wage with local minimum wage: This demonstrates how a company contributes to the economic well-being of employees.	4. Competitive standard entry levy wage for project employees in comparison with local minimum wage during construction phase.	3,5
Policy, practices and spending on locally based suppliers.	5. IPPs spending on locally based suppliers during construction phase.	4,5
Procedures for hiring local workforce	6. IPP's procedures for hiring local workforce during construction phase.	4,5
Proportion of local hired senior management	7. IPP's procedures for hiring local workforce during operation and maintenance phase	4,5
	8. Proportion senior management allocated to local hired individuals for each project.	4,5
Indirect economic impacts		
Infrastructure investment and services impact on public	9. IPP infrastructure investment for local communities during construction phase.	1,3
	10. Impact made on public by IPP electricity services.	1,3
Understanding and describing significant indirect economic impact: Economic development in areas of high poverty, improvement of deteriorating social or environmental conditions, availability of products and services for those on low incomes.	11. Economic development in areas of high poverty due to the IPPs.	1,3,5
	12. Improvement on deteriorating social conditions due to IPPs.	
	13. Providing IPP electricity services for those living with a low income	
Availability and Reliability		
Planned capacity against projected demand over long term	14. IPP's plans and processes to ensure reliability of electricity supply to demand side during operating phase.	1,6

System Efficiency		
Overall efficiency; (electricity sent-out + heat supplied) / energy input	15. Overall efficiency of power plant during operation.	6
Transmission and distribution losses	16. Management of transmission losses on plant site during operation phase.	6
Management approach to economic aspects		
Research and development aimed at providing reliable energy and promoting sustainable development.	17.Research and development aimed at providing reliable energy	1,3
	18. Research and development aimed at promoting sustainable development.	3

Environment Dimension		
Aspect Question	**Revised aspect**	**Nr**
Materials		
Used by weight or volume	19. Total direct (materials in final product) and non-renewable materials (such as minerals, metals, oil, gas and coal) used by project during construction phase.	7
Percentage recycled input materials	20. Percentage recycled input materials used by the project during construction phase	7
Energy		
Indirect energy consumption	The amount of intermediate energy purchased during operation and consumed from renewable energy sources. *Removed: Other than the licensing there is no significant cost to harness sun or wind.*	7
Energy saved due to conservation and efficiency improvements	21. Energy saved by plant during operation and maintenance due to conservations and efficiency improvements	7
Initiatives to provide energy-efficient or renewable energy-based products and services	Initiatives by company's management to reduce indirect energy consumption during operation phase; like selecting energy-efficient materials, services or replacing travel with a phone/video call. *Removed: The impact of these initiatives on sustainability will not be on the desired level. Sustainable energy without hot air comes to mind.*	7
Reduction in energy requirements as a result of the above mentioned initiatives.	Plant reduction in indirect energy consumption as a result of the above mentioned initiatives during operation phase. *Removed: Same as above*	7
Water		
Total water use	22. Plant's total volume of water withdrawn in cubic meters per year, per Megawatt installed (m^3 /year/MW installed) during construction phase.	7

Total water use	23. Plant's total volume of water withdrawn in cubic meters per year, per Megawatt installed (m^3 /year/MW installed) during operation and maintenance phase.	7
Water sources significantly affected by water use	24. Local water sources significantly depleted by plant during whole life cycle.	7
Water recycled and reused	25. Water recycled and reused by plant during operation	7
Biodiversity		
Location and size of land used	26. Location and size of land used by plant during whole life cycle.	7
Significant impact due to activities, products and services on areas that is of high biodiversity value.	27. Significant impact on areas that is of high biodiversity value due to the project's activities during whole life cycle.	7
Habitats protected and restored	28. Habitats protected and restored by IPPs during whole lifecycle.	7
Managing impacts on biodiversity: Mitigating negative effects on forested areas, landscape, marine freshwater, wetland ecosystems and loss of indigenous species.	29. IPP's mitigation of negative effects on biodiversity during whole life cycle.	7
Number of rare species in areas affected	30. Number of rare species in areas affected by the power plant during whole life cycle.	7
Emissions, effluents and waste		
Total Green House Gas (GHG) emissions	31. Total Green House Gas (GHG) emissions by project during construction phase.	2,7
Other indirect GHG emissions	32. Indirect GHG emissions caused by the plant and workforce during whole life cycle; for example travelling and buying products that were made by emitting GHG.	2,7
Reduction in GHG achieved	33. Plant reduction in GHG achieved by IPP in tonnes of CO_2 equivalent during operation phase.	2,7
Total non-hazardous waste and Polychlorinated Biphenyls (PCBs) used as insulation for capacitors and transformers.	34. Total weight of plant waste during construction and maintenance phase.	7
Total number of oil, fuel, waste or chemical spills	35. Total number and volume of spills (oil, fuel, waste or chemical) made by IPP plant during life cycle.	7
Weight of hazardous waste transported, imported or exported.	Weight of hazardous waste transported, imported or exported by plant during construction and maintenance phase. *Removed: CSP, PV and Wind only has hazardous waste during manufacturing*	7
Products and services		
Mitigation of environmental impact	36. Initiatives to mitigate IPP services' environmental impact during whole life cycle.	7
Compliance		
Total fines for non-compliance with environmental laws and regulations	37. Total annual fines made out to the IPP for non-compliance with environmental laws and regulations.	7

	Removed: Will not make a direct contribution to sustainability; is more of an indicator or sustainability	
Transport		
Environmental impact of transport	38. Environmental impact of transport during construction phase	2,7
Overall		
Total expenditure or investments for environment protection and damage mitigation.	39. Total expenditure for environment protection and damage mitigation during whole life cycle.	7

Social Dimension		
Aspect Question	**Revised aspect**	**Nr**
Employment		
Total workforce	40. IPP's total workforce on site during construction phase	3,4,5
	41. IPP's total workforce on site during the operation and maintenance phase	
	42. IPP's total workforce that has a sustainable job during whole life cycle of plant.	
	43. IPP's percentage workforce from local communities.	
Total number and rate of employee turnover	44. Total number and rate of employee turnover during project phase.	3,4
	45. Total number and rate of employee turnover during operation phase.	
Processes and processes to ensure the availability of a skilled workforce.	46. Processes by management to ensure the availability of a non-local skilled workforce before construction phase.	3,4,5
	47. Processes by management to ensure the availability of a local skilled workforce before construction phase.	
Percentage of employees eligible to retire in the next 5 and 10 years broken down by job category and by region.	48. Percentage of plant operation employees eligible to retire in the coming 5 to 10 years during operation phase.	3,5
Days worked by contractor and subcontractor employees.	49. Days worked on site by all contractor employees during construction phase.	3,4
	50. Days worked on site by all contractor employees during operation phase.	
Benefits exclusively provided to full-time employees	51. Benefits exclusively provided by the company to full-time employees during operations phase.	3,5
Training and education		
Average hours of training per year per employee	52. Average hours of training provided by management per year per employee during construction phase.	3,5
	51. Average hours of training provided by management per year per employee during operation and maintenance phase.	

Programs for skills management and lifelong learning that support the continued employability and help them in managing career endings.	52. Programmes provided by management for skills management and lifelong learning during construction phase.	3,5
	53. Programs provided by management for skills management and lifelong learning during operation and maintenance phase.	
Percentage of employees receiving regular performance and career development reviews.	55. Percentage of employees receiving regular performance and career development reviews by management during operation phase.	3,5
Diversity and equal opportunity		
Composition of governance bodies and breakdown of employees according to gender, age group, minority group membership and other indicators of diversity	56. Composition of governance bodies and breakdown of these employees according to gender, age group, previously disadvantaged and other indicators of diversity during whole life cycle of project.	5
Ratio of basic salary of men to women	57. Ratio of basic salary of men to women during construction phase.	5
	58. Ratio of basic salary of men to women during operation and maintenance phase.	5
Non-Discrimination		
Total number of incidents of discrimination and remediation actions taken	75. Total number of incidents of discrimination made against employees by management during construction phase. *Removed: BBEEE and AA are in place to correct discrimination issues and human rights are in place to protect people from discrimination. Does not make a significant impact on sustainability.*	5
	76. Total number of incidents of discrimination made against employees by management during operation and maintenance phase. *Removed: Same as above*	5
Community		
Effectiveness of programmes and practices that asses and manage the whole life cycle operation's impact on communities.	59. Practices that manage the IPP operation's impact on communities during the whole life cycle.	1,3,4, 5,7
	60. IPP's approach to managing the impact of displacement of local community members during construction phase	3,8
Number of people physically or economically displaced due to energy infrastructure development and their compensation.	61. Number of people physically displaced due to energy infrastructure development during whole life cycle of plant.	1,3,5
	62. Number of people economically displaced due to energy infrastructure development during whole life cycle of plant.	
	63. Compensation made by company for physical or economical displacement during whole life cycle.	
Public policy		
The current public policy position	64. The public policy position provided by government during construction phase.	3,5

The public's participation in future public policy development and lobbying	65.The public's participation in future public policy development and lobbying provided by government	3,5,6
Total value of contributions made to political parties, politicians and related institutions.	66. Total value of IPP contributions made to political parties, politicians and related institutions during operation phase.	3,5,6
Anti-competitive behaviour		
Anti-competitive behaviour: Number of legal actions for anti-competitive behaviour, anti-trust and monopoly practices.	67. Number of legal actions taken by IPP's management for anti-competitive behaviour during operation phase.	6
	68. Number of legal actions taken by IPP's management for anti-trust and monopoly practices during operation phase.	
Product and service labelling		
Type of product and service information required by procedures.	69. Type of IPP service information required by market procedures to indicate degree of impact on overall sustainability during operation phase	2,4,7
Practices related to customer satisfaction.	70. Practices by IPP related to customer satisfaction during operation phase	1,3,4
Marketing communication		
Programmes for adherence to laws, standards and voluntary codes related to marketing communication.	71. IPP programs for adherence to laws, standards and voluntary codes related to marketing communication before construction phase commence.	3
	72. IPP programs for adherence to laws, standards and voluntary codes related to marketing communication during operation phase.	3
Incidents of non-compliance with regulations and voluntary codes concerning marketing communication.	106. Incidents of IPP non-compliance with regulations and voluntary codes concerning marketing communication during whole life cycle. *Removed: Would not have a significant impact on the overall sustainability. Decrease socio-economic benefits.*	3
Access		
Programs to improve or maintain access to electricity and customer support services.	73. IPP programs to improve access to electricity during operation phase.	1
Percentage of population not served electricity in licensed distribution or service area	74. Percentage of population not served IPP electricity in licensed distribution or service areas during operation phase.	1,3
Number of residential disconnections for non-payment	75. Number of residential disconnections by municipality for non-payment during operation phase.	1
Duration of disconnection for non-payment and reconnection if payment arrangements were made.	76. Responsiveness of municipalities measured in duration to disconnect or reconnect power supply based on used payment.	1,3
Power outage frequency	77. Power outage frequency by plant during operation phase.	1,3
Power outage duration to demonstrate the utility's ability to restore power in a timely fashion.	78. Power plant outage duration during operation phase	1,3

Plant availability factor.	79. Plant availability factor to the demand side (Eskom) during operation and maintenance phase.	1,3

APPENDIX G: CRITICAL CONTROL DRIVERS' IDENTIFICATION

How to interpret critical control drivers:

The critical control driver is presented in bold. Each critical driver is prioritised according the value calculated by the author. Beneath each critical driver are quoted sentences from literature that supports the relevance, importance and significance of the mentioned critical control driver. Take note that the quoted literature provides insight from all sides, both negative and positive, thus the contrast between the sub-supporting statements. In the end these quoted statements contribute to the reason for identifying the suggested critical control driver.

Why necessary? The reason why the critical control driver is necessary or what the possible consequences will be if this driver was addressed or implemented.

What happened thus far? Some of the critical control drivers already have its positive or negative effect on the REI4P. This supports the relevance and importance of each driver and gives an idea where to start if this driver was to be amended.

Is it a concern? The critical control driver can cause or address a concern. In some cases the driver must be addressed so that concerns can be resolved. In other cases the driver must be implemented to deal with concerns experienced in the REI4P. In both cases by dealing with these concerns the sustainability of the programme can be promoted.

Economic	
Funding for the Renewable Energy Independent Power Producer Procurement Programme (REI4P) [9, 8 = 72]	
Government	
It's necessary	• Due to lack of past funding for proper generation and infrastructure development because retail electricity prices had been kept too low for too long in South Africa. • Due to adequate financial and economic incentive that needs to be in place.
What happened thus far?	• Spending by government on State-owned companies in the energy environment. • Private sector and government came together to direct capital towards addressing long term sustainability issues. • Possible carbon tax that should be implemented and revenues generated should be used to support energy efficiency technologies, emission reduction projects and further incentives for the development of renewable energy. • Government will provide guarantee over the PPA payment obligations through National Treasury. • South African Renewable energy investment for 2012 was US$5.7 billion; according to UN energy programme this was the world's highest renewable energy investment growth in 2012.
It's an concern	• Due to outdated data and plans that rely heavily on large capital-intensive multiyear investment programmes • Due to renewable energy development that should not be left in the hands of the private investors alone. Eskom and the government need to be responsible for more renewable energy development.

	International
What happened thus far?	• International Financial Corporation (IFC) was committing US$480 million to South African renewable energy in the form of direct financing and loans. • South Africa's renewable industry received considerable support from Development Bank of Southern Africa (DBSA) along with other international financial institutions. • High profile companies, like European utility firms such as EDF, Enel and Acciona, manufacturers such as Vestas Wind Systems, Nordex and Siemens, are looking to capitalise from the opportunities presenting themselves.
It's a concern	• Due to South Africa not being properly marketed as investment destinationswhich could deliver dollar returns in the power sector of between 12-13%. • Due to US and Europe that is highly interested in investing in Africa, but see the continent as a big risk. • Due to Development Finance Institutions (DFIs) from Europe that have expressed considerable interest in the market, but have battled to get comfortable with the Foreign Exchange risk associated with lending in EUR/USD and getting repaid in ZAR.
	Banks and private companies
It's necessary	• Due to primary source of funding being from local South African Banks. • Due to private investment, in conjunction with funding from IFI's or development banks, that help alleviate risk associated with economic feasibility.
What happened thus far?	• Private companies, banks and financial institutions were able to participate in REI4P by providing finance in the form of debt or equity. • Old Mutual's IDEAS (Infrastructure, Development and Environmental Assets management) and pension funds were invested in IPPs. • Banks stating that renewable energy is already financially viable and makes financial sense. • In 2013 Investec bank approved $813 million of debt financing for clean energy projects which adds up to the $2 billion already committed to South African renewable industry. • Standard Bank, in conjunction with Industrial and Commercial bank of China, financed US$2.2 billion in 2012.
It's a concern	• Due to the ability of local banks to continue to lend into the renewable energy market, it will be driven by their ability to distribute what debt they have lent into the projects that have closed in the first two bidding windows. • Due to impact Bassel III has on local banks; that it is proving punitive and tenor of hedges is too long for local banks to handle without becoming unreasonably expensive.

Materialisation of the Independent System Market Operator (ISMO) [9,7 = 63]	
It's necessary	• Due to conflict of interest between Eskom and renewable energy IPPs when it comes to using the transmission and distribution system. • Due to Eskom favouring current type of generation plants; dictating how grid is designed and managed. • Due to single buyer office (SBO) that is currently buying electricity from IPPs and is non-independent but remains part of Eskom.
It's a concern	• Due to lack of progress in privatising the power sector limits investment
General decrease of feed in tariffs (FIT) for renewable energy technology over the programme period. [8,7 = 56]	
It's necessary	• To increase competition between bidders and conventional energy generation like coal
What happened thus far?	• FITs decreased due to advances in renewable energy technology. • FITs decreased due to increase competition between bidders during the initial stages.
It's an concern	• Due to downgrade on quality of IPP plant and products to be able to bid at lower rates. • Due to the REI4P auction system that may lead to developers to underbid their competitors, jeopardising the successful completion of projects.
Greater dialogue for the REI4P between government, Eskom, IPPs, financiers and industry during programme period. [7,8 = 56]	
It's necessary	• To ensure engagement between all parts of industry and government as far as possible. • To help with simplification and alignment of future bid documentation. • To ensure dialogue between preferred bidders and DoE's IPP unit during the bidding process. • To encourage greater industry ambition by improving industry understanding of government's priorities. • To promote minimising and streamlining trading agreements, land access, environmental requirements, licensing and power purchase agreements. • To improve engagement with BEE funders on an early stage to fully understand their lending conditions.
It's a concern	• Due to industry responding with uncertainty to many of the REI4P requirements. • Due to lack of nationally based (Governmental) expertise in smart energy technology. • Due to the procurement process that was initially too slow to get off the ground because it was complicated and lacked transparency. • Due to buy-in from civil society and private sector that is crucial for successful development and implementation of REFITs

Research and development aimed at promoting sustainable energy [6,9 = 54]	
It's necessary	• For research and development focusing on reliable energy. • For research on using available energy resources in a sustainable fashion.
Upgrade of and connection on transmission network/system [9,6 = 54]	
It's necessary	• Due to transmission system that needs to adapt to the new renewable energy supply (smart grid). • For implementation and support of SASGI (South African Smart Grid Initiative). • To obtain a fully optimised smart grid system that would be a solution for a climate-conscious, job-creating, polluting-lowering and sustainable energy system. • The grid requires upgrading and strengthening regardless of the electricity source.
It's a concern	• Due to current location of power generation, located in the east then transported to the west and south, transmission losses and high costs for transmission system. • Due to delays to grid connection for IPPs. • Due to renewable energy that has to adapt to the condition of the grid. In some cases renewable energy plants need to shut down when there is a great quantity of renewable resources combined with low grid demand just so that base load stations are able to continue to run at full power. • Due to vulnerability of the traditional grid. A failure at a big centralised station could have a severe effect on the grid. • Due to huge impact expected on the grid owing to renewable energy projects coming online. Several experts have warned of the impact of solar and wind energy on the grid as far as harmonics and availability, for example, are concerning. • Due to the achievement of low capacity factor of renewable energy in China partly owed to grid constraints. • Due to the current electricity system that has only room for 25% variable renewable energy. • Due to the fact that, if renewable energy exceeds 50%, the strategy of moving power between areas, shifting demands and shutting down renewables at peak time, can no longer work. • Due to the challenge of efficient integration of renewable plants into the country's underdeveloped power infrastructure despite of Eskom's most recent Transmission Ten-Year Development Plan (2012-2020).
What happened thus far?	• "Own build" grid connection option being finalised and appears to be a preferred option as bidders are not prepared to risk delays in the grid connection. • The World Economic Forum's Global Competitive Report of 2012-2013 gave South Africa 3.9 out of 7, ranking it 94th out of 144 when it comes to the current transmission network. The need for investment into the grid network is high.
Partnerships and consolidation of both local and foreign companies to promote local manufacturing of international standardised renewable energy products [9,5 = 45]	

It's necessary	• Due to South Africa's resource potential and the REI4P that places its country strategically when it comes to technology development, local manufacturing and creating a market for these products in SA, Africa and eventually the world. • Due to South Africa that can serve as springboard for renewable energy technology to rest of sub-Saharan Africa. • To address inadequate availability of supplies.
What happened thus far	• The DoE recognise partnerships are necessary in its mature REI4P approach.
Government policies regarding the future of renewable energy implementation during the REI4P period. [9,5 = 45]	
It's necessary	• Political support is crucial; strong commitment from government is needed to move towards a clean energy future. • Due to the fact that it is not technology, resources nor economics that prevent the full implementation of renewable energy, but rather misconceptions of the capability and lack of political will to move to a clean energy future. • Due to more than 25% of renewable energy is needed on a global scale to effectively mitigate climate change. • Due to policies that can help eliminate curtailment or renewable energy, competing against base load coal and nuclear plants.
What happened thus far?	• The REI4P auction system requires 3,725 MW of green energy capacity to be installed by 2016 and recently added 3.2GW of capacity targets to be installed by 2020. • Broad political consensus that renewable energy serves as centrepiece of a green economy • Current government policy framework around introduction of power from renewable energy generated a lot of certainty. • Implementation of REI4P resulted in development of green economy under the IPAP. • Although recently weakened by political infighting, the African National Congress's dominance ensures political stability and broad policy continuity.
It's a concern	• Due to REI4P being limited to 9% renewable energy by 2030 with focus on security of supply as opposed to access to electricity. • Due to government's latest energy proposals that make curbing of country's CO_2 emissions very unlikely and also indirectly create many social problems, including health impact, substantial water wastage and environmental pollution. • Due to possible omissions in regulatory frameworks and existing market frameworks such as supplier diversity and long-standing price misrepresentations. • Due to power supply of renewable energy to be a small portion of generation mix. • Due to uncertainty of generation projects after 2020 – Brian Dames. • Due to powers vested in the energy minister as unrealistically ambitious preventing the identification of a myriad of opportunities and options around new power.

	• Due to renewable energy development that should not be left in the hands of the private investors alone. Eskom and government need to be responsible for more renewable energy development than is currently planned. • Due to strong sector lobbying to keep coal generated power. • Due to current electricity generation model (coal and nuclear) that has not helped to reduce unemployment. • Due to renewable energy's limited contribution to the country's electricity mix so that more conventional electricity generators, mainly coal, will most probably dominate.
Amendment of latest REI4P documentation requirements [7,6 = 42]	
It's necessary	• For simplification and alignment of future bid documentation. • For minimising and streamlining trading agreements, land access, environmental requirements licensing and power purchase agreements. • To address the "slow-to-get-off-theground" progression due to the initial process that was complicated, lacked transparency and an expensive bidding process. • For targeting realistic equity returns and preferably back-end development fees.
It's a concern	• Due to industry responding with uncertainty to many of the REI4P requirements. • Due to uncertainty on interest rate risk. • Due to long bid risk duration; bid risk is required to be valid for 300 days from submission date. • Due to challenges experienced from local lending facilities owing to changes made in agreed EPC terms and conditions in post-preferred bidder selection phase. • Due to documentation issues experienced by lenders such as; ▪ Contractual termination regime; ▪ Delays in getting Return of Debt (RODs) in place; ▪ The Corrupt Acts indemnity in the PPA; ▪ Credit standing of equipment suppliers; ▪ Generation licence drafting; and ▪ Section 53 of Mining Rights.
Development and implementation of nuclear power generation in South Africa [7,6 = 42]	
It's a concern	• Due to Government's hope with the IRP 2010 to build 9.6GW of nuclear power by 2030, jeopardising its commitment to renewable energy. • Due to preference given to nuclear and coal as base load. • Could result in curtailment of renewable energy as nuclear need to run at full capacity.
Targeted research to develop good practice recommendations [5,7 = 35]	
It's necessary	• To find the most appropriate governance structure for development funds as community trusts are problematic. • To find the finance mechanism for sharing community ownership, ensuring more stable and predictable funding streams to

	communities.
Full scale Implementation of fracking for shale gas in South Africa [8,4 = 32]	
It's a concern	• Due to gas being a possible game changer according to CEO of Eskom, Brian Dames. • Shale gas being much more economically rewarding than renewable energy on the short to medium term.
Implementation of cost effective energy storage facilities [6,5 = 30]	
It's necessary	• For storage of excess power on grid like using water pump schemes. • For fuels that can be produced and stored as hydrogen from water by using the excess energy for electrolysis processes. • For energy stored in heat format, like CSP storage.
Enabling legislation for renewable energy in South Africa [7,4 = 28]	
It's necessary	• Legal framework needs to be improved and there is space for transparency to be strengthened.
What happened thus far?	• Current legislation resulted in deployment of significant renewable energy to be slow. • Lack of net metering and feed-in tariffs that hampers renewable energy uptake. • Current cost and procedural setting up of REI4P that makes it impossible for small to medium uptake of renewable energy. • Legal uncertainty surrounding the business environment could discourage investors; a number of IPPs have been exposed to delays.
Global renewable energy growth forecast [8,3 = 24]	
What happened thus far?	• Renewable energy to nearly triple from 2010 to 2035, reaching 31% of total electricity generation. • Investment of $6.4 trillion required over the period 2012-2035 for renewable energy. • Renewable energy subsidies of $240 billion per year by 2035 to achieve trends projected in the New Policies Scenario. • Global renewable energy would increase by over 40% in the next five years
Future electricity demand projection [8,3 =24]	
What happened thus far?	• National power supplies are currently running extremely low; therefore there is a great deal of scope for increasing energy security.
It's necessary	• For scale of sales; • For scale of energy infrastructure growth potential; and • For future electricity demand by electricity dependent utilities.

It's a concern	• Due to only having an electrification rate of 75%, leaving large parts of the population without electricity.
SA moving to base load IPP procurement plan [7,3 = 21]	
It's necessary	• To break down Eskom's monopoly industry.
What happened thus far?	• Progress of procurement of base load capacity from IPPs has been far less that renewable energy.
It's a concern	• Due to increasing coal and nuclear capacity. • Due to strong lobbying sector supporting to keep coal. • Due to lack of progress in privatising power sector limits investment. • Due to coal being a favoured fuel choice for power generation because there is an abundant indigenous supply of coal that is not vulnerable to international supply and has a low cost for capacity expansion.
Current governmental implementation of REI4P process	
What happened thus far?	• The REIPPP auction method has been successful at encouraging private investment into the sector. • Some of the greatest barriers facing the country's renewable energy expansion have already been overcome, like the signing of the power purchase agreement (PPA) with state utility Eskom.
It's a concern	• Due to both original dated proposed by the government for the financial close of projects for round one and tow have been delayed by at least three months. • Due to business environment has still numerous challenges to investors; South Africa's track record for implementing project in the power sector is poor. • Due to delays in the REI4P that stems from issues of land permits and PPA's • Due to the downside risk of using auctions for power projects, as companies vie to offer the lower bid. Lower return margins may mean that projects remain vulnerable to complications that are likely to arise as the programme continues.

Environment	
South African policy to address climate change by reducing GHG. [9,7 = 63]	
What happened thus far?	• South Africa is one of the world's top 15 emitters of GHG and an international promise to reduce country's emissions trajectory by 34% in 2020 and 42% by 2025 was made. • The Integrated Resource Plan (IRP) 2010, National Growth Path and National Development Plan addresses climate change. • A number of tonnes of CO2 will be offset by the renewable energy's IPPs.

	• Carbon tax has been delayed until 2015 due to objections made by metal companies including ArcelorMittal South Africa Ltd and Gold Fields Ltd, whose profit margins would no doubt narrow if such a tax was imposed.
It's necessary	• For addressing climate change, which is one of the greatest social injustice challenges of today, by various programmes like the REI4P.
It's a concern	• Due to increased medical costs owing to respiratory diseases for using coal based generation. • Due to slow execution on achieving reduction of GHG.
Effect on water sources during IPPs plant lifetime [8,8 = 64]	
It's a concern	• Due to plant's total volume of water withdrawn in cubic meters per year per Megawatt installed (m^3 /year/MW installed) during plant lifecycle. • Due to local water sources that can be significantly depleted by plant during whole lifecycle.
It's necessary	• To recycle and reuse water used by plant during operation.
Emissions, effluents and waste due construction phase of IPP plants [7,9 = 63]	
It's necessary	• Results in plant reduction in GHG achieved by IPP in tonnes of CO_2 equivalent during operation phase.
It's a concern	• Due to total Green House Gas (GHG) emissions by project during construction phase. • Due to indirect GHG emissions caused by the plant and workforce during whole life cycle; for example travelling and buying products that were made by emitting GHG. • Due to total weight of plant waste during construction and maintenance phase. • Due to total number and volume of spills (oil, fuel, waste or chemical) made by IPP plant during life cycle.
Protection and enhancement of biodiversity [7,8 = 56]	
It's a concern	• Due to location and size of land used by plant during whole life cycle. • Due to significant impact on areas of high biodiversity value because of the project's activities during whole life cycle. • Due to number of rare species in areas negatively affected by the power plant during whole lifecycle. • Due to possible expenditure for environment protection and damage mitigation during whole lifecycle.
It's necessary	• To protect and restore habitats by IPPs during whole lifecycle. • For IPP's mitigation of negative effects on biodiversity during whole lifecycle.
Current South African transport and logistics infrastructure for renewable energy [6,7 = 42]	
It's a concern	• Due to logistic challenges as most renewable energy sites are

	remote and parts or equipment need to travel long distances.
What happened thus far?	• Results in using the road as necessary railway infrastructure is not available to the appropriate sites. • Results in using large transport vehicles that contribute to GHG emissions, place strain on roads and damage environment using temporary gravel roads in remote areas.
Volume and weight of materials used by IPPs during construction phase [4,8 = 32]	
It's a concern	• Due to total direct (materials in final product) and non-renewable materials (such as minerals, metals, oil, gas and coal) used by project during construction phase.
It's necessary	• To ensure a percentage of recycled input materials is used by the project during construction phase.

Social	
Development of a representative community platform to collaborate on community benefits issues [9,8 = 72]	
Is necessary	• For communities being well-informed about the REI4P implications for local job creation and wider development planning and foster community engagement in developing locally sustainable processes and projects. • Ensures collaboration between municipalities with developers.
What happened thus far?	• The private sector still retains total control over deciding how socio-economic development and enterprise development revenues are spent.
It's a concern	• Due to uncertainty if the private sector is the right sector to be driving these processes. • Due to communities' voices not being well represented in policy formulation and other processes/negotiations.
Current labour relations and restrictive regulations between IPPs and South African local workforce [10,6 = 60]	
What happened thus far?	• Wildcat strikes at energy installation sites.
It's a concern	• Due to lack of site managers with weak understanding of local labour market requirements. • Due to lack of mature processes and experienced labour relations officers.
Engagement of IPPs with policymakers (DoE, DTI, DBSA and IDC) to reform the bidding requirements and consequently provide better support for the community benefit process [8,7 = 56]	
It's necessary	• To make amendments on socio-economic development requirements by providing clarification on job creation obligations. • For deliverance of tangible social and economic benefits in

	order to sustain political support for the REIPPP implementation.
What happened thus far?	• The thresholds are too unrealistically low.
Is a concern	• Due to the current policy framework that does not necessarily address the fundamental issues that communities deal with.
Employment and employment practices by IPPs [8,7 = 56]	
It's necessary	• For IPP's total workforce on site plant's whole life cycle. • To ensure workforce has a sustainable job during whole life cycle of plant. • To ensure a percentage of workforce is from local communities. • For processes by management to ensure the availability of a non-local skilled workforce before construction phase. • For benefits exclusively provided by the company to full-time employees during operations phase.
It's a concern	• Due to total number and rate of employee turnover during plant's whole lifecycle. • Due to percentage of plant operation employees eligible to retire in the coming 5 to 10 years during operation phase. • Due to days worked on site by all contractor employees' plant's whole life cycle.
Future price increase of electricity, especially for the general public [9,6 = 54]	
It's a concern	• Due to 77% of public that want cheap electricity and almost 70% already feels the pricing of electricity is too high in South Africa (survey 2012). • Due to low (only 22%) public support of government subsidising renewable energy application in South Africa (survey 2012). • Due to the fact that the only reason why, in Germany, the increase of electricity price is sustained and supported by the public, is because approximately 84% of Germans support Germany's plan towards renewable energy. • Due to future tariff increases for Eskom-generated electricity with the possibility of added CO_2 taxation. • Due to Eskom's yearly 8% tariff increase over the next five years. • Due to strong unions in South Africa that can cause a backlash against rising consumer electricity prices and projects may be in jeopardy as financing becomes increasingly uncertain.
What happened thus far?	• Results in protests as more that 40% of South Africa's population admits that it is not wrong to protest over electricity prices and access (Survey 2012). • Eskom is heavily indebted and plans pass the buck to foot the bill to the consumers for its capacity expansion plans for

	both renewables and conventional power projects.
Diversity and equal opportunity for jobs and equity [7,7 = 49]	
It's a concern	• Due to composition of governance bodies and breakdown of these employees according to gender, age group, previously disadvantaged and other indicators of diversity during whole lifecycle of project • Due to ratio of basic salary of men to women during construction phase. • Due to ratio of basic salary of men to women during operation and maintenance phase.
Local communities having access to electricity generated by IPP plants. [8,6 = 48]	
It's necessary	• For the responsiveness of municipalities to disconnect or reconnect power supply based on user payment.
What happened thus far?	• IPP internal programs were implemented to improve access to electricity during operation phase.
It's a concern	• Due to percentage of population not served IPP electricity in licensed distribution or service areas during operation phase. • Due to number of residential disconnections by municipality for non-payment during operation phase. • Due to power outage frequency and duration by plant during operation phase. • Due to plant availability factor to the demand side (Eskom grid) during operation and maintenance phase.
Workforce training and education [8,5 = 40]	
It's necessary	• To ensure hours of training provided by IPP management during whole life cycle • For programs provided by IPP management for skills management and lifelong learning during operation and maintenance phase. • To ensure percentage of employees receive regular performance and career development reviews by IPP management during operation phase.
Increasing localisation demands and its associated threshold decrease [8,4 = 32]	
It's a concern	• Due to companies being under immense pressure to remain competitive. • Due to South African technologies that were not used because it was too expensive and the consumer would pay for the expense.
It's necessary	• For bringing in most of the value chain to South Africa to stimulate economic growth in an areas which are huge in their potential. • To support the collaboration between DoE and Department of Trade and Industry (DTI) to ultimately reach the ideal aim of 100% local content in future windows. This is done by ensuring that enabling legislation and incentives are in place.

Crime and theft: Direct and indirect losses due to high cable and electricity theft [7,3 = 21]	
It's a concern	• Due to annual losses of R5bn due to cable theft. • Due to annual losses of R5bn due to electricity theft.
Materialisation of small scale renewables [3,6 = 18]	
It's necessary	• For small IPPs generating units that can provide electricity to rural areas and stimulate the economies in these areas; subsequently also address some of the social development goals. • For funding of minigrids that will provide power to small rural communities. Local sources and project financiers can obtain a return on investment on these grids.
What happened thus far?	• Germany gets most of their renewables from multiple small projects and households.
It's a concern	• Due to resistance from net metering from Eskom, NERSA and local municipalities. • Due to municipalities having banked on selling electricity as part of their funding model and will not allow rooftop PV electricity generation unless they are bailed out.
Corruption and fraud on key stakeholder level [8,2 = 16]	
It's a concern	• Due to billions of rand earmarked for development projects being wasted, mismanaged or stolen under the ruling party's leadership. • Due to corruption that can be directly linked in certain countries too increasing levels of poverty and income inequality.
What happened thus far?	• Investment interruption, restricting trade, reduced economic growth and distortion of facts and figures associated with government figures are experienced due to corruption. • Results in capital flight; funds required to acquire assets abroad shrinks a country's savings pool that could have been invested in the local economy. • Results in higher costs and declining quality of public sector infrastructure projects.

APPENDIX H: RESPONDENTS' RATING OF IDENTIFIED DRIVERS

3.1 Please rate 'Economic' control drivers | Impact

	1	2	3	4	5	6	7	8	9	10	Total Responses
Governmental policies regarding the future of renewable energy implementation during the REIPPP programme period	0 (0%)	0 (0%)	0 (0%)	1 (4%)	3 (12%)	1 (4%)	1 (4%)	5 (20%)	5 (20%)	9 (36%)	25
Partnerships and consolidation of both local and foreign companies to promote local manufacturing of international standardised renewable energy products	1 (4%)	0 (0%)	0 (0%)	0 (0%)	4 (16%)	5 (20%)	7 (28%)	4 (16%)	2 (8%)	2 (8%)	25
Upgrade of and new connections on transmission network/system	0 (0%)	0 (0%)	2 (8%)	1 (4%)	2 (8%)	1 (4%)	4 (17%)	7 (29%)	1 (4%)	6 (25%)	24
Current governmental implementation of REIPPP processes	0 (0%)	1 (4%)	1 (4%)	0 (0%)	4 (17%)	2 (8%)	2 (8%)	4 (17%)	4 (17%)	6 (25%)	24
Greater dialogue between government, Eskom, Independent Power Producers (IPPs), financiers and industry during REIPPP programme period	0 (0%)	0 (0%)	1 (4%)	1 (4%)	3 (12%)	2 (8%)	6 (25%)	4 (17%)	4 (17%)	3 (12%)	24
General decrease of feed in tariffs (FiT) for renewable energy technology over the REIPPP programme period	0 (0%)	1 (4%)	1 (4%)	0 (0%)	6 (26%)	4 (17%)	0 (0%)	6 (26%)	4 (17%)	1 (4%)	23
Materialisation of the Independent System Market Operator (ISMO)	0 (0%)	0 (0%)	2 (9%)	1 (5%)	6 (27%)	3 (14%)	5 (23%)	3 (14%)	1 (5%)	1 (5%)	22
Funding for the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)	0 (0%)	1 (4%)	0 (0%)	1 (4%)	2 (8%)	2 (8%)	1 (4%)	6 (25%)	3 (12%)	8 (33%)	24

Figure 17: Respondents' level of impact rating on economy drivers

3.1 Please rate 'Economic' control drivers | Control

	1	2	3	4	5	6	7	8	9	10	Total Responses
Governmental policies regarding the future of renewable energy implementation during the REIPPP programme period	3 (12%)	5 (20%)	1 (4%)	4 (16%)	4 (16%)	4 (16%)	1 (4%)	0 (0%)	2 (8%)	1 (4%)	25
Partnerships and consolidation of both local and foreign companies to promote local manufacturing of international standardised renewable energy products	2 (8%)	1 (4%)	3 (12%)	4 (16%)	3 (12%)	2 (8%)	6 (24%)	4 (16%)	0 (0%)	0 (0%)	25
Upgrade of and new connections on transmission network/system	5 (21%)	6 (25%)	2 (8%)	2 (8%)	2 (8%)	5 (21%)	0 (0%)	1 (4%)	1 (4%)	0 (0%)	24
Current governmental implementation of REIPPP processes	5 (21%)	2 (8%)	2 (8%)	2 (8%)	6 (25%)	1 (4%)	1 (4%)	2 (8%)	1 (4%)	2 (8%)	24
Greater dialogue between government, Eskom, Independent Power Producers (IPPs), financiers and industry during REIPPP programme period	1 (4%)	3 (12%)	1 (4%)	3 (12%)	8 (33%)	1 (4%)	2 (8%)	3 (12%)	0 (0%)	2 (8%)	24
General decrease of feed in tariffs (FiT) for renewable energy technology over the REIPPP programme period	2 (9%)	2 (9%)	5 (22%)	0 (0%)	6 (26%)	2 (9%)	2 (9%)	4 (17%)	0 (0%)	0 (0%)	23
Materialisation of the Independent System Market Operator (ISMO)	6 (27%)	3 (14%)	3 (14%)	0 (0%)	6 (27%)	1 (5%)	2 (9%)	0 (0%)	0 (0%)	1 (5%)	22
Funding for the Renewable Energy	2 (8%)	4 (17%)	2 (8%)	3 (12%)	3 (12%)	0 (0%)	2 (8%)	4 (17%)	1 (4%)	3 (12%)	24

Figure 18: Respondents' level of controllability rating on economy drivers

3.2 Please rate 'Environmental' control drivers | Impact

	1	2	3	4	5	6	7	8	9	10	Total Responses
Volume and weight of materials used by IPPs during construction phase	2 (8%)	2 (8%)	2 (8%)	2 (8%)	7 (29%)	4 (17%)	2 (8%)	2 (8%)	1 (4%)	0 (0%)	24
Current South African transport and logistics infrastructure for renewable energy	1 (4%)	0 (0%)	2 (8%)	2 (8%)	6 (25%)	5 (21%)	3 (12%)	4 (17%)	1 (4%)	0 (0%)	24
Protection and enhancement of biodiversity	2 (8%)	0 (0%)	1 (4%)	1 (4%)	4 (17%)	2 (8%)	6 (25%)	5 (21%)	3 (12%)	0 (0%)	24
Emissions, effluents and waste due construction phase of IPP plants	3 (12%)	0 (0%)	3 (12%)	6 (25%)	4 (17%)	4 (17%)	2 (8%)	1 (4%)	1 (4%)	0 (0%)	24
Effect on water sources during IPPs plant lifetime	3 (13%)	1 (4%)	3 (13%)	3 (13%)	5 (22%)	1 (4%)	3 (13%)	1 (4%)	0 (0%)	3 (13%)	23
South African policy to address climate change by reducing green house gases (GHG)	0 (0%)	1 (4%)	2 (9%)	1 (4%)	3 (13%)	2 (9%)	2 (9%)	7 (30%)	3 (13%)	2 (9%)	23

Figure 19: Respondents' level of impact rating on environment drivers

3.2 Please rate 'Environmental' control drivers | Control

	1	2	3	4	5	6	7	8	9	10	Total Responses
Volume and weight of materials used by IPPs during construction phase	3 (12%)	1 (4%)	4 (17%)	2 (8%)	5 (21%)	3 (12%)	2 (8%)	3 (12%)	1 (4%)	0 (0%)	24
Current South African transport and logistics infrastructure for renewable energy	4 (17%)	2 (9%)	5 (22%)	2 (9%)	3 (13%)	1 (4%)	4 (17%)	2 (9%)	0 (0%)	0 (0%)	23
Protection and enhancement of biodiversity	4 (17%)	2 (8%)	1 (4%)	1 (4%)	6 (25%)	3 (12%)	5 (21%)	2 (8%)	0 (0%)	0 (0%)	24
Emissions, effluents and waste due construction phase of IPP plants	2 (9%)	0 (0%)	0 (0%)	2 (9%)	5 (22%)	3 (13%)	4 (17%)	6 (26%)	1 (4%)	0 (0%)	23
Effect on water sources during IPPs plant lifetime	2 (9%)	1 (5%)	1 (5%)	1 (5%)	5 (23%)	4 (18%)	2 (9%)	3 (14%)	3 (14%)	0 (0%)	22
South African policy to address climate change by reducing green house gases (GHG)	4 (18%)	5 (23%)	1 (5%)	1 (5%)	4 (18%)	3 (14%)	1 (5%)	3 (14%)	0 (0%)	0 (0%)	22

Figure 20: Respondents' level of controllability rating on environment drivers

3.3 Please rate 'Social' control drivers | Impact

	1	2	3	4	5	6	7	8	9	10	Total Responses
Workforce training and education	1 (4%)	1 (4%)	2 (8%)	0 (0%)	3 (12%)	1 (4%)	4 (17%)	7 (29%)	2 (8%)	3 (12%)	24
Local communities having access to electricity generated by IPP plants	2 (9%)	1 (4%)	5 (22 %)	1 (4%)	6 (26%)	4 (17%)	0 (0%)	2 (9%)	1 (4%)	1 (4%)	23
Diversity and equal opportunity for jobs and equity	2 (9%)	0 (0%)	2 (9%)	1 (4%)	7 (30%)	4 (17%)	2 (9%)	3 (13%)	2 (9%)	0 (0%)	23
Future price increase of electricity especially for the general public	1 (4%)	1 (4%)	2 (9%)	1 (4%)	0 (0%)	0 (0%)	3 (13%)	9 (39%)	4 (17 %)	2 (9%)	23
Employment and employment practices by IPPs	0 (0%)	0 (0%)	1 (4%)	3 (13%)	5 (22%)	5 (22%)	2 (9%)	4 (17%)	3 (13 %)	0 (0%)	23
Engagement of IPPs with policymakers (DoE, DTI, DBSA and IDC) to reform the bidding requirements and consequently provide better support for the community benefit process	1 (4%)	0 (0%)	0 (0%)	2 (8%)	3 (12%)	5 (21%)	5 (21%)	5 (21%)	2 (8%)	1 (4%)	24
Current labour relations and restrictive regulations between IPPs and South African local workforce	0 (0%)	1 (4%)	2 (8%)	3 (12%)	3 (12%)	1 (4%)	5 (21%)	5 (21%)	2 (8%)	2 (8%)	24
Development of a representative community platform to collaborate on community benefits issues	1 (4%)	2 (8%)	2 (8%)	0 (0%)	3 (12%)	4 (17%)	4 (17%)	3 (12%)	2 (8%)	3 (12%)	24

Figure 21: Respondents' level of impact rating on social drivers

3.3 Please rate 'Social' control drivers | Control

	1	2	3	4	5	6	7	8	9	10	Total Responses
Workforce training and education	1 (4%)	1 (4%)	3 (13%)	1 (4%)	5 (22%)	3 (13%)	5 (22%)	4 (17%)	0 (0%)	0 (0%)	23
Local communities having access to electricity generated by IPP plants	4 (17%)	4 (17%)	1 (4%)	5 (22 %)	2 (9%)	1 (4%)	4 (17%)	2 (9%)	0 (0%)	0 (0%)	23
Diversity and equal opportunity for jobs and equity	3 (13%)	3 (13%)	2 (9%)	1 (4%)	4 (17%)	3 (13%)	4 (17%)	3 (13%)	0 (0%)	0 (0%)	23
Future price increase of electricity especially for the general public	5 (22%)	2 (9%)	3 (13%)	2 (9%)	2 (9%)	6 (26%)	1 (4%)	1 (4%)	0 (0%)	1 (4%)	23
Employment and employment practices by IPPs	3 (13%)	1 (4%)	4 (17%)	1 (4%)	2 (9%)	5 (22%)	1 (4%)	4 (17%)	2 (9%)	0 (0%)	23
Engagement of IPPs with policymakers (DoE, DTI, DBSA and IDC) to reform the bidding requirements and consequently provide better support for the community benefit process	3 (12%)	4 (17%)	3 (12%)	4 (17 %)	2 (8%)	2 (8%)	3 (12%)	2 (8%)	1 (4%)	0 (0%)	24
Current labour relations and restrictive regulations between IPPs and South African local workforce	5 (21%)	2 (8%)	2 (8%)	1 (4%)	4 (17%)	5 (21%)	1 (4%)	4 (17%)	0 (0%)	0 (0%)	24
Development of a representative community platform to collaborate on community benefits issues	2 (8%)	3 (12%)	3 (12%)	0 (0%)	6 (25%)	5 (21%)	3 (12%)	1 (4%)	0 (0%)	1 (4%)	24

Figure 22: Respondents' level of controllability rating on social drivers

APPENDIX I: ALTERNATIVE DRIVERS SELECTED AND IMPACT AND CONTROLLABILITY RATING

(loop:"Increasing localisation demands and its associated threshold decrease") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	1 (11%)	0 (0%)	0 (0%)	0 (0%)	1 (11%)	3 (33%)	2 (22%)	1 (11%)	1 (11%)	9
Level of controllability	1 (11%)	1 (11%)	2 (22%)	0 (0%)	0 (0%)	3 (33%)	0 (0%)	2 (22%)	0 (0%)	0 (0%)	9

(loop:"Crime and theft: Direct and indirect losses due to high cable and electricity theft") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (40%)	1 (20%)	1 (20%)	0 (0%)	1 (20%)	5
Level of controllability	1 (20%)	0 (0%)	0 (0%)	0 (0%)	1 (20%)	3 (60%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5

(loop:"Materialisation of small scale renewables") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (12%)	1 (12%)	1 (12%)	2 (25%)	1 (12%)	2 (25%)	8
Level of controllability	0 (0%)	0 (0%)	1 (12%)	2 (25%)	1 (12%)	2 (25%)	0 (0%)	1 (12%)	1 (12%)	0 (0%)	8

(loop:"Corruption and fraud on key stakeholder level for REIPPP") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (20%)	0 (0%)	0 (0%)	3 (60%)	0 (0%)	1 (20%)	5
Level of controllability	1 (20%)	1 (20%)	0 (0%)	2 (40%)	1 (20%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5

(loop:"Amendments of latest REIPPP documentation requirements") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (11%)	1 (11%)	2 (22%)	4 (44%)	1 (11%)	0 (0%)	9
Level of controllability	1 (11%)	2 (22%)	1 (11%)	1 (11%)	2 (22%)	0 (0%)	0 (0%)	1 (11%)	0 (0%)	1 (11%)	9

(loop:"Development and implementation of nuclear power generation in South Africa") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (12%)	1 (12%)	2 (25%)	2 (25%)	0 (0%)	2 (25%)	8
Level of controllability	0 (0%)	0 (0%)	1 (12%)	1 (12%)	1 (12%)	1 (12%)	1 (12%)	1 (12%)	2 (25%)	0 (0%)	8

(loop:"Targeted research to develop good practice recommendations for REIPPP") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (40%)	0 (0%)	2 (40%)	1 (20%)	0 (0%)	5
Level of controllability	0 (0%)	0 (0%)	0 (0%)	1 (20%)	0 (0%)	1 (20%)	0 (0%)	1 (20%)	2 (40%)	0 (0%)	5

(loop:"Full scale Implementation of shale gas mining (fracking) in South Africa") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (33%)	0 (0%)	1 (33%)	1 (33%)	0 (0%)	0 (0%)	3
Level of controllability	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (33%)	0 (0%)	2 (67%)	0 (0%)	0 (0%)	3

(loop:"Implementation of cost effective energy storage facilities") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (45%)	1 (9%)	5 (45%)	11
Level of controllability	1 (9%)	0 (0%)	2 (18%)	2 (18%)	0 (0%)	3 (27%)	1 (9%)	1 (9%)	1 (9%)	0 (0%)	11

(loop:"Enabling legislation for renewable energy in South Africa") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	1 (6%)	0 (0%)	0 (0%)	1 (6%)	7 (44%)	1 (6%)	6 (38%)	16
Level of controllability	2 (12%)	2 (12%)	3 (19%)	2 (12%)	1 (6%)	2 (12%)	3 (19%)	0 (0%)	0 (0%)	1 (6%)	16

(loop:"Global renewable energy growth forecast") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	1 (25%)	0 (0%)	0 (0%)	1 (25%)	2 (50%)	0 (0%)	0 (0%)	4
Level of controllability	2 (50%)	1 (25%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (25%)	0 (0%)	0 (0%)	4

(loop:"Future electricity demand projection") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (15%)	1 (8%)	5 (38%)	2 (15%)	3 (23%)	13
Level of controllability	3 (23%)	3 (23%)	0 (0%)	1 (8%)	2 (15%)	1 (8%)	2 (15%)	0 (0%)	1 (8%)	0 (0%)	13

(loop:"SA moving to base load IPP procurement plan") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	2 (33%)	1 (17%)	0 (0%)	0 (0%)	2 (33%)	6
Level of controllability	1 (17%)	2 (33%)	2 (33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	0 (0%)	0 (0%)	6

(loop:"Addressing source measurement issues for wind and sun") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (33%)	2 (67%)	0 (0%)	0 (0%)	0 (0%)	3
Level of controllability	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3

(loop:"Successful output performance of first IPPs like Kalkbult") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	2
Level of controllability	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	2

(loop:"Governments preference of renewable energy technology") Please rate "{{ drivers }}" in terms of 'level of impact' and 'level of contrallability'

	1	2	3	4	5	6	7	8	9	10	Total Responses
Level of impact	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (8%)	2 (17%)	1 (8%)	3 (25%)	1 (8%)	4 (33%)	12
Level of controllability	1 (8%)	2 (17%)	1 (8%)	2 (17%)	3 (25%)	0 (0%)	1 (8%)	1 (8%)	1 (8%)	0 (0%)	12

APPENDIX J: SELF SUGGESTED CONTROL DRIVERS SORTED ACCORDING TO RESPONDENT

Alternative control drivers	Impact Mean	Control Mean	*Priority value	Respondent
1. Abundance of input resources	4	4	16	Economist for Lesedi Power, Mr Bansundu Fredrick Maseko
2. Availability of land with development permits	9	3	27	
3. Availability of skilled labour and machinery	7	3	21	
4. Demand for power in new developing areas	5	2	10	
5. The rate of return on IPP project	10	1	10	
6. Availability and equal access to grid	9	2	18	Sol Plaatje municipality representative
7. De-bundling of Eskom	10	5	50	
8. Certainty of MW allocation per technology per year in IRP	10	3	30	Robor Steel representative
9. Contribution to upgrade of bulk services towards local municipalities	7	6	42	Town and regional planner of Kouga Municipality, Mr. Danie Rautenbach,
10. Impact on birds and bats during operation phase	6	2	12	Environment Specialist for BioTherm Energy, Mr Wright,
11. REIPPP bidding windows	10	1	10	
12. Timeline to authorisation of EIA and appeals process	8	2	16	
13. Municipal level acceptance for Nett Metering for residential and small businesses to encourage small scale renewables	9	3	27	Hatch representative
14. Ratio of preferred bidders to bidders in subsequent rounds of REIPPPP	16	2	16	RMB representative

APPENDIX K: STATISTICAL OUTPUT FROM NWU STATISTICAL CONSULTATION

Case Processing Summary

		N	%
Cases	Valid	21	84.0
	Excluded[a]	4	16.0
	Total	25	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics for Economy

Cronbach's alpha	Cronbach's alpha Based on standardised items	N of items
.758	.766	8

Summary item statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item means	7.268	6.143	8.333	2.190	1.357	.647	8
Inter-item correlations	.291	-.029	.721	.750	-24.654	.033	8

Item - total statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
@11000000000000001	49.810	64.762	.732	.681	.683
@12	51.190	71.162	.437	.299	.736
@13	50.571	67.457	.497	.443	.725
@14	50.857	66.029	.547	.574	.715
@15	51.000	75.000	.419	.517	.739
@16	51.762	76.290	.236	.223	.776
@17	52.000	77.600	.291	.168	.760
@18	49.810	72.162	.567	.631	.718

Reliability statistics for environment

Cronbach's alpha	Cronbach's alpha Based on standardized items	N of items
.632	.626	6

Summary item statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item means	5.514	4.696	6.609	1.913	1.407	.585	6
Inter-item correlations	.218	-.200	.576	.776	-2.878	.048	6

Item - total statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if Item deleted
@21	28.087	47.083	.402	.408	.575
@22000000000000002	27.348	55.419	.117	.533	.667
@22999999999999998	26.957	40.498	.588	.658	.494
@24	28.391	45.704	.416	.510	.568
@25	28.174	42.150	.406	.280	.571
@26	26.478	48.897	.267	.565	.625

Reliability statistics for social

Cronbach's alpha	Cronbach's alpha based on standardized items	N of items
.689	.699	8

Summary item statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item means	6.167	4.952	6.905	1.952	1.394	.424	8

Inter-item correlations	.225		-.417	.679	1.096	-1.627	.058	8

Item - Total statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
@31	42.667	87.133	.391	.768	.658
@32	44.381	93.748	.278	.403	.684
@33	43.905	77.690	.774	.836	.568
@34	42.429	103.157	.054	.650	.739
@35	43.095	92.790	.475	.643	.645
@36	42.905	102.290	.173	.211	.699
@37	43.048	86.248	.468	.595	.639
@38	42.905	79.990	.553	.464	.614

APPENDIX I: FOLLOW UP INTERVIEW QUESTIONNAIRE

1. Funding for the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

The author's study so far has shown that the lion's share of the funding came from local banks and, based on literature and personal research, their capacity and appetite for future investment is far from attained or satisfied. They will continue with investments as long as there is policy, regulatory, investment and legal certainty. The author therefore concludes that, if the Government honours its contracts like they did in the past with PPPs, it will give investors/lenders the assurance they need to continue investing.

1. When it comes to the funding for the REIPPP programme a lot was realised and accomplished. How can this successful funding recipe be maintained?
2. What should be done to ensure there will be a sustainable availability of funding for the REIPPP programme?
3. What can be done to ensure there will be off-takers in the future, like the National Treasury (NT), DoE (Department of Energy) and Eskom?
4. *If the feed in tariff (FiT) is too low, then the investment loses its attractiveness; if it is too high it can cause the future Government to bail out on their agreement because the FiT is more expensive than other available forms of energy*. What should be done to ensure that the feed-in tariff cap is always market related?

2. Workforce training and education

The author's research to date has shown that there are various ways to comply with the expected local content requirements for IPP bidding. He realised that training and educating our nation's people was one of these targets that needed to be realised.

1. When it comes to training/educating local people for renewable IPPs, who should be the key role players?
2. In cases where the level of workforce training/education is not acceptable, what should be done to improve local skill or expertise development?
3. What can be done to ensure that the training provided is retained in the REIPPP programme once construction of a site is completed?

3. Enabling legislation for renewable energy in South Africa

The outcome of the author's research also demonstrated that the current enabling legislation for renewable energy was to a large extent in place, especially for large IPPs. On the other hand he concluded that laws and regulations like connection to grid, strict procurement laws and realisation of an independent system marker operator (ISMO), still needed to be investigated and improved.

1. What should be done to ensure that the enabling legislation stays unchanged for future projects?
2. In what way should the regulatory framework be amended to obtain more and better enabling legislation for renewable energy in South Africa?

4. Partnerships and consolidation of both local and foreign companies to promote local manufacturing of international standardised renewable energy products

MThe author's research illustrated that ART-solar (Switzerland) and 3W/AEG Power Solutions (Germany) are examples where local and foreign companies went into partnership to achieve local manufacturing. These two companies manufacture PVs and inverters respectively, and their locally produced products contribute largely to the local content during bidding as IPPs.

1. What should be done to optimally increase the local manufacturing capacity of renewable energy components?
2. In what way should these partnerships and consolidation be created so that their manufacturing can be sustained for extended time periods to come?

5. Greater dialogue between Government, Eskom, Independent Power Producers (IPPs), financiers and industry during the REIPPP programme period

The researcher's study so far has shown that greater dialogue will ensure engagement between all relevant key role players, which will in turn simplify and/or align future bid documentation, encourage industry ambition and streamline agreements. This should not only be achieved before the undertaking of a bid, but also during and after the bidding process. He also concluded that there could be a delayed, or even withheld, industry response due to uncertainty with many REIPPP programme requirements and that this was something which extensive dialogue could correct or at least improve.

1. What is currently being done to address/achieve the above mentioned driver?
2. If there was no effective platform for having REIPPP programme relevant discussions, and should you support the idea of such a platform, who do you suggest should take the lead for this proposal?
3. In which way should the above mentioned platform for greater dialogue be managed so that the maximum benefit could be achieved for all involved entities?

General

1. Do you have any comments/suggestions that are related to one of the above mentioned control drivers that will consequently promote the sustainability of the programme itself?

Could you provide any other comments/suggestions that were not covered in this interview, but which would help to ensure the sustainability of the REIPPP?

APPENDIX J: FOLLOW-UP INTERVIEW TRANSCRIBED ANSWERS

1. Funding for the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

Author's study so far has shown that the lion's share of the funding came from local banks and, based on literature and personal research, their capacity and appetite for future investment is far from attained or satisfied. They will continue with investments as long as there is policy, regulatory, investment and legal certainty. Therefore the researcher concludes that, if the Government honours their contracts like they did in the past with PPPs, it will give investors/lenders the assurance they need to continue investing.

1.1 When it comes to the funding for the REIPPP programme a lot was realised and accomplished. How can this successful funding recipe be maintained?

Maduna Ngobeni – DoE (I : 6:30 – 13:30)

The DoE decided to use local currency because foreign funding could have an impact on the South African economy. The possible impact on the economy is due to the effect foreign currency would have on the electricity price, like it did with fuel (oil, petrol, diesel). The volatility of the ZAR should not affect the price of electricity.

From the government's side Mr. Ngobeni, would not be in the position to say that there is enough funding for the REIPPP programme going forward; not the same way as the Government did in the past at least, but the SA financial market is big and it will be able to support the REIPPP programme to a certain extent.

Over time other creative means of funding should be investigated as DoE also needs to finance other forms of energy programmes. He believed that the appropriate investors were interested to invest at a sustainable level. Local funding would be able to carry the programme and DoE will compensate for any money value lost due to rand depreciation from announcement up until financial closure.

Denish Jugmohan – Nedbank Capital (I : 10:50 – 22:00)

When it comes to financing the Private and Public Partnership (PPP) structure was used in the past. The PPP structure worked very well and gave the necessary credit history to be used as baseline for the REIPPP programme. The same documentation from the PPP structure were utilised for the IPPs, but were simplified to apply and understand.

There need to be a balance between the private sector that wants to make a profit and Government that wants the optimum benefit for their people and their communities. The first compiled RFP achieved the above mentioned balance. In round one the tariff for each technology was determined by Government based on its budget and striking the above mentioned balance. In round two the participants suggested to decrease the FiT so that they could serve as preferred bidders. Government could then pick IPPs that did not only conform to

the performance and local content requirements, but also have the best FiT.

Some other companies said they could not participate or compete because the big utilities came in with a very low FiT. According to Mr. Jugmohan achieving the lowest FiT is the whole point; why should the country or consumer pay more just so that smaller companies could be part of the programme?

When it comes to the actual investment, the investors are not as much bothered about the local content, but rather having a sound project with quality components. The investors would like to know and see their project is operating and performing well without taking a large risk by having a too large local content.

Piet Badenhorst – IDC (24:40)

For the REIPPP funding would not be a problem. Based on the target set out by the IRP 2010 and the low cost of renewable energy plants in comparison to other energy generation options, funding will not be a problem. There is even funding available from outside South Africa.

Local large banks can sell their debts to acquire more funding for future projects. This is usually done after the plant is de-risked; the plant is commissioned, working and will continue to operate. The only risk left is operating risk, not technology risk. Once again, funding from outside South Africa could be made available to buy debt from banks.

Bonds are another form of financing, but it is difficult to implement and would not play a major role in the programme as yet.

Reaching a stage where Government funding is not required to continue the programme is possible. For now Government serves as the guaranteed off taker. Going forward, even having a form of ISMO would still not prevent IPPs from investing and continuing to be part of the REIPPP programme as the financial potential is large enough, even without a guaranteed off taker. For the present Government would need to be involved due to the current Eskom Structure, but if they wanted to let the programme continue on its own, many rules (ESKOM structure) need to change.

Dr Adila Marengo – NERSA

Monitoring was necessary of the successful renewable energy IPP's performance in terms of energy output/sales, and on obligations of enterprise and social development. Also proper planning for prospecting IPPs, investigating the price and impact on the system/grid in terms of stability.

1.2 What should be done to ensure there will be a sustainable availability of funding for the REIPPP programme?

Maduna Ngobeni – DoE (I : 12:00 – 13:30)

Consider other forms of finance, but do it in a creative way so that the volatility of the rand does not affect the price of electricity. It must be addressed in an effective way, but in a way that will not expose the consumers.

Denish Jugmohan – Nedbank Capital (I : 22:10)

Banks need to stay in touch with Government about their fund availability, or when they will reach their cap for green development funding. Unlike with European banks, there is a small banking sector in South Africa that would be able to provide funding for the REIPPP programme. If one of the 5 mayor systemic banks of South Africa were to be in a troubled situation, it would have a 25% effect on the funding potential when it comes to local banks. Government would try and prevent that anything happens to one of the systemic banks as the effect thereof on the economy will be very large.

In the case where banks reached their cap with green development funding, debt could be redistributed and Government makes this clear in their documentation. That way banks can make financing available for future projects. The last mentioned can be achieved by having good communication between the banks and the relevant stakeholders.

Pension funds for debt redistribution are another option. Banks like Nedbank are very strict in terms of requirements and documentation, which make a project/energy plant a very secure investment option for funding like pension funds.

Financiers are much more lenient when it comes to retrieving loaned money from the REIPPP programme, due to the good will and ideal of green, renewable energy.

Piet Badenhorst – IDC (31:30)

He does not see funding as an issue and there are many alternatives to obtain funding. Local funding is and will be readily available, and if local funding is not available there is international funding.

Dr Adila Marengo – NERSA

Various types of renewable technology should be included in the modelling of the Integrated Resource Plan, focusing on scenarios and impact on average prices. Renewable Energy technologies that are cheaper and able to delivery energy will have to be prioritised in order to avoid paying for energy that is not always available.

1.3 What can be done to ensure there will be off-takers in future, like the National Treasury (NT), DoE (Department of Energy) and Eskom?

Maduna Ngobeni – DoE (I : 13:30 – 19:00)
The DoE is busy with a willing buyer, willing seller concept, which getting traction. Unfortunately the DoE is not at the stage where this concept would work perfectly because South Africa comes from a monopoly structured electricity generation background. Currently Eskom will serve as off-taker as long as the IRP provides for renewable energy capacity. Of the total energy, 30% must come from the private sector and Eskom will provide the balance. Mr. Ngobeni does not see an issue with the off-takers in the near future. Going forward the municipalities could serve as potential off-takers; that way the energy system can be decentralised. Unfortunately municipalities' current revenue structure does not allow for the last mentioned. Another challenge – if a municipality served as off-taker – would be that there could be a different price projection for each area in South Africa; the small pool of population means higher price tariffs due to smaller subsidisation from the group of people. This places a huge burden on municipalities, forcing them to increase their tariffs to compensate for renewable energy application. These issues must be addressed and one way is to buy and sell electricity on a national level.
Denish Jugmohan – Nedbank Capital (I : 36:00 -)
There needs to be an electricity demand and it cannot be controlled directly. In European or developed countries the energy demand is fairly consistent, year on year. Based on the South African development and population growth prediction, there will be an increase of demand for electricity. Identifying companies or big industries to serve as electricity off-takers is where the market is going.An ISMO that could co-ordinate and let IPPs produce according to specific loads is necessary. The full potential of a renewable energy project could then be achieved, because it is tailor-made according to the specific load.
Piet Badenhorst – IDC (33:20)
Essentially for our energy generation we need to split Eskom in two; one would be the generation and the other should form the ISMO. Both of the entities could be Government-owned, but they need to be managed independently and there should not be a conflict of interest. As long as there is not an ISMO, Government must be part of the programme to ensure there is an off-taker.
Dr Adila Marengo – NERSA

Government will have to ensure that there is a legislated independent system and market operator that purchases energy from all electricity generators.

1.4 ***If the feed in tariff (FiT) is too low, then the investment looses its attractiveness; if it is too high it can cause the future Government to bail out on their agreement, because the FiT is more expensive than other available forms of energy*****. What should be done to ensure that the feed-in tariff cap is always market related?**

Maduna Ngobeni – DoE (I :20:00 – 24:45)

DoE moved away from deciding on the FiT since the beginning of the programme because it is difficult to determine the correct tariff. In most instances it will be too high or too low. The DoE's model allows the market to determine the correct price, and with competition the price is internally pressed down. That way the DoE does not have to be concerned about the price, as the market will determine the price that would be best for the market at that stage, in other words a sustainable price would be obtained.

With each window the FiT substantially decreased and the current prices are very attractive for the consumer, even on an international level. At some stage the price will stabilise per technology, but it is highly unlikely that the tariff obtained now will be questioned in the future.

Denish Jugmohan – Nedbank Capital (I : 41:35 -)

When it comes to the FiT, Government did a very good job compiling the REIPPP documentation. With round 2, Government improved the FiT by taking the requests and suggestions from current and potential IPPs into consideration. Having a larger group of potential IPPs the competition also improved the FiT.

Not only did the IPPs focus on improving the FiT, but also other relevant aspects and they still kept the investors happy.

Piet Badenhorst – IDC (35:20)

The way the programme is structured now, there is assurance that the price will be very low due to competition and high level of supply (developers bidding). The chances of collusion between bidders are very slim due to the large number of developers bidding. Mr Badenhorst is fairly sure that when bidders talk to each other, it will not be to benefit the other person as everyone wants to win. There are just too many players.

The only technology where possible collusion could take place, but this is on another level, is CSP. CSP is not modular like wind or PV solar and needs to be specifically designed according to a certain size. It has other benefits like storing capacity and competition is quite low for CSP

technology.

When the CSP developers determine their FiT, they do a form of back-solve. They define the price by looking into what the shareholder wants and determining what would seem to be a fair price to Eskom. That way they have a much larger FiT than necessary, which means the profit is much higher than what it could be.

As long as there is competition the FiT price will be market related. If the price is not market related in spite of competition, the most probable reason would be collusion. Competition keeps everyone honest.

Having an ISMO in place can also help increase competition, because now all forms of energy generation can compete against each other. If one were to promote a certain technology, then the rules between competitors should be adapted accordingly. One way would be to provide a form of subsidy to green energy generation, or giving preference to green energy usage before using other forms of energy like coal. That way the end goal can still be achieved by having a certain percentage of renewable energy generation.

Dr Adila Marengo – NERSA

International benchmark of tariffs should be done continuously and tariffs should match the availability of renewable energy resources i.e. solar energy tariffs are high in areas where there is less sunlight due to lower energy sales over the contract period, but if the same solar energy facility is located in sunny area, the levelised cost over the contract period is lower.

2. Workforce training and education

The research to date has shown there are various ways to comply with the expected local content requirements for IPP bidding. Author realised that training and educating our nation's people was one of these targets that needed to be realised.

2.1 Who should be the key role players in training/educating local people for renewable IPPs,?

Maduna Ngobeni – DoE (I :25:15)

The DoE emphasize that IPPs should take lead on the training as they have the skills, technology and understanding of their project/product.

Currently SA does not have much renewable energy background/experience, and that is why the DoE wants investment from well established companies to develop these experience/skills to achieve localisation and promote the transfer of knowledge and skills.

Higher education institutions (HEI) should play a bigger role, ensuring that the skills are developed and taken further. The IPP can then invest in the last mentioned development. Finance is the biggest reason why training/education is not achieved. IPPs can then promote training by providing financing or they can have their own training facilities. Mr. Ngobeni agreed

that training is not part of the IPPs' business profile and that IPPs should play an education/training role by providing funding and/or work opportunities.

Denish Jugmohan – Nedbank Capital (I : 47:30)

The IPPs, as they develop the projects and they are working on the ground. They will need authorisation from local municipalities, which means they will have discussions on local community development. Municipalities will then give the IPPs guidance on what they need most.

There will be a community trust that can be utilised for education and training. The trustees will take the lead on using this trust fund according to what is best for the community.

Piet Badenhorst – IDC (41:20)

The minimum training and education will be achieved when there is only a local content requirement. Bids were mostly allocated by government based on the price, rather than the local content.

Government need to change their stance, not only about their preference for renewable energy in their IRP 2010 plan, but commit to renewable energy in South Africa. Government needs to realise that there is a large potential for a renewable energy industry that could be here for an extended period. This can be done by legislating the IRP 2010 and not only having it as a plan. Having a minimum amount of energy generated by renewable energy as law, would automatically create a market for the future. Government does not necessarily have to commit itself to the REIPPP programme as the ISMO can drive it in a different way, but Government can commit itself to renewable energy as a country commitment.

The biggest challenge for companies investing in manufacturing for renewable energy components in South Africa is that there is no certainty of the future market. These people are taking a risk and many others are not willing to take this risk.

There are other ways to resolve this type of issues. As with the motor industry, credits could be given to companies that export locally produced renewable energy components to stimulate local manufacturing. To achieve training and education in the renewable energy sector, a renewable energy industry must be created. In contrast, what would be the benefit of training people in this field if there is no guarantee of a renewable energy industry? If people are to be trained, money will be spent and investment would be made and who would be motivated to train and educate people if there is no certainty about the industry?

Wind and PV solar does not need a large operating team as most of the people are only used during the construction phase. CSP is about the only technology that needs a large operation

team, but some of these team members come from overseas.

If Government could only commit to the IRP 2010 plan it will already have a huge impact on creating the industry. Another would be if government could give export credit to those who manufacture locally. These two alone will promote local manufacturing, research and essential training or education to be able to work in this industry. This, however, would be a long process and the reason why no one is starting with it, is because the risk is too big as there is no commitment.

Training and education should rather be looked at based on the need for it. A person who is trained in the programme does not necessarily learn dedicated skills, but improve/adapt skills he/she already has. Training being done is more like a soft transfer of skills.

There were cases where half-skilled labourers were being trained and provided with work which they did not have in the past, but when it comes to sustainability of training and providing jobs, Government needs to create the industry. Instead of artificially training people to reach trained and education targets, rather create an industry where there is a need for trained and educated people. Then people will be trained or educated automatically.

Dr Adila Marengo – NERSA

The role players should be government (DTI) and the IPPs.

2.2 In cases where the level of workforce training/education is not acceptable, what should be done to improve local skill or expertise development?

Maduna Ngobeni – DoE (l :25:15 - end)

Currently the effectiveness of training and education is not being measured. For the DoE the question is rather how the IPPs invested in people, who did they train, and are the trained people being employed. If people are not being employed after training, then the training is not at an acceptable level.

No specification has been given in terms of the quality of training. This is where the HEI should play a role to make sure training is at a good quality standard. It's not the DoE's mandate to make sure training is at an acceptable level, but rather the HEI.

The IPPs should be given room so that they can do what they are supposed to do. If it is not correct, then something should be done to correct it. One way would be to get modules and training content registered by the Sector Education and Training Authorities (SETAs). Currently there is some form of co-ordination between the DoE, HEI and IPPs and this is being monitored from time to time.

Denish Jugmohan – Nedbank Capital (52:50)

One way would be to investigate if the training and education requirements; to determine if the set out requirements are realistic and/or acceptable. However according to Mr Jugmohan, the last mentioned is unlikely as the documents are very clear and there is regular improvement due to reporting.

To have people going through a training schedule just for the sake of it would not be ideal. The ideal would be having the trained people in a work environment or providing a recognised certificate indicating that they are qualified. That is how the success of training will be determined. Government must stipulate what they want in terms of training and education and not wait until it is too late.

Piet Badenhorst – IDC (52:20)

The function of the municipalities and local economic is to see to that local people are trained and used, but in many cases the appropriate management is not in place to correct it. This could be a problem, but this is where the community should place pressure on management to get it where it should be.

I would not have a personal suggestion for this, but because this is economically driven it will be internally resolved over time.

Dr Adila Marengo – NERSA

Obligations from IPPs should be put in order to ensure that training is in line with the work done in the field, i.e. in-service training must be undertaken to ensure that individuals receive necessary skills.

2.3 What can be done to ensure that the training provided is retained in the REIPPP program, once construction of a site is completed?

Maduna Ngobeni – DoE (II :1:00 -)

The programme is a rolling programme, meaning that people that were trained in the first project can be used in the next. The momentum of providing work opportunities is being sustained in this way. Once there are competent people they should not be limited to work in South Africa alone, but work on similar projects outside of South Africa. Mr Ngobeni is led to believe that Africa is to play a critical role in the renewable energy space.

If all the projects were done in a very short time it would not mean much when it comes to training and education as all the developers will be gone after commissioning. By rolling out the project slowly, it gives enough time for people to build up experience and eventually make them

experts. That way the trained people could obtain sustainable work, even with job opportunities overseas.

Denish Jugmohan – Nedbank Capital (56:00)

Most of the training done is physical labour orientated, opposed to operation and maintenance. These trained people would not necessarily want to do office work. Obtaining future construction work is necessary to retain their training.

Another way would be to take the emotion out of choosing people and rather go to the unions so that they identify the people who should work on a specific project. This would not only help with retaining the education by working locally, but also by working on projects away from home. Training is then not necessarily retained for a specific project, but retained within the greater programme.

The type of skills developed with PV and CSP construction could also be used in applications other than renewable energy development, because it is construction-orientated.

Piet Badenhorst – IDC (57:10)

The only way to retain the education is to ensure the REIPPP programme is a long term programme. Once the programme is over, there are some skills that could be used and applied in other sectors, but when it comes to retaining the specific skills and achieving a professional level of expertise there needs to be future renewable energy projects.

If Government does not want to give a strong commitment to renewable energy, but the market would be a free market driven by entities like the ISMO, then there will be future projects as there will always be an electricity need.

Government can commit to renewable energy by sorting out their energy policy or committing to the REIPPP programme. They have no other choice if they want to see the renewable energy roll-out to be sustained.

Dr Adila Marengo – NERSA

Databases of individuals who were involved with construction of previous power plants should be created, and if there are opportunities on subsequent REIPPP projects, those individuals should be given jobs.

3. Enabling legislation for renewable energy in South Africa

The outcome of author's research also demonstrated that the current enabling legislation for renewable energy is to a large extent in place, especially for large IPPs. On the other hand I concluded that laws and regulations, like connection to grid, strict procurement laws and realisation of an independent system marker operator (ISMO), still needed to be investigated and improved.

3.1 What should be done to ensure that the enabling legislation stays unchanged for future projects?

Maduna Ngobeni – DoE (II :8:00 -)

There is no intention to change the legislation and the DoE would like to improve on what they have now. The DoE believes that the current model is the correct and best model for rolling out the renewable IPPs. The legislation for smaller application is not where it should be, but this is to be expected as the DoE cannot resolve the problems all at once.

The DoE would rather take a phase approach: first deal with all the issues on the large IPPs and then move on to the next phase. The DoE has learned a lot from the first phase and now this knowledge can be applied and used for the smaller scale application The second phase is 1 to 5MW and third phase is rooftops or less than 1MW application.

Small-scale application may be easy contractually, but it is much more complex when it comes to implementation as the stability or the impact of the system is as yet unknown. Many studies are still needed to predict the impact renewable energy generation will have on the network.

Denish Jugmohan – Nedbank Capital (1:02:20)

Nothing stays unchanged, but rather keeps positively evolving. That way the legislation that does not work, can be improved.

There need to be communication and goodwill attitude between the stakeholders like the banks, Government and IPPs so that legislation could be improved without inhibiting set programme objectives.

Piet Badenhorst – IDC (1:00:40)

This is very much politically driven. In the short to medium term, renewable energy must be supported and driven by Government.

Dr Adila Marengo – NERSA

The government should be committed to renewable energy going forward. One way of ensuring that legislation is not changed is to ensure that the country can afford the prices of renewable energy, and this means that future planning of scenarios is done, looking at possible risks that might be encountered. Good outputs in terms of renewable energy performance must be made public in order to inform everyone (politicians, decision makers) about the benefits of using RE.

3.2 In what way should the regulatory framework be amended to obtain more and better enabling legislation for renewable energy in South Africa?

Maduna Ngobeni – DoE (ll :11:20 -)

The DoE would like to see the REIPPP programme sustained without having Government to play a facilitating role all the way. DoE acknowledge that the current monopoly structure is not best for the REIPPP programme. That is why the DoE would like to see a structure that helps everyone participate freely and create an environment where parties can interact in a way to provide competitive prices. It is not ideal that Government do the procurement for renewable energy while Eskom is the main energy player. The last mentioned was a given and DoE had to work with the status quo.

When DoE decided to unbundle the energy sector, subsidises became difficult and this can be resolved by having an Independent System Market Operator (ISMO). An independent buyer, that has control over the transmission system and co-ordinate subsidies, is needed. The buyer also needs to be transparent with the finance and infrastructure as it would be critical for the consumer not to pay more than needed.

Denish Jugmohan – Nedbank Capital

From a holistic perspective Mr Jugmohan does not see need for significant amendments as various procurement and project activities take place successfully with the regulatory framework as it is.

Piet Badenhorst – IDC (1:04:00)

The ISMO should be realised or Government needs to commit to renewable energy by having a percentage of renewable energy as policy or even law.

For small scale renewable application there is a long way to go and Government needs to provide even more support for smaller application going forward. The IDC suggests giving a larger tariff for small IPPs, but DoE wants to have the same FiT as for the big IPPs. Government needs to decide what the objective should be, either have a small FiT or support the small to medium upcoming businesses. The small to medium IPP is where most training and education can be achieved. The biggest barrier is the DoE which would like to keep its tariff low. With a higher FiT for small IPPs, 90% of all the problems will be resolved. The financial implications would not too be big to handle as it is small projects and an entity like the ISMO could subsidise the small IPP projects. By doing this so much more will be achieved for the local industry.

The IDC does not work with EPCs that is not investment grade as they should be able to finanically cover the costs if the project fails. For small IPPs this is not always the case, but

having a larger FiT and giving the needed support, small companies will buy into participating.

Dr Adila Marengo – NERSA

For now, enactment of an Independent system and market operator (ISMO) will ensure that every player is treated the same when it comes to grid connections, curtailments etc.

4. Partnerships and consolidation of both local and foreign companies to promote local manufacturing of international standardised renewable energy products

The research illustrated that ART-solar (Switzerland) and 3W/AEG Power Solutions (Germany) are examples where local and foreign companies went into partnership to achieve local manufacturing. These two companies manufacture PVs and inverters respectively, and their locally produced products contribute largely to the local content during bidding as IPPs.

4.1 What should be done to optimally increase the local manufacturing capacity of renewable energy components?

Maduna Ngobeni – DoE (II :17:00)

DoE is continuously looking at the local content requirements, but they are mindful of the supply and demand situation.

The local content requirement is determined in a way so that it does not give a monopoly to the local suppliers. Some slack is given to obtain overseas materials, but the local industry still needs to be supported. When local manufacturing is available and local content requirements increased, there still need to be sound competition to drive the prices down. Care is taken not to over-increase local requirements

Denish Jugmohan – Nedbank Capital (1:08:10)

Companies interested in manufacturing should have recent local short term experience. On the long term, if there is certainty about making more profit by manufacturing locally and that there will be a market, then there will be an increase of manufacturing capacity.

Piet Badenhorst – IDC (1:10:10)

Putting up a manufacturing plant locally without appropriate partnerships would be unwise and unrealistic. The foreign partner or their financier needs to have proof there will be a market for at least 7 years or more, otherwise there will not be enough reason establish up a manufacturing plant.

For now, even with the REIPPP programme, no-one would like to commit to such a period. There already are companies that would have liked to produce blades for the wind turbines, but because there is no certainty about having a local market in the future, they decided not to put up a manufacturing plant. Focusing on export would also not necessarily make sense, as there

are already manufacturing plants exporting components to the rest of the world.

The DTI could support local manufacturing by giving credits for components manufactured locally and then exported.

Dr Adila Marengo – NERSA

Some form of tax credit or incentives for foreign companies should be introduced in order to encourage investments in the early years and reduce tax once companies are well established.

4.2 In what way should these partnerships and consolidation be created so that their manufacturing can be sustained for extended time periods to come?

Maduna Ngobeni – DoE (II :19:40)

The DoE needs to make sure the REIPPP programme does continue to give certainty and confidence to the manufacturing entities that there will be a need and a market in future. The manufacturing industry can then reach a point where it does not only supply for the renewable energy programme, but also for other non-South African programmes, projects or markets.

Mr. Ngobeni believes that there will be a point where the need will not be limited to the REIPPP programme alone. There will be opportunities, like rooftop application and other local needs, which will then diversify the demand/market. This also includes the African market as the African Market does not have sufficient need to put up manufacturing capacity and would most likely buy from South Africa as it is the most economical option.

Denish Jugmohan – Nedbank Capital (1:12:00)

Having 50/50 JV would serve as a good in comparison to having a 70/30 structure. Having a skew structure would make sense as the main investors have all the expertise, intellectual property and knowhow, but on the long term it could be an issue as there could be reluctance to share corporate knowledge and profit.

Piet Badenhorst – IDC (1:14:50)

There should not be much interference. The less interference and prerequisites the better for the partnerships or consolidation. Both partners will need each other based on what they can bring to the table and this should be done in an enabling environment, rather than a prescribing environment. The enabling environment can be done by making it easy for the people to come in and don't expect them to adhere to unnecessary laws and regulations.

There were IPPs that withdrew in the past because they wanted a share larger than 40% and the DoE declined their offer. This will cause the foreign investors to stay away as they would like to have control over their intellectual property and investment. The result would be less

competition, which would affect all stakeholders negatively.

Dr Adila Marengo – NERSA

Agreements should be entered into between Governments and IPPs, and as mentioned above future allocations of capacities should be available.

5. Greater dialogue between Government, Eskom, Independent Power Producers (IPPs), financiers and industry during the REIPPP programme period

The study so far has shown that greater dialogue will ensure engagement between all relevant key role players, which will in turn simplify and/or align future bid documentation, encourage industry ambition and streamline agreements. This should not only be achieved before the undertaking of a bid, but also during and after the bidding process. Author also concluded that there could be a delayed, or even withheld, industry response due to uncertainty with many REIPPP programme requirements, and that this was something which extensive dialogue could correct or at least improve.

5.1 What is currently being done to address/achieve the above mentioned driver?

Maduna Ngobeni – DoE (II :26:30)

There are regular meetings between the DoE and other stakeholders like the banks, IPPs and sellers.

There is opportunity to submit requests; this helped to improve the programme going forward.

The DoE is obligated to respond in writing on all requests and if changes are made, reasons for changes are given through the appropriate channels. So far the current dialogue systems have worked very well.

Denish Jugmohan – Nedbank Capital (1:14:00)

After the 3rd round there were IPPs that were not happy with the limited MW available per technology. Government wanted to provide another opportunity, round 3.5, but due to the upcoming elections, communication between government, IPPs EPCs, banks and other stakeholders were needed to make sure there was enough interest before going ahead. Communication played a key role in this regard.

Outside the RFP documentation Government held question and answer session and bidders' conferences, and they release official responses referred to as official briefing and clarification notes. These responses are distributed to the stakeholders or registered members, giving clarification on ambiguous requirements.

Nedbank would serve as one of the enabling institutions by looking at issues in most relevant areas (legal, financial, technical) in advance. This is necessary to get their credit committee comfortable and eventually convinced to provide funding.

The banks are open with IPPs and would point out anything that would be of concern, even

using equipment/components that are not normally used, would be indicated.

Piet Badenhorst – IDC (1:17:50)

Any negative feedback obtained from stakeholders would mostly be complaints due to personal preferences than anything else.

Much was learnt between windows 1 and 2. One of the good decisions was to have one window per year. The rules are quite clear, everyone knows what is expected from them, the cap is removed on the FiTs and most issues are addressed.

He agrees that, with window 1 and 2, there was some form of frustration, but over time this was resolved. The bad communication now, however, is the DoE that stated that they will have another announcement of more preferred bidders after the announced round 3's preferred bidders, which did not happen at all. The reason for the delay is because of the coming election, but according to Mr Badenhorst this is very bad for the DoE.

Complaints brought to light are usually about small frustrations. Everyone made money, Government obtained their planned benefits and those who did not make money are just weak. Mistakes in windows 1 and 2 were corrected, but people must understand the communication/dialogue will be a bureaucratic type of communication, and this will not change. Worldwide where Government needs to be involved politics will play a role and this is not something non-governmental stakeholders can change or even control.

When politics are involved there is always some form of control that needs to be achieved. The less control there is and the more open the industry/market is, the more people will get involved as they will make money or save money.

Dr Adila Marengo – NERSA

There are a number of conferences and seminars that take place annually, but these are mostly separate and for specific renewable energy technologies not necessarily covering all technologies at once.

5.2 If there was no effective platform for having REIPPP programme relevant discussions, and should you support the idea of such a platform, who do you suggest should take the lead for this proposal?

Maduna Ngobeni – DoE (II :24:50)

The DoE is playing the procurer role; hence they should take lead for this platform. The current platform is sufficient and it is working. The necessary interaction is there and it is open to stakeholders; most of the IPPs are involved in these discussions.

The only thing that the DoE does not want to do is to negotiate the procurement document at hand as this could take years to resolve. DoE listens, take points, and by using their own judgement they respond/act accordingly. The DoE has no obligation to implement specific requests.

Denish Jugmohan – Nedbank Capital (1:17:10)

If government were not able to take the lead on this platform, there are three stakeholders that should create and manage this platform – the sponsors (developers and equity investors), debt funders and contractors.

Sponsors will look at the projects from an investment point of view, debt funders will look at the project over a long term by investigating the expertise of the business, and the contractor will look at the equipment, cost and company feasibility. The three representatives from each would serve together on a board to manage it together.

Piet Badenhorst – IDC (1:24:00)

Industry bodies does a very good job at discussing and addressing both technical and regulation issues. These bodies exist out of a multitude of role players to brainstorm and work with the DoE. Some of the members of the bodies have the mandate to communicate with DoE and the DoE involve these entities when making a decision from time to time.

The Southern Africa Solar Thermal and Electricity Association (SASTELA), for example, convinced the DoE that they,, with their CSP plants, were not that expensive with their FiT if they were to supply on peak periods in comparison to OCCTs. If it was not for the association, it would not have happened.

Dr Adila Marengo – NERSA

I would support the idea and the government as the procurer should lead this.

5.3 In which way should the above mentioned platform for greater dialogue be managed so that the maximum benefit could be achieved for all involved entities?

Maduna Ngobeni – DoE (II :28:20)

The DoE will respond in writing and the response will be available to all who are registered. DoE also has their own engagement with Stakeholders like Eskom, NERSA and other, but this is an internal engagement. This helps to improve the document as it is.

Denish Jugmohan – Nedbank Capital (1:26:10)

It needs to be an open platform. The feedback should be relevant and should also provide

clarity to stakeholders.

Stakeholder-specific restrictions can then be brought to light, but unfortunately this could serve as an expropriation opportunity for competition as they do not have the same restrictions. To address this, there needs to be a representative of the group of entities, like a chairperson, representing the banks.

All the other associations like SAPVIA are also platforms where these dialogues can be held, but these associations are technology-specific, which means it would only provide for technology-specific discussions. In these associations it becomes difficult to be open, as specific constraints/restrictions cannot come to light.

Piet Badenhorst – IDC (1:28:00)

The renewable energy environment is much more dynamic as opposed to the mining sector. In the mining sector the big players determine what needs to be done and the other companies must fall in with what they decide. When there are open discussions about the renewable energy issues, the smallest person would be heard and taken seriously, where this calibre of person would be ignored by something like the mining indaba.

The current dialogue between the role players is quite modern, energetic and dynamic. The IDC would not want to change it for now.

There may be competition between the different associations as each would like to promote their technology as the preferred option, but it should stay like this as it forces each technology to bring their best to the table.

Dr Adila Marengo – NERSA

For now I don't have an answer.

6. Concluding comments

6.1 Do you have any comments/suggestions that are related to one of the above mentioned control drivers that will consequently promote the sustainability of the programme itself?

Maduna Ngobeni – DoE (II :24:50)

None

Denish Jugmohan – Nedbank Capital (II : 2:10)

The identified control drivers make sense and are chosen logically. These drivers are the main focus areas when it comes to the programme's sustainability, with the rest of the drivers as secondary. Addressing these main issues first would most probably indirectly solve some of the secondary challenges.

Piet Badenhorst – IDC
The questions asked covered the main issues and the IDC would not necessarily want to add or change that.
Dr Adila Marengo – NERSA
None

6.2 Could you provide any other comments/suggestions that were not covered in this interview, but which would help to ensure the sustainability of the REIPPP?

Maduna Ngobeni – DoE (II :24:50)
If there is something that could make the programme unsustainable, it's the price of electricity. The price is the key of everything. If the DoE were to try to determine the price, the chances are good that they will determine the wrong FiT. A high tariff could be given and a few will benefit from this price, but it adds a cost to the consumer's electricity price. This is where the nation would say enough with renewables. Now that it is open for bidding, the prices are driven down due to competition. Prices of wind and PV are very good and highly competitive. The prices are affordable and no one will have concerns or question it in the future, especially now that it can compete with coal as well. In South African electricity is a big driver for the economy. Making electricity too expensive will constrain it. For the DoE it is important to protect the economy through the tariffs that is being determined in the REIPPP programme. At the end of the day, the final chosen FiT will indirectly determine the price consumers will pay for their electricity; for now and in the future.
Denish Jugmohan – Nedbank Capital (3:30)
It is important for bidders to understand the MW per technology application. Banks are looking for certainty when it comes to government preference for IPPs. Government should have a third short listing criteria: projects that have no other project within close proximity should receive preference. That way the benefits could be brought to more communities, rather than having all of the projects only benefitting one or two small communities. This should be looked at in spite of lower performance.
Piet Badenhorst – IDC (31:30)
For the IDC the whole industry must benefit from the programme. The REIPPP programme is successful and it is driven well, but the IDC wants to see more emphasis placed on local content. Local content requirements can be made more specific, such as the components of a plant, than having the requirements over the larger scope of the project. Much more can be

done in terms of local content, but the programme is much more economically driven.

Increasing local content requirements per window is good, but more can be done. Creative ways should be investigated to increase local content. The DTI knows about some of these ways, but no one is doing something about it. The reason for this is unknown.

Another aspect that prevents achieving more local content is reluctance to commit to renewable energy on the long term.

Dr Adila Marengo – NERSA

None