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Expeditious deployment of electricity solutions for the poor in South Africa

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

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ABSTRACT

The rate of electrification for the indigent rural communities in South Africa has slowed down over the years. The South African electrification programme aimed to provide universal access to electricity by 2012, but this deadline was not realized. The new target is the year 2025. In its initial phases, the programme achieved many connections annually. Currently, the electrification backlogs are comprised of 75% rural areas and 25% urban areas (mostly informal settlements). The study focuses on the delays in the electrification of rural areas and on what can be done to address the challenges.

A qualitative design method was adopted for this study, where an interview schedule was utilized to gather data from the pertinent stakeholders in the electrification process for the poor. Recent literature was also utilized in informing the findings to this research.

South Africa has performed extraordinarily well in achieving the 87% electrification level. However there are a number of challenges that are curtailing the rate of electrification for the poor in rural areas. These challenges include the lack of integrated planning amongst the stakeholders, the financial challenges, the inefficiencies within the Electricity Distribution Industry (EDI) and the negative perceptions towards non-grid technologies.

The Department of Energy needs to revolutionize the electrification methods to be able to ensure universal access by 2025. The electrification methods that worked 20 years ago need to be enhanced drastically for progress to be made, especially in the rural areas. The focus needs to be on integrated planning, ensuring quality monitoring processes, attracting private funding, the enhanced marketing of non-grid solutions and ensuring that electricity solutions enable socio-economic development for the poor, rural communities.

DECLARATION

I, Cynthia Ngomane, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

(Cynthia Ngomane)

Signed at ……

On the …….. day of …… 2014

DEDICATION

To God, who made this possible and to my lovely family for their endless support and encouragement

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I would like to acknowledge the following individuals/organizations:

- My supervisor, Professor Stuart Woolman for his guidance and support.
- Professor Terri Carmichael, for her assistance.
- The Department of Energy, the Department of Public Enterprises, Eskom, the Concessionaires, NEPAD and Salga, amongst other stakeholders, who dedicated their time to assist with this research.

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1. CHAPTER 1: INTRODUCTION

1.1. Purpose of the study

The purpose of this research is to provide insights pertaining to the challenges of providing electrification for the indigent, rural households in South Africa. The research aims to propose recommendations on how electricity access delays can be curtailed and how the developmental objectives for the poor can be enabled through the deployment of pertinent electricity solutions.

Just as economic growth and industrial development require energy, as noted in the Energy Policy (DOE, 1998), quality-of-life is enhanced through energy access. Therefore, poverty is usually inversely proportional to energy use and hinders development (DOE, 1998).

This study intends to highlight the deficiencies within the South African institutional context which might be leading to the slow rate of electrification. Additionally, it focuses on the value-added, if any, by the deployment of the non-grid solar home systems in the hard-to-reach, remote, rural areas.

1.2. Context of the study

When the South African electrification programme commenced, a transitional political period, alongside a change in policies, resulted in entities other than government (such as individuals and organizations) influencing electrification policies (Bekker, Eberhard, Gaunt, & Marquard, 2008). The programme identified innovative ways of curtailing technology costs in order to enable the social objectives of government at that time, which included energy poverty alleviation (DOE, 1998).

The South African electrification programme enabled approximately 3 million new connections between 1990 and 2000, raising electricity levels from 36% to 67% (Gaunt, 2004). More than 5 million households received access to electricity during the period between 1990 and 2007, according to Bekker et al.

(2008). Salga (2012a) indicates that between the year 1994 and 2010, the electrification levels grew from 36% to 82%, which equated to 5.2 million households in a period of 16 years. The Integrated National Electrification Programme (INEP) indicates that between 1994 and 2012, 5.6 million households received electrification, increasing electrification from 36% to 84% in that period (DOE, 2013). This conflicts with the figure from Statistics South Africa (2013) which notes an electrification level of 85.3% by 2012. The high electrification levels reached in the country is a reflection of the leadership role that South Africa has played in the Sub-Saharan region pertaining to electrification, (DOE, 2013).

The Residential Sector Survey on Energy-related Behaviours and Perceptions in South Africa by the Department of Energy (DOE, 2012b) defines household energy poverty as a percentage of the total household income that gets utilised towards energy services expenditure. An energy-poor household spends 10% or more of its total monthly income towards energy services (DOE, 2012b). This survey (DOE, 2012b) states that an average South African household spends approximately 14% of its monthly income on energy services, effectively making half of the South African population fall under the energy-poor category. Statistics South Africa (2013) states that 8.8% of households spend 20% or more of their earnings on electricity. In cases where intense energy poverty is experienced, the direct adverse impact could be disease, malnutrition or even death (DOE, 2012b).

The New Household Electrification Strategy by the Department of Energy (DOE, 2013) indicates that electricity has a huge role to play towards the curtailment of energy poverty as it contributes towards the operation of equipment in clinics, provides clean illumination for households, increases productivity for small businesses and enables telecommunications.

Electrification is also a contributor and/or an enabler of job creation, education, health, housing and crime prevention (DOE, 2012b). It is estimated that 5% of newly electrified households are able to do more work that generates more income, generating roughly an additional R175 on a monthly basis (DOE, 2012b; Salga, 2012b). The length of time spent on studying by learners is

increased by approximately an hour and forty minutes on a weekly basis (DOE, 2012b; Salga, 2012b). Households that have received solar home systems have indicated a cost saving ranging from R81 to R188 on a monthly basis and since 1994, electrification has been provided to approximately 442 clinics. (DOE, 2012b; Salga, 2012b).

Bekker et al. (2008) indicate that the apartheid regime left huge discrepancies between black and white. Previously, especially before the post-apartheid government, the Energy Policy had neglected the needs of the poor (DOE, 1998). The research by Bekker et al. (2008) highlights three phases pertaining to the electrification programme in South Africa. Pre-1994 (phase 1) the electrification efforts were scattered and were not necessarily aimed at the electrification of the bulk of society (Bekker et al., 2008).

Through the Energy Policy by DOE (1998), government committed to making energy services affordable, particularly for disadvantaged homes, small farms, small businesses and community services.

According to Bekker et al. (2008), the South African government prioritized a number of components as enablers to the electrification process during the transition to the post-apartheid era. These were the institutional context, the planning, the innovations in technology and the utilization of electrification as a tool to achieve social aims (Bekker et al., 2008).

Phase 2 was the transition phase from 1994 to 1999 (the rate of electrification was at its highest during this phase) and phase 3 was from the year 2000 onwards, where the electrification programme stabilized and was institutionalized (Bekker et al., 2008).

The Integrated National Electrification Programme (INEP) was established in 2001/02 to deal with the backlogs in un-electrified households (DOE, 2013). Government's intent was that newly-built households would be handled by the Electricity Distribution Industry (EDI), which didn't materialize; therefore these households became the responsibility of INEP in addition to the backlogs, which caused the required funding to escalate to 4 to 5 times the cost allocation to INEP annually (DOE, 2013). It is assumed that INEP is one of the reasons why

most South Africans voted for the ruling party again in 1999 (Banda & Tinto, 2005). The Free Basic Electricity (FBE) subsidy was established in 2003 to assist energy poor households (DOE, 2012a; Salga, 2012a; Statistics South Africa, 2013). Political support is one of the social objectives government aimed to achieve through free electricity for the poor provisioned through INEP (Gaunt, 2004).

The planning in 2002/03 mandated EDI to provide the required electrification backbone infrastructure and since this responsibility had been passed onto INEP, 25% of the annual INEP funding had to be utilized towards backbone infrastructure development (DOE, 2013). According to Banda and Tinto (2005), the INEP programme is one of the better performing government initiatives.

Currently, approximately 3.4million households are without electricity (DOE, 2012b). The main provinces with the backlogs are the Eastern Cape (mostly formal settlements), KwaZulu Natal and Gauteng (mostly informal settlements) (DOE, 2012).

When the electrification programme commenced, the focus in those days was mainly on the densely populated urban areas close to the grid (DOE, 2013; Statistics South Africa, 2013).

The Energy Policy (DOE, 1998) states that it is imperative that the energy-related policies align to policies in other impacted or applicable sectors so that undesirable side effects can be avoided. Rural electrification in isolation is insufficient in the elimination of poverty (DOE, 1998); other complementary policies are necessary, such as job creation and education policies. Integration is also necessary at energy sub-sector level, which incorporates for example, ways of ensuring affordability to electrical appliances for the poor (DOE, 1998).

Bekker et al. (2008) state that what is important to note in the early 1990s was the restructuring and corporatization of Eskom in such a way that it was put in a good position to be a key role player in the electrification efforts post-apartheid. Eskom is still a key role player in the electrification efforts in the country (Eskom, 2013). Before then, Escom, as it was previously known, had built huge

supply capacity and by the early 1990s, was ideally positioned to execute the electrification programme (Bekker et al., 2008).

The NELF (National Electrification Forum) assisted in enabling Eskom, the municipalities and other stakeholders to align to government policies around energy or electrification access and assisted in establishing a regulatory body to oversee the whole process, which came to be known as the National Electricity Regulator (Bekker et al., 2008).

During phase 2 of the programme, government (the ANC) requested Eskom and the municipalities to electrify 2.5 million households between 1994 and 1999, which was documented in the Reconstruction and Development (RDP) agreement (Statistics South Africa, 2013). Eskom was licensed to operate in the bulk of the rural areas (Salga, 2012a).

A huge number of connections did occur during phase 2 but in total, it was mostly the urban areas that had the larger percentage of the connections by 2002 (Bekker et al., 2008). During phase 3, there was a shift in the focus of the programme to rural electrification, as indicated by Bekker et al. (2008). It is estimated that the bulk of currently un-electrified areas are rural (United Nations, 2013; Salga, 2013). Rural electrification implied that the average costs of extending the grid or power infrastructure into these areas increased and therefore, one of the attributes of phase 3 is the slowing down of the connection rates (Bekker et al., 2008).

The Department of Energy (DOE, 2013) states that currently, approximately 200 000 connections occur every year. For universal access to be reached by 2025 (which is the target for South Africa), 350 000 connections will need to be done on an annual basis. This takes into account the backlogs and the newly built households (DOE, 2013).

Government acknowledges that the provisioning of energy sources to households to enable services like heating, cooking, lighting and communication are a basic need (DOE, 1998). While certain fuels and certain appliances can address these needs, the lack of access to electricity and other

desirable, convenient fuels, limits development for the citizens of South Africa (DOE, 1998; Salga, 2012b).

Some households were too remote to be connected to the grid, so the Energy Policy (DOE, 1998) recommended the installation of photo-voltaic systems in these areas. Therefore, an important initiative that was decided on during phase 3 of the electrification programme, was the execution of a programme that is concession-based that would focus on the installation of decentralized or non-grid photovoltaic systems or solar home systems (Lemaire, 2011). Statistics South Africa (2013) does mention that remote and poor rural areas should obtain energy access through non-grid, renewable energy technologies.

According to Yumkella (2013), the African continent has a huge capacity of untapped energy resources. Wind-power potential alone is more than 1000GW, which equates to more than five times the continent's current capacity and solar energy is 10 times higher than wind power, while only 5 per cent of hydropower-capacity has been exploited (Yumkella, 2013).

According to Bekker et al. (2008), the blanket electrifications (also known as area coverage), that were done as part of the electrification programme when it commenced, enabled a large number of poor households to be electrified. Area coverage enabled Eskom to electrify an area as opposed to going through the process of sending individual quotations to those who applied formally; unfortunately, it also highlighted the issue of low-usage of electricity by poor communities which came with increased operational costs (Bekker et al., 2008).

Although some grid connections for the poor have occurred as part of the electrification programme, it has mostly not been feasible to extend grid infrastructure into the rural areas (Salga, 2012a). The profits typically cannot support the grid maintenance & operational costs for these areas and the underlying factors leading to this situation are the low concentration of households in rural areas compared to similar-sized urban areas (Dekker, Nthontho, Chowdhury, & Chowdhury, 2012).

Government has had to come up with alternative methods to provide electricity access for the poor, especially in rural areas, such as hydro systems and solar home systems as indicated by Dekker at al. (2012). The financial sustainability of deploying these technologies for poor rural communities is one of the business gaps to be addressed in this study. This will take into consideration the private investment into rural electrification programmes, government subsidies and customer attitudes towards paying for electricity services.

Renewable technologies do, however, come with their own challenges and an example is the research by (Chellan, 2012), which focuses on a case study of a KwaZulu Natal village of Mnweni. The village dwellers preferred grid electricity to the renewable electricity installations that were in progress in that area and this phenomenon is not unique to that village (Chellan, 2012). This is just one of the challenges pertaining to non-grid rural installations and this research will aim to highlight the challenges in efforts to improve this process. The end-goal is to ensure that recommendations are made that will enable electrification or energy access for poor rural communities which will enable a higher level goal of socio-economic development in these areas.

There potentially exists some deficiencies with regards to the integrated planning and implementation of electricity solutions for the poor which includes stakeholders such as DOE, Eskom, the municipalities, the communities and the non-grid concessionaires (DOE, 2013). This study will aim to highlight these deficiencies.

Due to the important role that energy access plays in the enablement of development, especially for the poor, the provisioning of affordable, reliable and adequate energy services to achieve the millennium development goals (DOE, 2013) will be explored. The eradication of extreme poverty is one of the Millennium Development goals and this cannot be achieved by 2015 as planned without improving access to energy (RSA, 2013; Statistics South Africa, 2013)

Chaurey, Krithika, Palit, Rakesh, and Sovacool (2012) state that affordability for the poor is a major challenge in the electrification efforts and the poor rural communities will normally depend on subsistence farming or other sources of

income, which are oftentimes erratic. These communities can hardly afford the capital costs of electrification, let alone operational & maintenance costs (Chaurey et al., 2012). Such challenges for the poor are faced by many developing countries and there is a need for resolutions (United Nations, 2013).

Due to issues of affordability, electricity often augments the energy mix for the poor (Thom, 2000). This is the reason why electricity will oftentimes not displace existing fuels such as paraffin (kerosene), candles, wood and coal; but will be used in conjunction with these. Therefore the issue of multiple fuel-use will also be analysed.

1.3. Problem statement

1.3.1. Main problem

Identify and investigate the gaps or bottlenecks in the South African electrification programme, with emphasis on the poor in rural areas. This will take into account the reality that some poor rural communities are still without electricity access. Amongst those that do have access, some are utilizing multiple fuels for their energy needs. Consequently, elucidation and optimization of role integration in expediting and streamlining of the electrification process, from planning to maintenance, needs to be done to enable sustainable business models.

1.3.2. Sub-problems

The first sub-problem is to examine factors leading to some poor, rural communities not having access to electricity. For poor communities that do have access to electricity, to explore the need for multiple energy sources and the contributing factors to this phenomenon. This will incorporate the investigation of the deficiencies in the electricity solutions being deployed.

The second sub-problem is to clarify how an integrated approach to electrification for the poor in rural areas can be enabled by identifying issues of collaboration amongst disparate stakeholders from the planning to the

execution phases of the electrification process, that restrict sustainable business models.

1.4. Significance of the study

The study fills a gap by identifying the constraining factors that are curtailing the rate of electrification for the poor in rural areas in South Africa. Additionally, it aims to investigate the sufficiency of the electricity solutions that are being deployed for these communities, specifically renewable technology solutions (i.e., solar, wind). These solutions form part of the distributed and non-grid generation technologies that are part of the focus of the South African Integrated Resource Plan 2010 to 2030 (DOE, 2011).

The study addresses stakeholder expectations that must be met through pertinent policies and the implementation of business models that will work for South Africa. The need to address these expectations has been raised by Davidson and Mwakasonda (2004). Policy could be influenced to ensure that all pertinent role-players (DOE, Eskom, the municipalities, the non-grid concessionaires, etc.) fulfil what is expected of them.

Studies have shown that the private investors will normally focus on the richer developing countries, such as South Africa, where they are likely to get a return on their investment (Kouassi & Pineau, 2011). This study will aim to highlight factors potentially constraining the attraction of private investment into South Africa by focusing on aspects such as the institutional context, the planning and so forth.

The study will aim to identify or highlight areas where entrepreneurs can step in to fill in certain gaps in the deployment of renewable technologies in rural areas and in the process, possibly enabling socio-economic development for these communities.

The unemployed youth who reside in these rural areas can be trained to provide services such as basic maintenance of the renewable electricity technologies,

trading in other energy sources such as kerosene/paraffin, or even the provisioning of other renewable energy solutions.

The end-user communities can potentially benefit from the research findings and recommendations which might enable the deployment of pertinent solutions for their areas. Research has shown that government, private companies, and other institutions that are involved in the electrification programme will sometimes not involve local communities in the electrification process from planning to execution (Chaurey et al., 2012) and this can lead to a situation where, once the systems are operational, end-users do not fully understand the management or maintenance of such systems.

The role played by the national electricity utility, Eskom and the municipalities in the electrification process for the poor rural communities is crucial. The potential challenges pertaining to these role-players will be highlighted in efforts to improve the process.

1.5. Delimitations of the study

- Although energy poverty impacts most developing countries, particularly in Sub-Saharan Africa and South Asia (Kouassi & Pineau, 2011), the context of this study will only be South Africa.

- Climate change or the impact to the environment is an important consideration nowadays when it comes to the provisioning of electricity generation facilities (DOE, 1998). However, issues of climate change will not be incorporated into this study.

- The indigent communities can reduce the electricity costs through the utilization of energy-efficient devices, such as CFLs (DOE, 2012b). An investigation of the level of awareness of the poor pertaining to the efficiency of such devices will not be addressed in this study.

- Currently, the non-grid concessions programme in South Africa operates in 3 provinces, which are KwaZulu Natal, the Eastern Cape and Limpopo

(Madzhie, 2013). The reference in this study to the non-grid concessions will therefore refer to these provinces.

1.6. Definition of terms

Energy poverty - is a lack of access to modern energy services where these services are enabled by household access to electricity and clean cooking facilities such as fuels and stoves that will not typically result in air pollution in the house. These services include lighting, cooking, water heating, refrigeration, usage of electricity media, etc. (International Energy Agency, 2013).

Concessionaire – a person or firm that operates a business within the premises belonging to another (the grantor) under a concession, usually as the only seller of certain goods or services (Business Dictionary, 2014).

Solar Home System – “a Solar Home System (SHS) is typically a small standalone solar electrical system with a single solar panel, a charge controller/regulator and a battery that operates low powered electrical appliances” (Chow, 2010; p.4).

1.7. Assumptions

- Private investors are keen to invest in South Africa as the country is seen as one of the richer countries in Sub-Saharan Africa (Kouassi & Pineau, 2011), but sufficient governance processes and policies need to be put in place to safe-guard their investments.

- The government requires enhanced methods of enforcing conformance to policy by the disparate stakeholders in the electrification process for the poor (Zomers, 2003); this will ensure sustainability of the process in the longer term.

- Renewable energy capacity is abundant in South Africa is therefore not the challenge in the electrification process (Waindi & Khalid, 2011; Yumkella, 2013); leveraging this capacity is the challenging aspect.

2. CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This section highlights the challenges pertaining to the universal electrification access goal in South Africa, with a focus on the indigent, rural communities. Some of these communities are still without electricity access (Salga, 2014) whilst others are connected to the limited-capacity, solar home systems (SHSs) (DOE, 2012a).

The gaps that might exist in the energy sector's institutional context, thereby contributing to the delays, are investigated, by focusing on the need for an integrated approach to the electrification process.

Furthermore, this section entails an investigation of the deployment of limited-capacity, renewable energy solutions and the usage of other energy sources in addition to these renewable solutions (Thom, 2000).

2.2. Background Discussion

An efficient institutional context is necessary in enabling the electrification process for rural communities in South Africa (DOE, 1998; Zomers, 2003). It is often the case that private investors will not be attracted to such programmes because of the perceived lack of financial profitability (Gaunt, 2004; Salga, 2012; Zomers, 2003). It is therefore in the best interests of governments to ensure that effective funding mechanisms, policies, business models and electrification technology solutions are availed to attract private investment in order to enable socio-economic development for the poor through electricity or energy access (DOE, 1998).

The electrification process in itself is a complex endeavour as it requires the collaboration and co-operation of different entities that might have differing priorities (DOE, 1998). Therefore the role of government in ensuring

governance and monitoring of the process needs to be prominent (Zomers, 2003).

Approximately 87% of South Africa does have access to electrification (DOE, 2012b); therefore the focus now needs to be on the remaining 13%. Of this 13%, 75% is made up of rural areas (Salga, 2014). When the electrification programme commenced in South Africa, the number of connections per year was high because urban households are located closely together and it was easy to connect the bulk of households in an area at any one time and eventually, after most of the urban or peri-urban connections had been done, the focus became the connection of rural areas (Bekker et al., 2008).

In contrast to urban or peri-urban areas, rural households are normally widely dispersed and are sometimes located on rough terrain and this makes it more challenging and less cost-effective to connect these households to grid networks (Banda & Tinto, 2005; Dekker et al., 2012). This is one of the reasons why the rate of electrification in South Africa has slowed down (Bekker et al., 2008) leading to 75% of the remaining un-electrified areas to be in the rural areas (Salga, 2014). Due to such challenges, government decided to deploy renewable energy solutions to some of the rural areas where it might take a long time for grid to reach (Dekker at al., 2012).

The renewable energy solutions or the solar home systems are viewed in both a positive (Chaurey et al., 2012) and negative way (DOE, 2013; GNESD, 2012). Some rural communities are deriving value (Chaurey et al., 2012) from these systems while others reject this technology as inferior (DOE, 2014). The renewable energy solar home systems have limited capacity (DOE, 1998; DOE, 2012a); they can only enable lighting, media and telecommunications (Lemaire, 2011). This sometimes leads to cases of theft, vandalism and misuse of these solutions (GNESD, 2012). Where value is derived from these solutions the communities are able to open up small businesses (Chaurey et al., 2012) and so forth.

Therefore, government needs to work on a plan that will ensure that all the pertinent role players work together to ensure that the rate of electrification for

the remaining 13% is expedited in order to reach the universal electrification access goal of 2025 and this plan entails the deployment of both grid and non-grid solutions (DOE, 2013).

The renewable energy, non-grid solar home systems have limited energy capacity as the energy source is the sun (DOE, 1998; DOE, 2012a); therefore, although the rural households will have access to electricity at certain times of the day, there are times where these technologies are depleted of energy. There is sometimes a need for the availability of other fuel sources such as LPG, paraffin and so forth where electricity needs to co-exist with other fuel sources (Madubansi & Shackleton, 2006). Government can play role in ensuring that these communities do have access to these other fuel-sources affordably so that these communities can have energy sources for their energy needs, this is partially achieved through the energy stores that the concessionaires are supposed to have and through the government Free Basic Alternative Energy (FBAE) policy (DOE, 2006; DOE, 2012a; GNESD, 2012).

Community involvement from the initial stages of the electrification programme is imperative to increase the likelihood of adoption and success of these non-grid technologies (Chaurey et al., 2012).

2.3. Electricity access and usage for the poor

This section provides information pertaining to issues leading to the lack of electricity access for poor, rural communities in South Africa (Salga, 2014). Some poor households that do have electrification will utilize a mix of energy sources (Thom, 2000). The deployment of limited-capacity electricity solutions and the issue of affordability could be adding to the multiple-fuel usage phenomenon (Cook, 2011; DOE, 2012a).

2.3.1. Renewable-energy for the poor in rural areas

Since the focus of South Africa's universal access programme has mostly been on grid connections, rural households that are currently located far from the grid might have a long time to wait for these connections (Bekker et al., 2008).

Challenging terrain and the remote-ness of some rural areas are making it hard to extend the grid into those areas (Banda & Tinto, 2005; Dekker et al., 2012). Additionally, grid connections in poor households are not deemed financially sustainable (Gaunt, 2004; Salga, 2012; Zomers, 2003). Therefore, government has decided to deploy solar home systems in the short to medium term for those households (DOE, 2012a; Salga, 2012). The rural concessions project to connect rural areas to non-grid solar home systems in South Africa is an ambitious one that aims to achieve that goal (Lemaire, 2011).

According to DOE (2012a), a single SHS system is meant to service only a single household and it comprises of a 50Wp Photovoltaic (PV) panel, a battery (105 Amp-hour), a charge controller, outlets/wiring for small appliances and 4 energy-efficient Compact Fluorescent Lights (CFLs). A single 50W panel is equivalent to roughly 250Wh/day (DOE, 2012a). These SHS systems must conform to the NRS 052 specifications, although deviations are sometimes allowed (DOE, 2012a). The SHS system is capable of provisioning lighting for 4 hours, 4-hour viewing of a black and white TV, 10-hour portable-radio use and cell phone charging (Chow, 2010; DOE, 2012a). An SHS system is typically configured similar to figure 1 below (Chow, 2010):

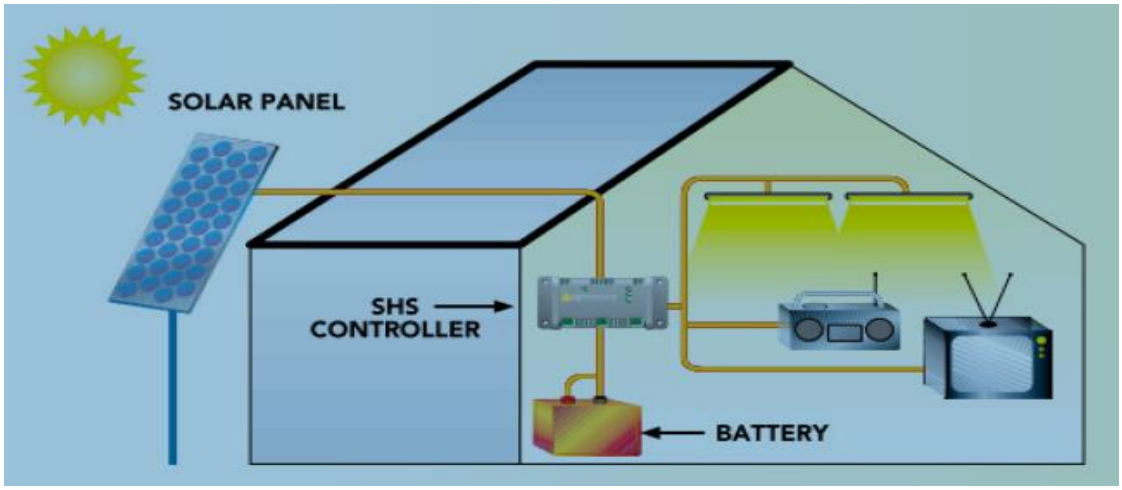

Figure 1: Typical SHS system configuration (Chow, 2010)

Statistics South Africa (2013) indicates factors leading to the curtailed deployment of solar systems in South Africa need to be investigated. Government originally planned that 300 000 solar home system units should be

installed (DOE, 2012b). According to Lemaire (2011), by 2011, around 30 000 solar units had been deployed. Thereafter, only 60 000 units had been deployed by 2012 according to INEP (DOE, 2012b). Between 2002 and 2012/13, over 65 000 solar home system units had been installed in the country across the three provinces which are KwaZulu Natal, the Eastern Cape and Limpopo (Madzhie, 2013). Of the total funding that was allocated to the solar home systems, only 1% has been paid out to-date (DOE, 2013). The break-down of the number of installations is according to Table 1 below (Madzhie, 2013):

Table 1: Number of Non-grid systems deployed in South Africa (Madzhie 2013)

Province	**Number Deployed**
Eastern Cape	12,282
Kwazulu Natal	43,511
Limpopo	9,381

In the future, non-grid solar home systems will be rolled out in other areas in the country, not just in the current provinces or concession areas listed in Table 1 (Madzhie, 2013). For remote areas, renewable energy sources are the most feasible solution in terms of cost, which includes environmental and social costs (DOE, 1998).

Some of the conditions for non-grid system installations are that they should not be installed if a grid line is about 2 kilometres away, the area must not be part of a grid electrification plan within the next 3 years, the municipal integrated development plan must contain this area as one of those to obtain non-grid, a cost-benefit analysis must be carried out and Eskom or the licensed distributor for the area must confirm that the area has not been earmarked for grid in the near future (DOE, 2012a).

The total budget allocation towards non-grid systems for the financial year 2013/14 was R91 150 000 (Madzhie, 2013). Government subsidizes 80% of the solar home system (SHS) capital costs while the concessionaire or service provider covers the remaining 20% (DOE, 2012a; GNESD, 2012). The SHS equipment is co-owned by the Department of Energy and the concessionaire,

whilst the customer only pays for the service fee (DOE, 2012a). SHS system customers pay a once-off connection fee and pay a service fee on a monthly basis; this fee covers maintenance costs, operational costs, fee-collection, battery-replacement, support, customer service and the management of the system (DOE, 2012a).

The majority of poor communities are willing to pay for electricity services but this requires sufficient subsidies on capital costs and other subsidies for the communities as beneficiaries (Zomers, 2003).

According to Lemaire (2011), two models were identified as best suited for the proliferation of solar home systems (SHS) in South Africa and these are the fee-for-service concessions and the micro-credit schemes. Fee-for-service concessions comprise of small companies that acquire loans from government which get utilized for the deployment of SHS systems and the concessions are ideal in situations where there are no adequate bank services in the rural areas (Lemaire, 2011). The SHS systems have been selected as interim alternatives to grid connections in South Africa (DOE, 2012a). These SHS systems are attractive alternatives to satisfy initial electrification requirements (Zomers, 2003). Over time, demand is likely to grow in these rural communities as development is enabled; therefore government needs to have a policy that addresses this growth in a phased approach (Zomers, 2003).

Lemaire (2011) adds that micro-credit schemes, differ from the fee-for-service schemes in that they are comprised of solar enterprises which are responsible for the maintenance of installed SHS systems; separate institutions focus on the finances, but both entities need to work together to be successful. Some Asian countries have managed to implement the micro-credit model particularly well (Lemaire, 2011).

Non-grid or renewable energy is viewed as insignificant when it comes to the large scale proliferation of electrification (Gaunt, 2004).

It is generally agreed that rural electrification costs versus benefits are not easy to quantify, although on-going research suggests that the socio-economic advantages of electrifying rural areas are much more than what was initially

thought (Zomers, 2003). People can survive without electricity, as millions currently do on a daily basis, but the availability of electricity makes a huge difference as it is politically and socially significant and can represent a degree of progress (Zomers, 2003).

There are global programmes focused on renewable electrification as well, such as the programme initiated by the United Nations Secretary-General, Ban Ki-Moon; the Sustainable Energy for All (SE4All) programme (United Nations, 2013). According to the United Nations (2013), the intent of this programme is to provide sustainable energy for all by 2030, with the main focus being on developing countries. Nearly 1.3 billion people in the world do not have access to modern energy services (Chaurey et al., 2012; United Nations, 2013). Sub-Saharan Africa and South Asia constitute more than 80% of the population living without electricity access (Kouassi & Pineau, 2011). There are about 585 million people in Sub-Saharan Africa without access to electricity and most of these are in poor, rural communities (Hailu, 2012; Kouassi & Pineau, 2011).

Some concessionaires have been successful in their deployment of SHS systems through the fee-for-service model (Lemaire, 2011). According to GNESD (2012), a concessionaire can be viewed as a small utility that is local to where the SHS installations are taking place and supplies electricity services to households (GNESD, 2012). The concessionaires are supposed to establish local energy offices or stores which should provide other energy sources such as LPG or kerosene, to cater for thermal services that can't be provided by the limited-capacity solar home systems; such thermal services include heating, cooking and refrigeration (DOE, 2012a; GNESD, 2012).

The main provinces with electrification backlogs are the Eastern Cape (mostly formal settlements), KwaZulu Natal and Gauteng (mostly informal settlements) as stipulated in the Survey of Energy-related Behaviour and Perceptions in South Africa by the Department of Energy (DOE, 2012b). The survey also shows that none of the poor rural households utilize solar home systems for heating rooms and for keeping warm (DOE, 2012b). This trend is to be expected as Lemaire (2011) states that the original intent of the solar home systems was mainly for lighting, media and telecommunications.

Similar renewable technology programmes have occurred in other countries, such as the example found in the research by Chaurey et al. (2012). This research discusses the Lighting a billion Lives (Labl) programme in India, which is managed by The Energy & Resources Institute (TERI), where entrepreneurs are encouraged to operate solar charging stations and to rent out solar lanterns at an affordable price in the evenings (Chaurey et al., 2012). This is a fee-for-service model that enables lighting in poor communities through solar power (Chaurey et al., 2012). In countries such as India and Bangladesh, non-grid renewable technology has been utilized to electrify areas where grid is a long-term possibility (DOE, 2014).

A South African case of rural electrification using the fee-for service model that seems to be a success is based on the research by Lemaire (2011) and it discusses the Nura fee-for-service concessionaire in KwaZulu Natal. This concessionaire is surviving despite facing challenges which were the cause of the downfall of other concessionaires and it proves that even if the supporting institutional structures might be lacking, it is still possible for such schemes to survive (Lemaire, 2011).

The agreement between Nura and government was that 25 000 SHS installations will have been deployed by 2005 and in 2006, only 11 500 installations had been deployed; Lemaire (2011) highlights that the delays were mainly due to capital subsidies from government not forthcoming.

According to Davidson and Mwakasonda (2004), in 2003, Zimbabwe was the country with the largest number of installed SHS systems, amounting to roughly 85 000. This was partially due to the utilization of low-cost, silicon-type systems imported from South Africa & Botswana and some do-it-yourself (DIY) systems developed in Zimbabwe (Davidson & Mwakasonda, 2004). Although the number of installations was high, as indicated by Davidson and Mwakasonda (2004), the solar home system connections in Zimbabwe did not do as well as the grid ones due to the solar panels being mostly expensive & the high failure rate of these systems (Davidson & Mwakasonda, 2004).

The cost of a single solar system in South Africa in 2006 was approximately R4000, whereas grid connections by Eskom would have ranged between R10000 and R15000 per connection and the solar installation subsidy from government was R3500 at that time while the subsidy provisioned to Eskom for a grid connection was R4000 (Lemaire, 2011). The cost of implementing these SHS systems in South Africa comparatively seems low to other African countries (Lemaire, 2011).

The research by Chaurey et al. (2012) discusses a case study about making electricity access solutions relevant for poor communities, which is the RGGVY (Rajiv Gandhi Grameen Vidyutikaran Yojna) project. The RGGVY project in India was political in nature and aimed to electrify all Indian households by the year 2012 and it provided non-grid electrification to areas where it was not feasible to extend the grid (Chaurey et al., 2012). Viable business models were tried and tested through servicing a cluster of villages that consist of different categories of customers such as commercial, domestic, agricultural and industrial (Chaurey et al., 2012).

2.3.2. Renewable energy challenges

One of the aims of the Energy Policy is to stimulate development in alternative, renewable and new energy sources (DOE, 1998). In South Africa, the solar home system (SHS) electrification programme commenced in 1999, as indicated by Lemaire (2011). This was to enable electrification in areas where grid will not be able to reach in the short-to-medium term (DOE, 2013). The bulk of the electrification backlog remains predominantly in the rural areas (DOE, 2012b; Salga, 2014).

There are many renewable energy avenues in Africa which include solar power, geothermal energy, wind energy and hydropower (Waindi & Khalid, 2011). Approximately a quarter of the South African population supports the implementation of energy sources that are renewable in nature (DOE, 2012b).

The challenges to the implementation of the SHS systems are the upfront capital costs and the costs for battery replacement; the panels are normally very

expensive compared to the Kilowatt hours (KWh) produced (Lemaire, 2011). Additionally, the usage of non-grid technologies is not streamlined due to issues such as a lack of planning, coordination and the perceptions that this type of technology is inferior (DOE, 2013).

According to DOE (2012a), Free Basic Electricity (FBE) was established in 2003 to assist energy poor households; non-grid customers also receive FBE. In the case of non-grid customers, where the systems were installed as part of the INEP programme, the customers are entitled to an FBE subsidy of up to R48 per month, which forms part of the service fee (DOE, 2012a).

Other challenges facing non-grid connections in South Africa are the oftentimes unprofitable business models, the inconsistencies in the payment of Free Basic Electricity by municipalities and the delays in the contracting processes by the municipalities, as indicated in the New Household Electrification Strategy by DOE (2013). Some municipalities rely solely on consultants as they have no electrification departments (Salga, 2012a).

Additionally, the policy to providing FBE might change depending on the municipalities' priorities, according to Lemaire (2011) and this causes dissatisfaction to the customers, which might lead to non-payment of the monthly service fees (20% of these customers are in arrears of more than a single month).

The Residential Sector Survey on Energy-related Behaviours and Perceptions in South Africa by DOE (2012b) states that 49% of the South African population indicated that policy should focus more on assisting poor households by providing them with more Free Basic Electricity. The survey stipulates that the 50KWh provided through FBE cannot sustain a fridge that needs to run 24hours a day, let alone other appliances. Therefore, although government is praised for the FBE initiative/subsidy, quality-of-life specialists and academics still insist that 50KWh is not enough to ensure improvement in quality-of-life (DOE, 2012b).

Lemaire (2011) adds that the concessionaries get delayed in contract-negotiations with the municipalities, in efforts to get these FBE grants provided since the negotiations with each municipality can be very long.

The payment of FBE is at the discretion of the municipality and some of these entities do not see the value of the non-grid systems and would rather direct these funds to other areas where they are needed more, such as water and sanitation (GNESD, 2012). The income from electricity distribution forms the major source of revenue for local municipalities (Salga, 2014). Some municipalities are struggling financially (Salga, 2012a). Therefore, in some areas the payments are erratic, while in others, they are non-existent altogether (GNESD, 2012). The pressure from DOE is not enough to enforce the effectiveness of these payments (GNESD, 2012). The research by Zomers (2003) indicates that experience highlights that a strong regulatory framework is required to ensure proper implementation of renewable technologies and for consumer group protection (Zomers, 2003).

According to the DOE (2012a), the municipality is supposed to apply to DOE if it has identified an area for non-grid connections within its jurisdiction. The municipality must have engaged with Eskom (in case the area is an Eskom supply area) or any concessionaire that might be operating in the area for a go-ahead; DOE needs to also confirm this with all the pertinent stakeholders before granting approval (DOE, 2012a).

Other challenges faced by concessionaires are the cutting by government of the necessary funding and the slow process in awarding new contracts to concessionaires (GNESD, 2012). The solar home systems are placed on the premises of the customer although ownership does not lie with the customer; this creates a situation where there are cases of vandalism, misuse and neglect (GNESD, 2012). Communities will normally prefer grid-electrification over alternative energy forms (DOE, 2012a)

Besides solar home systems, South Africa is having challenges in leveraging other renewable technologies such as mini-grids in the short-term according to the DOE (2013). This is due to the fact that for now the available non-grid

choices are the technologies that have been tried and tested in the country, such as the SHS systems and also because the cost of mini-grid outweighs that of grid connections, (DOE, 2013).

The work by Holliday (2013) is a study that was done through the utilization of simulations of load and utilization information about the size and cost of hybrid diesel and solar systems to get an indication of cost for different aggregations and usage patterns for hybrid systems. What is interesting about this study is that if installations can be done for an aggregated number of people as opposed to a one-to-one mapping of customer-to-installation, costs are reduced by up to 200% (Holliday, 2013).

Six concessionaires were initially awarded contracts to install these SHS systems in 2001 (DOE, 2012a). These contracts are valid for a 5-year period and the service period is binding for a 20-year period (DOE, 2012a). These original concessionaires are as follows (DOE, 2012a):

Table 2: The six original non-grid concessionaires (DOE, 2012a)

Concessionaire	**Province**
KwaZulu Energy Services (KES)	KZN & Eastern Cape
Nuon RAPS Utility (Pty) Ltd	KZN
Solar vision (Pty) Ltd	Limpopo
Ilitha Cooperative	Eastern Cape
Summer Sun Trading (Pty) Ltd	Eastern Cape
Shine the Way cc	Eastern Cape

The German donor (KfW) is funding a project in the Eastern Cape implemented by the KES concessionaire (DOE, 2012a).

Due to some of the non-grid challenges, 2 out of the 6 original concessionaires have been discontinued and no new ones have been appointed since (DOE, 2013). Research by Lemaire (2011) states that in 2002, 6 fee-for-service concessionaires were selected, adding to one which already existed between

Eskom & Shell. Two were stopped due to financial difficulties and the withdrawal of some investors (Lemaire, 2011).

According to Chaurey et al. (2012), the implementation of certain renewable electricity technologies has not been a success, such as in countries like Nepal (micro hydro projects) in India. Such failures, which led to around 30% of the installed systems not working in Nepal, could be attributed to a number of issues, such as faulty engineering and sub-standard installations (Chaurey et al., 2012). DOE (2012a) emphasizes the need to train and educate end-user communities on aspects such as the benefits of the non-grid systems, what happens in situations of grid encroachment, basic system trouble-shooting and so forth (DOE, 2012a).

Chaurey et al. (2012) mention a case study of the cook-stoves programme which exhibited low success rates in some developing countries, except in countries such as China & Cambodia, because these forced people to change their habits and lifestyles. To some it was a culture change which they could not adjust to (Chaurey et al., 2012).

According to GSNED (2012), maintenance has proved to be a challenge in non-grid rural areas due to the long distances that need to be travelled; this has had an adverse impact on customers and concessionaires. This situation encourages the training of local communities to be able to do the basic maintenance which can be beneficial in terms of building local skills and job-creation as well as in improving the concessionaire operations (GNESD, 2012).

The disadvantages of these renewable energy sources are the reduced energy densities, increased capital costs and the reduced availability levels, which is dependent on the availability of the energy source such as the sun (DOE, 1998).

According to Chaurey et al. (2012), the non-grid electrification programmes will normally keep track of how many solar systems have been installed as opposed to how many homes are actually utilizing these systems. The latter is an important indicator of programme success (Chaurey et al., 2012). In South

Africa, it is not clear what other monitoring the Department of Energy is doing besides monitoring the number of non-grid systems installed (GNESD, 2012).

The Residential Sector Survey on Energy-related Behaviours and Perceptions in South Africa by DOE (2012b) indicates that 22% of the population indicated that government policy should focus more on renewable energy subsidization. When it comes to what future energy sources government should focus on, 25% of the population indicated that renewable energies such as wind, solar or water should be the focus (DOE, 2012b).

Salga (2012a) states that the electrification programme has stimulated economic activity where there previously was none. The most important challenge entrepreneurs can face in the rural areas is the low-quality and unreliable electricity service (Zomers, 2003).

2.3.3. Multiple fuel-usage

The lack of electricity in some poor households can sometimes be a matter of preference, as indicated in the study by Thom (2000) which states that some households, mostly those which consist of either women pensioners or men-only, indicated that they did not want electricity for cooking. Whilst in some areas, Thom (2000) indicates that even with the availability of electricity for cooking, other forms of fuel, such as wood and paraffin were the preferred options.

Additionally, the level of electricity-usage can be an issue of affordability in rural areas, possibly leading to multiple fuel-use (Cook, 2011; DOE, 2012a; Gaunt, 2004; Sotkiewicz, 2006; Statistics South Africa, 2013). The Residential Sector Survey on Energy-related Behaviours and Perceptions in South Africa by DOE (2012b) indicated that in 2012, approximately 26% of South Africans had to utilize other energy sources in addition to electricity due to the increasing electricity tariffs (DOE, 2012b) and this trend was observed mostly in traditional rural areas, households with a low-living-standard or households in the North West or Limpopo. Approximately a fifth of households that fall within the low-

living standards category did not have a plan or an idea of how they would cope if electricity prices were to increase further (DOE, 2012b).

The Residential Sector Survey on Energy-related Behaviours and Perceptions in South Africa by the Department of Energy (DOE, 2012b) indicates that most South Africans prefer the cheapest energy option, regardless of whether it is coal, solar, wind, natural gas and so forth. Most South Africans are more than willing to pay for energy as long as the cost is reasonable and therefore, energy source affordability is what matters the most to the majority of South Africans (DOE, 2012b).

A fuel biography refers to a person's fuel utilization history that influences an individual's fuel preference for certain types of energy services and this concept is influenced by disparate factors such as culture, taste, tradition, etc. (Thom, 2000).

The introduction of electricity in a number of rural communities had little impact in reducing the usage of other fuels in those areas (Madubansi & Shackleton, 2006). Households with a low income but with access to electricity continued with the utilization of multiple fuels (DOE, 1998; DOE 2012). The most prominent feedback from the communities was that the electricity tariffs should be reduced so that the cooking service could be enabled through electricity (Madubansi & Shackleton, 2006).

There are innate health risks to some forms of fuel such as kerosene or wood (DOE, 2012a). Therefore electrification is encouraged because of its positive health impact (Gaunt, 2004; Hailu, 2012).

Due to the fact that grid was taking a while to reach certain areas; government saw the need to implement another subsidy, the Free Basic Alternative Energy Policy (DOE, 2006); this was to assist indigent households with services such as cooking and the municipalities are responsible for the administration of this subsidy. The value of the energy source must be R55 minimum; examples are paraffin, LPG, coal and bi-ethanol gel (DOE, 2006).

The Energy Policy (DOE, 1998) indicates that some of the reasons behind the more wide-spread lack of use of electricity amongst the poor are the expensive electrical appliances, their single-purpose functionality and the expensive thermal usages of energy for services such as space heating and cooking.

Paraffin, specifically, is a fuel that has proved difficult to displace with electricity in rural areas (DOE, 1998; Thom, 2000) with the view being that paraffin is more cost-effective than electricity for cooking & water-heating purposes. General knowledge amongst the South African population on the operational costs of household appliances is limited (DOE, 1998). In informal settlement households, paraffin is utilized by 62% of the population, despite the increase in paraffin costs alongside petrol costs recently (DOE, 2012b). The Energy Policy encourages electrification (both grid and non-grid) over alternative fuel-sources (DOE, 1998; DOE, 2012a).

It is expected that as the South African population continues to develop and progress and living habits are altered, multiple fuel usage will decrease (DOE, 1998). The number of households utilizing electricity for lighting went up from 58.2% to 84.7% from 1996 to 2011; whilst candle and paraffin usage for lighting decreased over that same time (Statistics South Africa, 2012). In the meantime, for the next 20 years or so, government intends to promote multiple fuel use to enable energy access through policies like the Free Basic Alternative Energy (DOE, 2006).

2.3.4. Customer education & support

The Energy Policy (DOE, 1998) states that the introduction of new electrification technological interventions, such as the SHSs, must entail consultation with the households that will utilize them. This decreases the chances where households refuse to adopt such technologies (DOE, 1998). A case in Nepal exemplifies a programme that exhibited limited success because there was insufficient education, monitoring and aftercare for the customers after the installation of the non-grid electricity solutions (Chaurey et al., 2012). The involvement and ownership by the different stakeholders in concessionaire programmes is imperative for these to be successful (GNESD, 2012). Certain

concessionaires such as Nura, Solar Vision and Shine the Way have local ownership aspects, which encourages community involvement (GNESD, 2012).

In typical electrification programmes (both grid and non-grid), the role of government is to set the guidelines and policies, while the private partners provide some of the funding and expertise for the technology (Chaurey et al., 2012). Chaurey et al. (2012) mention that the community will hardly be involved at all except as just beneficiaries of the programme. This reduces the chances of success because communities are normally expected to manage these systems post-installation and they sometimes do not have an idea on how to (Chaurey et al., 2012).

2.3.5. Proposition 1

There is a need to examine factors leading to some poor communities not having access to electricity. For poor communities that do have access to electricity, to explore the need for multiple energy sources and the contributing factors to this phenomenon. This will incorporate exploration of the limitations in the electricity solutions being deployed and the issue of affordability.

2.4. An integrated approach to electrification for the poor

This section contains information pertaining to the role of disparate stakeholders in the electrification process for the poor in rural areas. It touches on aspects such as the institutional frameworks, contexts and policies that are a prerequisite to sustainable business models.

2.4.1. Energy sector institutional context

Some of the challenges facing the electrification programme in South Africa include the high connection costs, the sub-optimal use of the existing electrification funds (Salga, 2012a), inefficiency in coordination and a lack of fund discipline (DOE, 2013). Additionally, there have been large inefficiencies in the Electrification Distribution Industry (EDI) over the past 10 years (Madzhie, 2013; Salga 2014). Local government in 2009, at a Salga National Members

Assembly (NMA), made a decision to renew efforts of restructuring the EDI (Salga, 2014). The EDI challenges include capacity shortages, inadequately-maintained networks and the inconsistent and slow provisioning of FBE (DOE, 2008). Performance in terms of meeting electrification targets has been a major challenge (Salga, 2012a). The vacancy levels for municipal skilled resources is greater than 50% (Salga, 2012a). INEP needs to ensure coordinated planning amongst the electrification stakeholders (Salga, 2012a). INEP manages and oversees the electrification programme implementation processes, the finances and the planning processes (National Treasury, 2013).

From the year 2004 onwards, the prediction was that by 2012, electrification would only be at 80% in the country and then, at some point during that time, government committed to 100% electrification by 2012 (Bekker et al., 2008). Subsequently, by March 2012, INEP indicated an electrification level of 87% (DOE, 2012b). This is in comparison to Sub-Saharan Africa, where average access levels are currently at around 26% (Pillot, Muselli, Poggi, Haurant, & Hared, 2013). For the whole of Africa, if South Africa and Egypt are excluded, then overall grid electrification is slightly below 20% (Adkins, Oppelstrup, & Modi, 2012).

The goal-post to electrification in South Africa has now shifted to 92% of formal households for the year 2014 (DOE, 2012a; DOE, 2012b; DOE, 2013; GNESD, 2012; Salga, 2012a). Madzhie (2013) indicates that even the 92% target is being revised. The new universal access target for South Africa is now the year 2025 (DOE, 2013; RSA, 2013; Statistics South Africa, 2013). DOE, from the financial year 2014/15, aims to increase the annual electrification budget by R500 million in order to reach the 2025 universal access goal (DOE, 2013; Madzhie, 2013).

The electrification backlog is currently at 3.4 million (3.1 million formal households to receive grid connections and 300 000 formal households to receive non-grid), (DOE, 2013). About 75% of the backlogs are in rural areas and 25% in urban (mainly informal) settlements (Salga, 2014).

Many developing countries have aggressive targets towards universal access (Hailu, 2012). It therefore becomes imperative that progress monitoring is done and that objective feedback is provided to policy-makers (Hailu, 2012). INEP does not have enough capacity to do sufficient monitoring of the electrification process (Salga, 2012a).

In South Africa, the management and the governance of the energy sector has been a challenge and has often been difficult to fully discern; this is due to the fact that there are quite a reasonable number of players creating and necessitating complex relationships (DOE, 1998).

The lessons learnt from other countries that have engaged in large electrification programmes indicate that for success, there needs to be centralized planning, delivery, support and detailed monitoring of the whole process (DOE, 2013).

Bazilian, Nussbaumer, Rogner, Brew-Hammondc, Foster, Pachauri, Williams, Howells, Niyongabo, Musaba, Gallachóir, Radka, & Kammend (2011) indicate that ineffective business models are one of the obstacles to achieving universal electricity access in the Sub-Saharan Africa region. The right institutional environment is crucial in enabling electrification for the rural poor (Zomers, 2003).

Poverty alleviation can drive electrification efforts, as is evidenced in the electrification programme of South Africa (Gaunt, 2004).

The view held by Eskom, the ANC (through the Restructuring & Development Programme) and the municipalities, was that electrification was part of infrastructure development and should therefore be incorporated or integrated with other infrastructure development processes (Bekker et al., 2008; Salga, 2012a). The electrification programme efforts should align to other economic development programmes that are on-going in a country (Banda & Tinto, 2005; DOE, 2014; Zomers, 2003). Rural electrification needs to be accompanied by complimentary infrastructure such as educational facilities, to enable productive use of electricity (Cook, 2011).

South Africa did manage to a certain extent to put in place frameworks and platforms to enable electrification (Bekker et al., 2008). However, these eventually proved to be insufficient for the electrification of poor communities (Bekker et al., 2008).

Introducing competition and privatization in the electricity sector are viewed as mechanisms in which efficiency can be introduced, compared to a monopolistic situation (Zomers, 2003); the disadvantages of this are that fragmentation is introduced into the energy sector, which introduces complexities. This is usually acceptable in mature infrastructures where demand growth is low, which is often not the case with developing countries (Zomers, 2003).

South Africa has experienced numerous service delivery protests in recent history (DOE, 2012b; Salga, 2012a). According to the Residential Sector Survey on Energy-related Behaviours and Perceptions in South Africa by the Department of Energy (DOE, 2012b), about 44% of South Africans believe that protests pertaining to lack of electricity access are not wrong at all.

Rural electrification initiatives have so far not provided universal access (DOE, 2013). The two serious constraints to electricity access for the poor are the electricity & connection charges (Cook, 2011). Subsidies to cover capital costs are justifiable only if income caters for maintenance and operating costs (Cook, 2011).

To attract international and local investment, government has a challenge to ensure that a proper fiscal, regulatory and legal framework is developed and to ensure that simultaneously, such a framework enables the achievement of national policy objectives (DOE, 1998).

Other developing countries have also attempted to put proper frameworks in place according to Chaurey et al. (2012); in such programmes where a particular electricity technology proved to work, it remained a challenge to replicate such a technology model within a region or even in other countries. Chaurey et al. (2012) state that the reasons were that no real effort had been made to enable financing, maintainability and operationalization of such models. An example is the GEF (Global Environment Facility) which funded a number of

solar home systems (SHSs) technology programmes where these technologies were implemented in a number of countries but were often neither replicable nor self-sustainable and required additional international donor funding to be sustainable (Chaurey et al., 2012).

The Energy Policy (DOE, 1998) states that some of the policy challenges government is experiencing with electrification is ensuring that entities capable of proper execution of the electricity projects are allocated the task. South Africa needs to utilize the experience acquired from the electrification programme and must enhance existing policies to fast track the electrification process going forward (DOE, 2014).

According to research by Davidson and Mwakasonda (2004), hindrances to expeditious electricity deployments for the poor have been due to policy, institutional, and financial challenges; with financial challenges being the biggest obstacle. According to the New Household Electrification Strategy by DOE (2014), other countries that have been successful in their electrification programmes have drawn their funding not only from the fiscus, but also from private foundations and micro-finance. Some of the costs are being allocated to the customer, amortized over a certain period (DOE, 2013).

Chaurey et al. (2012), discuss a case study that focused on two projects that were carried out in India, where one was a non-grid project by a non-governmental organization (NGO) and the other was grid-based, run by the government of India. The research focused on innovative mechanisms, new forms of partnership, measures for success, new business models, the ability to replicate electrification initiatives, up-scaling of electrification programmes, affordability and technology institutions. These innovative mechanisms should be the areas of focus, according to Chaurey et al. (2012), to ensure the success of electrification programmes for the poor or the so-called bottom of the pyramid (BOP).

2.4.2. Partnerships

According to DOE (2012a), energy poverty challenges in South Africa cannot be handled by government alone. There is therefore an acknowledgement for the need for public/private sector partnerships to assist with service delivery and this is one of the reasons why the fee-for-service concession programme was initiated in 2001 (DOE, 2012a).

According to Chaurey et al. (2012), partnerships play a key role in electrification programmes since rural electricity access programmes can be very capital intensive. Normally the funds provided by government, the public funds, are inadequate to provide sustainable energy access in rural areas (Chaurey et al., 2012). Therefore private finance is crucial for South Africa (DOE, 1998). As indicated in the Energy Policy (DOE, 1998), there is a need for the country to create an environment conducive to attracting private investment. Unfortunately, it seems that the interest of the private sector in rural electrification is not at the level it should be (Zomers, 2003).

In certain municipal areas, regular energy forum meetings are held that involve the pertinent stakeholders such as the municipalities and the concessionaires and in such areas, the success in terms of payment of FBE and support for these non-grid systems has been higher (GNESD, 2012).

Chaurey et al. (2012) discuss a new role for public-private partnerships defined in the context of electricity access for the poor, called the pro-poor public-private partnerships (5P) model and the main aim of the 5P model is the provisioning of services to the poor. The 5P model looks at the poor not only as beneficiaries of Public-Private Partnerships (PPP) but also as partners (Chaurey et al., 2012).

There are a number of South-Asia case studies that have demonstrated the 5P model, according to research by Chaurey et al. (2012). Some of the examples include the Lighting a billion lives (Labl) case study from India and the Energy Sector Assistance Programme case study in Nepal (Chaurey et al., 2012).

The research by Chaurey et al. (2012) mentions that in Nepal, the AEPC (Alternative Energy Promotion Centre) has had experience with deploying non-

grid and mini-grid rural electrification projects and in this case, the financial contribution of communities towards these electrification projects has been as high as 50%. This enforced more involvement from the communities and increased the chances of sustainability of such projects, according to Chaurey et al. (2012), due to community involvement in determining the tariffs and the management process for the project. Chaurey et al. (2012) indicate that communities would also undertake other community development projects from the funds generated from these electrification programmes.

2.4.3. Proposition 2

There is a need for an investigation of an integrated approach to electrification for the poor, by exploring the issues in the collaboration of disparate stakeholders from the planning to the execution phases of the electrification process, which should ideally enable sustainable business models.

2.5. Conclusion of Literature Review

This research should shed some light into what the different stakeholders in the electrification of poor communities, especially rural areas, in South Africa should improve upon to expedite the process. It must also identify ways of ensuring the sustainability of the deployed solutions, for both the service providers and the customers. The developmental goals for the poor in South Africa need to be translated into pragmatic electricity access solutions that will assist in achieving the intended goals.

Proposition 1:

There is a need to examine factors leading to some poor communities not having access to electricity. For poor communities that do have access to electricity, to explore the need for multiple energy sources and the contributing factors to this phenomenon. This will incorporate exploration of the limitations in the electricity solutions being deployed and the issue of affordability.

Proposition 2:

There is a need for an investigation of an integrated approach to electrification for the poor, by exploring the issues in the collaboration of disparate stakeholders from the planning to the execution phases of the electrification process, which should ideally enable sustainable business models.

3. CHAPTER 3: RESEARCH METHODOLOGY

This section provides information on the research strategy and research design that have been selected for this study. The different way in which sampling was viewed is also discussed. Information on data collection and analysis is provided as well as how validity and reliability concepts were approached.

3.1 Research methodology

This study utilized a qualitative research method. Qualitative research is a "research strategy that usually emphasizes words rather than quantification in the collection and analysis of data and that predominantly emphasizes an inductive approach to the relationship between theory and research, in which the emphasis is placed in the generation of theories" (Bryman, 2012; p.36).

This study extracted meaningful insights and observations from the role players that are part of the electrification process. The qualitative method was suitable because as information was gathered, new information that might not have been thought of was acquired, which sometimes led to the need to gather more information from the same participants again or from new participants (Bryman, 2012).

Qualitative methods are usually utilized to gain insights into the world of the participants and the aim is normally to empower the participants and to alter their social conditions (Mouton, 2001). Hence, hopefully the findings from this study will add value into the electrification process.

Mouton (2001) mentions that qualitative research needs to be feasible, which implies paying attention to the amount of time, money & other resources required; different research types will have different resource implications. For this qualitative study, time was the most important resource that required careful management.

3.2 Research Design

According to Mouton (2001), once a research problem has been formulated, a research design needs to be selected and in its simplest form, a research design implies the type of study that will best answer the question or problem or address the proposition that has been formulated. The research design can be referred to as a blueprint or a plan of how the research problem will be approached (Mouton, 2001).

The research design of this study was a qualitative analysis of the national electrification programme for the poor in the rural areas in South Africa. The study incorporated the "collection and qualitative analysis of texts and documents" methods (Bryman, 2012; p.383). As Bryman (2012) indicates, it is not uncommon to utilize a multi-method approach in qualitative research. The focus on existing documents was invaluable in providing insights to this study.

For this research analysis, semi-structured interviews were utilized. This method is useful because as engagements were carried out with the participants, they sometimes raised important points which might have been missed in structuring the initial research problem. Therefore, the questions did undergo some refinement as more and more in-depth information was obtained. The same list of questions was utilized for all the interviewees, as is the case with semi-structured interviews (Bryman; 2012) and there were some recurring themes from a majority of the interviews and there were instances where interviewees shared sentiments that were not common to the list of candidates.

Perhaps in future, for the benefit of electricity access for the rural poor in developing countries, a study might be done in different countries where a central agency controls how the research is done by the disparate participants in the different countries to enable comparability amongst the countries (Bryman, 2012). According to Bryman (2012), this would entail a cross-cultural research, which incorporates the collection of data and the analysis thereof between two or more countries. Cross-cultural research is excluded from this study.

Cross-cultural research can enable different countries to carry out similar research that will ensure comparability of research questions or propositions (Bryman, 2012). This type of research will probably prove invaluable in electricity access programmes for the poor in developing countries because methods that do work can be shared across different countries, thereby enabling the fast-tracking of such initiatives.

3.3 Population and sample

3.3.1 Population

Insights were gathered from disparate stakeholders pertaining to the electrification programme in order to obtain their view in a number of aspects, such as the progress that has been made, any gaps or challenges that need to be addressed and what they think can be done better to expedite and optimize the electrification process for the rural, poor communities in South Africa.

3.3.2 Sample and sampling method

Since this study utilized the qualitative strategy, Mouton (2001; p.195) recommends the usage of the term “selection of cases” in ethnographic studies than the utilization of samples. This is because sampling implies more structured designs such as surveys and experiments (Mouton, 2001). In such cases, samples are a representation of larger populations, which is often not the case with qualitative research (Bryman, 2012).

Table 3 shows the list of stakeholders interviewed or engaged with.

Table 3: Profile of respondents

Description of respondent type	**Number sampled**
Deputy Director General at DOE	1
Electrification Specialist at DPE	1

Manager at Eskom	1
Manager at Eskom	1
Technical Specialist at Eskom	1
Manager at Nura	1
Manager at KwaZulu Energy Services, KES	1
Head of Energy Division at NEPAD	1
Manager at Salga	1
Manager at National Treasury	1
Manager at Statistics South Africa	1

3.4 The research instrument

This study utilized an interview schedule (see Appendix A) as a research instrument. According to Bryman (2012; p.713), an interview schedule is “a collection of questions designed to be asked by an interviewer”. The study utilized the semi-structured interview method (Bryman, 2012) and a qualitative analysis of the research problem; therefore the interview questions were open-ended to allow for the deep-insights that needed to be extrapolated as part of a qualitative analysis study.

Audio recordings and interview transcripts (Bryman; 2012) are the form in which the data was captured and stored.

3.5 Procedure for data collection

The data collection method for this study was a semi-structured interview (Bryman, 2012). The data was collected through a number of interviews where the participants were requested to answer a number of open-ended questions. These open-ended questions allowed for the acquisition of the deep insights that were required for this qualitative study. The literature review magnified the need for investigating the current challenges to the electrification process for the

poor in rural communities. Therefore the insights obtained, where participants were able to voice their opinions, provided the information needed to potentially assist in addressing some of these gaps. The participants were given the option of selecting an interview location they are most comfortable with. In cases where distance was a challenge, teleconferences were done to carry out the interviews.

During the interviews, if the participants agreed, audio-recordings were done. Fortunately, all the interviewees agreed to the recordings. For cases where recordings might not have been allowed, the backup plan was to take very detailed notes of the interview information. As part of the study, the intent was to provide a thick description of interview feedback and findings so that the context for the electrification programme and the challenges are understood (Bryman, 2012). Thereafter, the information was stored as interview transcripts (Bryman, 2012).

3.6 Data analysis and interpretation

Straight-forward, standardized rules with regards to qualitative data analysis do not yet exist (Bryman, 2012); for qualitative data analysis, a general strategy of analysis which provides the guidelines to the data analysis process is desirable. Two methods, grounded theory and analytical induction are options that can be utilized to perform a qualitative study (Bryman, 2012) and these two tend to be iterative in nature because as data is collected, analysis is done, which might lead to the collection of even more data not previously thought of, followed by more analysis, etc. This qualitative study adopted neither of these methods and focused only on the qualitative analysis aspect due to the limited period this study was to be completed in.

According to Bryman (2012), analytical induction requires the formulation of a hypothetical explanation to a research question and has the potential of being over laborious due to its potentially many iterations. There are few recent cases of the use of this methodology (Bryman, 2012) whilst grounded theory, on the other hand, is used widely to assist in qualitative data analysis (Bryman; 2012).

Had the study utilized grounded theory, then the coding and the concept of theoretical saturation of grounded theory would have been utilized to identify patterns in data; the theoretical saturation concept indicates when new data no longer provides new insights into the evolving content (Bryman, 2012).

This qualitative analysis study focused on identifying recurring themes or codes that were used to influence the findings and the recommendations.

This research utilized memos to record notes which served as reminders of code meanings or meanings of terms. Memos assisted in reflecting on ideas (Bryman, 2012).

Due to time constraints, re-interviewing certain candidates was not an option but the need to interview new candidates as more content was acquired was oftentimes necessary. This is linked to the nature of qualitative research (Bryman, 2012).

3.7 Limitations of the study

Mouton (2001) mentions non-standardization of measurement and the time consuming-nature of qualitative analysis as limitations. Additionally, he states that the researcher might be biased towards the outcome, which is another limitation or challenge with qualitative research.

Bryman (2012) states that qualitative research has an inclination of being subjective; the findings rely on the researcher's view of what is important. Because research interviews in the qualitative context are generic, the resulting low-level detail focused on might be ad-hoc and the detail of the findings might have no explanation as to why certain points were focused on (Bryman, 2012).

The researcher is the data collection instrument; what is significant to one researcher might not necessarily be important to the next (Bryman; 2012). The traits (personality, age, etc.) of the researcher play a role in the interviewing process as well (Bryman, 2012).

The participants in a qualitative research will not necessarily be representations of the population (Bryman, 2012). The findings from this study therefore, cannot necessarily be generalizable outside of the South African context.

Bryman (2012) mentions lack of transparency as another limitation of qualitative research where issues such as how were the research participants selected and how was the analysis done sometimes do come up.

Qualitative analysis has the tendency to be time-consuming due to the iterations and to the potential need to interview more and more candidates as content-analysis is progressing (Bryman, 2012). One outcome from this study with regards to the interviewing process is that it is almost always the case that the interviewees will highlight points that require investigation which were not originally incorporated in the research. The researcher should know where to draw the line.

3.8 Validity and reliability

3.8.1 External validity

Bryman (2012; p.711) describes external validity as "a concern with the question of whether the results of a study can be generalized beyond the specific research context in which it was conducted". This qualitative study is specific to the South African context. From the literature review, there have been instances where there was alignment with regards to the electrification process from other developing countries. Nevertheless, contexts, environments, etc., are not the same.

There probably will be content that other developing countries can learn from, but this qualitative study is not a sample of the total population of South Africa. A qualitative analysis study is not necessarily a sample of a larger population (Bryman, 2012) and therefore external validity or generalizability for such a study is almost impossible.

3.8.2 Internal validity

Bryman (2012; p.47) states that “internal validity is concerned with the question of whether a conclusion that incorporates a causal relationship between two or more variables holds water”. From a qualitative research point of view, this means “whether there is a good match between the researchers’ observations and the theoretical idea they develop”, (Bryman, 2012; p.390).

Bryman (2012) describes internal validity as the credibility criteria of trustworthiness and credibility is aligned to internal validity from a qualitative research point of view. Credibility is achieved by ascertaining that good practise in the research is followed and by providing the research findings to the research participants so that they can confirm that their social world was understood and captured accurately by the researcher. For this study it was a challenge to obtain feedback from the interviewees pertaining to the findings and the reason was mainly due to their inability to make more time for this study considering their busy schedules.

Generally, the challenge with credibility is that participants might react defensively or, if a good relationship was developed during the interview process, the participants might find it difficult to be objective (Bryman, 2012).

3.8.3 Reliability

Bryman (2012, pg.169) defines reliability as “the consistency of a measure of a concept”. This definition, which speaks of measurement, links mostly to quantitative research.

For this qualitative research study, the idea of dependability, which is one of the criterion for trustworthiness (Bryman, pg.392) can be utilized; dependability aligns to reliability from a qualitative research point of view. Dependability for this study can entail an auditing approach. All information and data gathered during the research process has been stored. Peers can then utilize the data to audit the process. This method is not yet widely used because it can be demanding on the auditors (Bryman, 2012). If the opportunity will present itself

in the future where a peer will be interested in auditing this qualitative research, the information will be available.

4. CHAPTER 4: PRESENTATION OF RESULTS

4.1 Introduction

The information collected from the interviews is derived from senior representatives and from technical experts from a number of entities that are currently playing a role in enabling electrification for the rural poor in South Africa. These stakeholders include those that are responsible for policy-formulation, the regulation and the monitoring, the implementation of the electrification projects and the maintenance of the electricity or generation technologies.

This report also incorporates the views of 2 of the 4 concessionaires that are busy with the deployment of solar home systems in rural areas. The results also incorporate the perception of the communities with regards to the electrification service in their areas, through the utilization of the results of a survey that was conducted by the Department of Energy (DOE, 2012a). Additionally, existing literature (texts and documents) was utilized to assist in addressing some of the concerns and issues pertaining to the research problem.

Recurring themes or codes were extracted from the interviews and the literature review to propose conclusions, findings and recommendations.

4.2 Demographic profile of respondents

The entities interviewed include most of the major players in the energy sector in South Africa, which include the Department of Energy (DOE), Eskom, the Department of Public Enterprises, two non-grid concessionaire companies and the New Partnership for Africa's Development (NEPAD). The Integrated National Electrification Programme (INEP) is part of DOE. Both non-grid concessionaire companies are operating in the KwaZulu Natal province whilst one also operates in the Eastern Cape. NERSA declined to be part of the interview process as they highlighted that DOE will have the pertinent information as they are spearheading the electrification programme in South

Africa. For customer perceptions, the Residential Sector Survey on Energy-related Behaviours and Perceptions in South Africa by the Department of Energy (2012) was utilized. The managers from Statistics South Africa (Stats SA), the South African Local Government Association (Salga) and National Treasury were not able to make time for the requested interviews but they kindly provided the pertinent content (texts and documents) that addressed the research topic. The findings from these documents are also incorporated in this study.

4.3 Results pertaining to Proposition 1

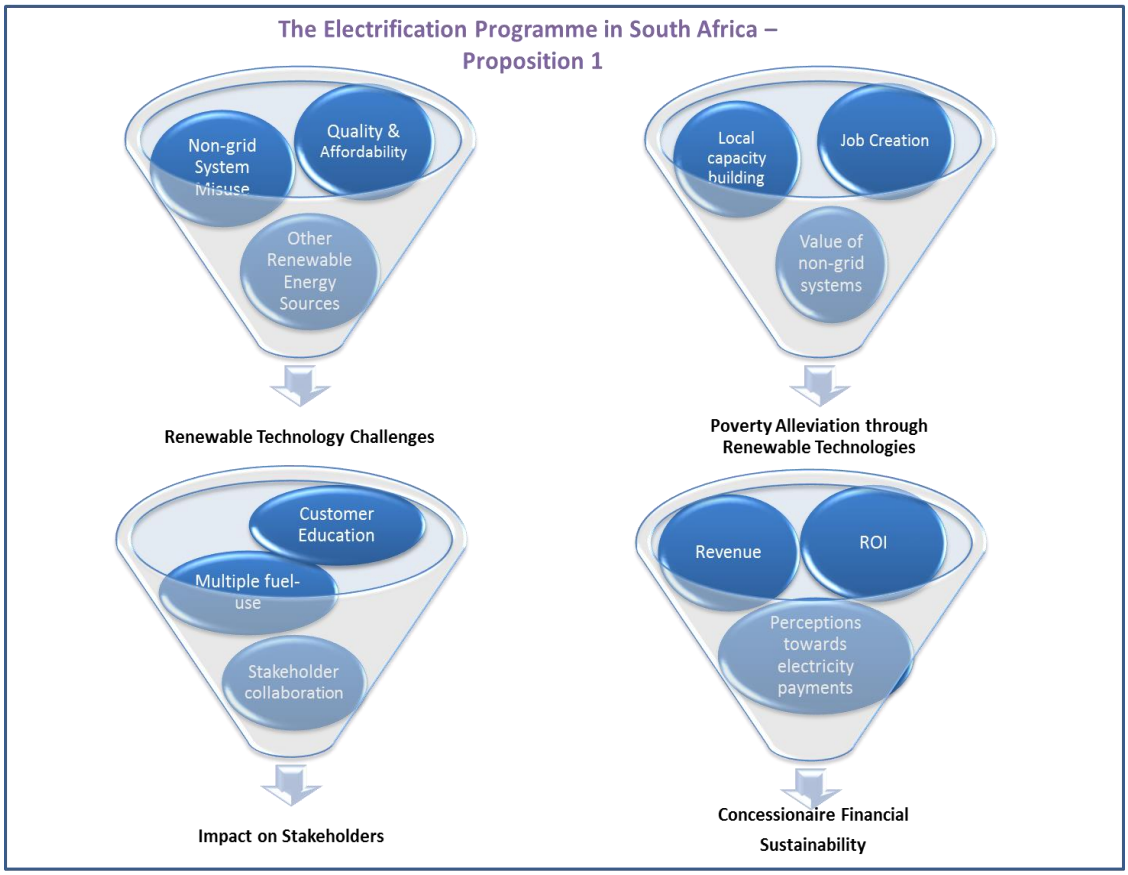

Figure 2: Aspects of Renewable Electricity access and usage for the poor

The aspects pertaining to renewable electricity access and usage for the poor contained in the findings include the renewable technology challenges, poverty alleviation through renewable technologies, the impact on the stakeholders and the financial sustainability of the concessionaires. These aspects are centred on

the work that is done by the non-grid concessionaires in the provisioning of renewable energy technologies, specifically solar home systems, for the poor.

The renewable technology challenges

The deployment of renewable technology solutions for the poor in rural areas poses some challenges, in addition to the benefits. These challenges pertain to the quality and affordability of the non-grid electricity solutions, the misuse of these systems and the need to investigate alternative renewable energy sources besides the solar home systems.

Poverty alleviation through renewable energy

The renewable energy technologies deployed for the poor enable a number of benefits for the community such as job-creation, local capacity-building and adds value for these communities.

Impact on stakeholders

Multiple fuel-use seems to be a necessary and important component to the rural communities that currently have access to solar home systems. The deployment of these renewable technologies requires community engagement throughout the whole process which entails customer collaboration, education and support.

Concessionaire financial sustainability

Private investors will normally require that their interests be taken care of. This incorporates the need to see the return on their investment and good revenue.

Proposition 1 Conclusion

There are a number of challenges that exist in the deployment of renewable energy technologies for the poor in rural areas and there are stakeholder management matters that need to be focused on. Poverty alleviation is one of the benefits of the implementation of the non-grid technologies although funding is a huge requirement to keep these projects going.

4.4 Results pertaining to Proposition 2

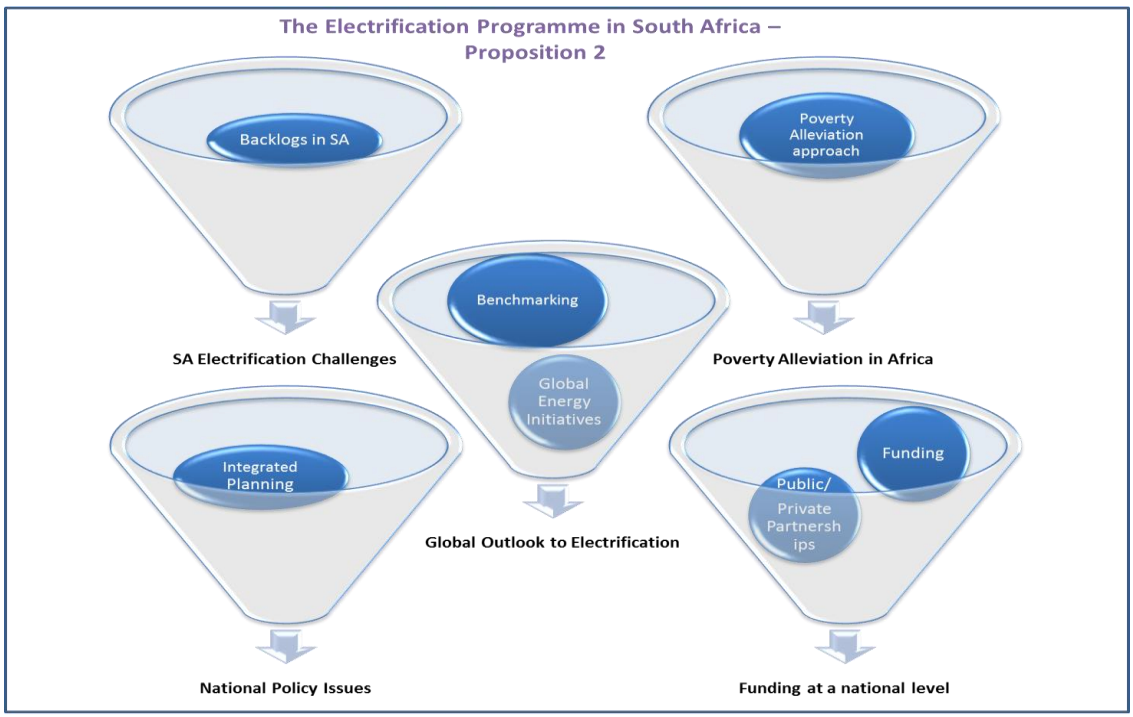

Figure 3: An Integrated approach towards electrification for the poor

The second proposition focuses on five areas which mainly have a high level focus of the institutional context within the energy sector in South Africa. These areas are the South African electrification challenges, poverty alleviation in Africa, the global outlook to electrification, national policy issues and funding at a national level.

The South African electrification challenges

There are challenges at a national level that have led to the existing backlogs in the electrification process in South Africa for both the grid and non-grid customers and these are discussed.

Poverty Alleviation through renewable energy

A number of initiatives are underway in the African and South African contexts that are aimed at reducing poverty. These entail dramatic shifts in the electrification process and these are discussed.

Global Outlook to electrification

This section highlights the global energy initiatives that impact South Africa and the benchmarking that the country does in order to learn from the electrification programmes of other countries that are embarking or have successfully embarked on electrification programmes.

National policy issues

This theme delves into the issues that are leading to gaps in the electrification integrated planning that are hindering the electrification process for the rural poor.

Funding at a national level

This theme focuses on the need for public/private partnerships in the rural electrification process for the poor and the need to attract other forms of funding towards this sector.

Proposition 2 Conclusion

Electrification backlogs exist in the country and these must be addressed. The lessons learnt from other countries and specific organizations need to be applied in South Africa to reduce poverty, specifically energy poverty. Government needs to focus on the lack of funding and other issues that are derailing the electrification process by re-looking at the relevant policy issues.

4.5 Summary of the results

The findings in this research highlight areas where there are both benefits and challenges in the non-grid electrification projects that are on-going in the KwaZulu Natal and the Eastern Cape provinces. Recommendations are made in terms of what issues should be impacting or influencing national policy at this point-in-time in order to fast-track electrification access, especially for the poor in rural areas.

5. CHAPTER 5: DISCUSSION OF THE RESULTS

5.1 Introduction

This chapter focuses on the value of the installation of non-grid systems for the poor in rural communities. It also focuses on the challenges to the deployment of these solutions such as the financial aspects, the negative sentiments towards these solutions and the sustainability thereof. Multiple fuel-use as an important component to the energy access process for the poor is also discussed. Finally, the chapter focuses on the current institutional context impacting electricity access for the poor, taking into consideration issues such as public/private partnerships.

5.2 Demographic profile of respondents

This study was of a qualitative nature. The intent was to interview all the major players in the electricity industry who are involved in the provisioning of electrification for the poor in rural areas, with a particular focus on non-grid renewable energy solutions. A number of interviews were carried out with managers or experts from the major stakeholders. Where interviews were not possible, recent literature or conten provided by these stakeholders was utilized to inform the findings. The findings highlight the deficiencies in the electrification process for the poor in rural communities, as was originally intended in the research problem statement. Additionally, insights were obtained in terms of how the process can be improved.

Part of the original propositions was to analyse the need for multiple fuel-use in South African poor households. Government's intention is to reduce the usage of certain types of fuels in time, especially those with an adverse health and environmental impact. However, the study highlights another trend where customers want energy-source choice for different energy services, with an emphasis on cleaner energy sources. These energy sources include renewable energy, LPG and the like.

5.3. Discussion pertaining to Proposition 1

5.3.1. Concessionaire financial sustainability

5.3.1.1 Revenue and ROI

The net present value (NPV) for the concessionaires over the initial five year period of operation is normally negative because the maintenance and installation costs will be higher than the revenues (DOE, 2013). The current installation contract with concessionaires is only valid for 2 years, whilst the maintenance contract is 20 years long. This poses a risk to the concessionaires should they decide to scale up their operations because planning for the long-term is restricted (DOE, 2013).

From a rural context, the biggest challenge with non-grid connections is the issue of topography. The landscape is challenging not only for grid electrification but for non-grid as well. The households, the ancestral homes of these communities are quite dispersed, which makes it very difficult for even standalone solar home systems to proliferate into those areas and penetrate to a significant scale. The installation of the grid network is even more problematic in such situations as it requires highly-skilled resources, a high cost and complex equipment to deploy it. Grid is not a feasible option for a few rural customers that are widely dispersed (Bekker et al., 2008). It was projected that for grid connections especially, after 5 years on average, rural areas that have been electrified would consume electricity at a rate such that the basic operational costs for distributors or operators would be recovered; but this is not happening. Low electricity-consumption by poor customers is causing financial challenges for electricity distributors.

Government intended that the non-grid concessionaires should recover their investments in roughly 15 years and this is currently not materializing. Most of the non-grid concessionaires are owned by international organizations and for them these initiatives are done from a corporate social responsibility point of view. Two of the six original concessionaires were discontinued due to lack of financial sustainability (DOE, 2013; Lemaire, 2011). To-date, the non-grid

programme in South Africa is not financially sustainable and the view is that the energy subsidies to the indigent are not sufficient. Therefore this is a serious issue that DOE needs to focus on to enable the sustainability of the remaining 4 concessionaires and any potential new ones.

There are challenges in the FBE process as well. In addition to the capital subsidy that government provides for the non-grid system costs, which comprises of 80% the value of the system, government provides FBE which should be paid out to the concessionaire through the local municipalities. These non-grid solutions are being deployed in deep rural areas where it is highly likely that the municipality responsible for servicing the area is struggling financially. The municipality can sometimes utilize these FBE funds towards other services where the need is deemed to be greater, such as water or sanitation. This action reduces the finances from the concessionaire. The concessionaires partially depends on the FBE funding for survival (DOE, 2013; Lemaire, 2011). Currently, approximately 1 out of 5 municipalities are providing FBE to the concessionaires. Policy does advice on FBE payments, but it is a recommendation, this fee has never been revised since 2002. Of the total South African population, 49% indicated that government should increase the amount of FBE it provides for the poor. The new non-grid model that is under development through DOE should address these critical issues.

Some energy-quality-of-life specialists and academics are of the view that the 50KWh of FBE, although it does make a difference, is not sufficient to improve the quality of life of the indigent (DOE, 2012b) but Salga (2012a) indicates that electrification has improved the quality of life of some communities.

Some of the lessons learned from the experience of other countries are that the role of government in non-grid programmes needs to be dominant. The rural communities will always aspire for grid-connectivity even though they do have access to a non-grid solution. To ensure the success of the non-grid solutions, local authorities must be involved in the planning process, must provide capex subsidization, provide a sustainable business model and both the non-grid installation and maintenance contracts should be between 10 to 15 years (DOE, 2013).

One of the 5 focus areas of The New Household Electrification Strategy by DOE (2013) is to ensure that INEP extends its focus into the non-grid programme. INEP will structure the contract period and the business model for the non-grid programme such that it attracts more private investment. Therefore, a more attractive environment will be created for the municipalities, the communities and private investors pertaining to the solar home systems.

Non-grid programmes in other countries are usually deployed on a small scale, ranging from 50 000 to 100 000 units. The terms of the contracts enable the concessionaires to engage in long-term planning; which ensures financial sustainability for them. Example countries that have done this are Cape Verde and Togo (DOE, 2013).

The non-grid programme was initiated in 1999. Between April 2006 and March 2012, there were very few non-grid installations in South Africa. The New Household Electrification Strategy by DOE (2012b) states that no new concession areas have been allocated since the initial allocations in 2001. If there isn't perpetual rollout of non-grid systems, then it does become quite challenging for the concessionaire to remain financially sustainable. In some instances the concessionaire shareholder (who is normally an international company) has had to intervene by providing the financial assistance required for the business to stay afloat.

5.3.1.2. Perceptions towards electricity service payments in South Africa

South Africa is faced with the problem of non-payment from some of the electricity consumers. The attitude that customers have towards electrification payment is sometimes a challenge for the sustainability of the industry. Most South Africans are willing to pay for the electricity service as long as it is affordable. If electricity was viewed as affordable, in general, non-payment would probably be curtailed.

When the non-grid programme began, the service fee was R58. Over the years this amount has increased. The non-grid customers are currently paying R89 per month for the service. If the municipality does pay FBE to the

concessionaire, then the customer payment can reduce to R41 on average. This is because some municipalities will provide an FBE subsidy to the tune of R48. As indicated by Lemaire (2011), at any point in time, roughly 20% of the non-grid customers are in arrears of more than a single month. According to GNESD (2012), this makes it difficult for the concessionaires to manage their budgets and finances well.

The issue of who should be paying for the installations for non-grid connections still needs to be explored further. This will take into consideration the sufficiency of current subsidies.

5.3.2. Non-grid renewable technology challenges

5.3.2.1. Quality and affordability

In South Africa, the solar home system renewable technologies are being deployed for rural areas that currently do not have access to grid electrification (DOE, 2012a; Salga, 2012b). Customers are expected to pay a deposit for these systems. Thereafter they are expected to pay a monthly service fee. These systems are prepaid systems which are not based on usage but on access. The affordability of these systems for the poor is an issue because not many of them can afford the monthly service fees, let alone the down-payments.

Rural customers tend to perceive non-grid connections as being more expensive and less convenient than grid because grid-connected indigent customers pay no connection fee while for non-grid, a connection fee of R110 is required. Grid-connected indigent communities receive their 50KWh free basic electricity reliably on a monthly basis, whilst for non-grid connections, FBE subsidies are sometimes erratic depending on the municipalities' discretion of paying these out (GNESD, 2012; Lemaire, 2011).

The biggest cost to the SHS systems are the upfront capital costs and the batteries over the lifetime of the system (Lemaire, 2011), which is arguably 20 years and this is pegged on the lifetime of the solar panel. The batteries can be

changed pretty much every 2 to 3 years, at a cost of just over R800, excluding VAT. At this point in time, non-grid solar home system generation technologies are still quite expensive and what counters that is the fact that a lot of these technologies are getting cheaper and cheaper. Looking at the components making up the solar home systems over the last 10 years, these have probably halved in cost (except the batteries). So if that trend continues, which is highly likely, then these technologies should be more affordable. At the moment the capital costs of these systems is covered by government and the concessionaire (DOE, 2012a; GNESD, 2012).

Looking at sustainability, renewable energies would be recommended for rural, poor areas. Solar home systems should become more permanent because they are continually improving in electricity capacity. The ones that are preferred are those with batteries with a long lifetime or a high-cycle life; but unfortunately these come at a cost. In certain areas people generally want better non-grid systems that enable more services, but they are generally not prepared or are not able to pay for them. The Energy Policy (DOE, 1998) does state that the low densities in terms of capacity is one of the disadvantages of these renewable technologies. This is one area where government subsidies can probably be increased to cater for better solutions. This implies though that they must be better in order to satisfy user electrification needs. When the SHS programme started, it enabled 4 lights; a black and white TV, a radio and cellphone charging; but now the SHS systems can power 8 lights, a small color TV, a radio and enable cellphone charging. Therefore there have been improvements in the technology itself. The non-grid technology providers are continually investigating more robust and affordable solutions so that the technological choices are such that less maintenance is required. The specifications for the non-grid technology solutions and the standards are in the South African National Standards (the previous SABS) as part of the NRS052 specifications.

It is a sad reality that some for some of these systems their lifetime is constrained or cut short solely based on the first instance of a breakdown. Sometimes the communities have no means or they don’t know how to repair these systems.

By January 2014, the Nura concessionaire had around 20 000 operational non-grid technology units.

5.3.2.2. Other Renewable Energy Sources

South Africa is a country rich in renewable energy sources such as the sun, wind and water (Waindi & Khalid, 2011; Yumkella, 2013). Although the installation of solar home systems for the poor is a good start, more needs to be done going forward to leverage the other renewable energy sources so that South Africa can catch up with other developing countries in this area. The New Household Electrification Strategy entails the installation of 90% grid connections and 10% non-grid connections for areas where it is more economically and financially feasible to do so (DOE, 2013). Therefore it is imperative that the streamlining and the enhancement, where possible, of the non-grid technologies is prioritized by government.

The need to investigate the wide-spread deployment of mini-grid systems was a recurring theme in the findings. Mini-grid systems are currently not a feasible alternative for South Africa because the installation of a mini-grid in a small rural area can cater for the electricity needs of a few, a 100 or maybe 200 households, which often does not make financial sense. When the deployment of mini-grid systems was piloted in South Africa, certain challenges were experienced. The security of these systems was not sufficient. Theft was not uncommon. Equipment that is worth millions of Rand is not easy to replace if incidents of theft keep recurring.

Mini-grid systems have been implemented in Nepal, which is a developing country (Chaurey et al., 2012). South Africa can utilize such case studies to benchmark against other countries in order to enable mini-grid in South Africa.

About 22% of the South African population indicated that government should focus more on subsidizing renewable energy sources (DOE, 2012b). There are other renewable solutions which are already economically viable, like wind energy, but the deployment thereof depends on the suitability of the environment for such technologies.

5.3.2.3. Theft, misuse and vandalism of the non-grid technologies

Customers sometimes misuse the batteries from the non-grid systems. They use them for their cars and for other uses, and thereafter they want to claim 2 or 3 batteries in one year. If the system is running effectively the batteries can last up to 5-plus years. Although most of the non-grid installations have been a success in the 2 provinces where South Africa has the biggest backlogs, which are the Eastern Cape and KwaZulu Natal, there are instances where these non-grid technologies have failed completely due to misuse.

There are instances where hundreds of millions of Rand of non-grid technology equipment are not being used due to a number of reasons. Sometimes the service provider is struggling financially to maintain the system. In some instances, communities attempt to utilize the systems for purposes for which they were not intended, such as for the utilization of big-screen color TVs that have high consumption requirements. These devices quickly use up all the available energy.

Non-grid systems tend to be viewed as an inferior technology. This is highlighted by DOE (2013). Some communities have a tendency to reject these systems because it does not make sense to them why a farm that is a short distance away has grid connection whilst they are expected to settle for non-grid electricity solutions, which are sometimes not viewed as electricity but as a form of power storage. There is also the issue is reliability of the solar home systems in that electricity is not always available when the sun is not shining. This limited availability characteristic of these technologies is also highlighted in the Energy Policy (DOE, 1998).

5.3.3. Poverty-alleviation through renewable technologies

5.3.3.1. Local capacity building and job creation

When it comes to rural areas, deep rural areas where the closest developed areas are at a relatively great distance, the technical expertise to support non-grid installations is mostly non-existent. Therefore system maintenance

becomes an issue should a fault occur. Ideally, capacity should be built or developed locally to enable system maintenance. The local youth can form a maintenance group or a cooperative that can attend to basic maintenance problems whilst the major problems are referred to the supplier or the distributor. This can alleviate the strain from entities like the municipalities and the concessionaires, enabling them to focus on other pressing matters. Electrification is an enabler or contributor to job creation (GNESD, 2012).

Therefore, the infrastructure needs to be put in place so that after the installations have occurred, there can be places where replacement parts, such as replacement batteries, can be easily available.

The Nura concessionaire company utilizes local contractors for the deployment of the non-grid systems. Nura contractors do the maintenance work themselves to ensure quality. This ensures that complaints or resistance does not occur when the monthly service fees have to be paid by the customers. This aligns to the research by Lemaire (2011) that the concessionaires are responsible for the maintenance of these systems.

Through entrepreneurship, other cooperatives can be formed to fetch wood, water, etc., as a service to the community so that communities have more time to focus on other developmental activities. A great potential exists in cooperatives for the concessionaire areas. This can make a huge difference economically and socially for the unemployed.

5.3.3.2. Value of non-grid systems

Non-grid generation technologies do add value as they bring modern technology to the poor, replacing old energy carriers such as candles, coal and even animal dung; so this technology brings tremendous relief. Through non-grid technologies, certain services like light, access to information, cellphone charging, access to entertainment through TV/radio and so forth are enabled. There are a number of households that utilize candles for lighting where their lighting expenditure could be less per month if they utilized non-grid technology solutions. Telecommunications is enabled through this technology as well, the cheapest place one can charge a cellphone will cost around R5, sometimes

R10. Non-grid technologies therefore enable services such as cellphone charging at a much cheaper cost.

Some non-grid concessionaires such as Nura have been involved in community upliftment programmes such as the container-project that was funded by the company shareholders. The programme entails availing a container which is partitioned into different sections. Already entrenched entrepreneurs who need electricity and a place to work utilize any one of those sections or spaces. If there aren't enough entrepreneurs in that rural area, the programme will attempt to stimulate a certain level of entrepreneurship in the community. Through these non-grid solutions, some people have managed to set up grocery/tuck shops and the like in remote areas where lighting has enabled their operations. So both the formal and informal entrepreneurs in rural areas benefit from these non-grid technologies.

The success of the non-grid solutions is measured by the levels of utilization (Chaurey et al., 2012). The concessionaires utilize energy management systems to obtain utilization statistics per household. Additionally, another measure that is recurring in the findings is the value that such utilization brings to the communities. These systems are changing people's lives. A lot of the Nura concessionaire employees come from the various communities where the non-grid systems have been deployed and to-date, the Nura employees own 20% of the company collectively. These employees have a vested interest in the success of the company which will then most likely decrease the occurrences of vandalism, theft and misuse of these systems.

The non-grid systems have so far been relatively successful in South Africa. Despite the challenges, over 65 000 of these systems have been installed (Madzhie, 2013) and the majority of them, approximately 80%, are operational.

The non-grid technologies are normally removed from areas where grid is encroaching. These systems are then installed elsewhere where they are needed. There has been a number of instances where customers don't want to release these non-grid systems, even with the advent of grid, because they view the SHS as a backup. These customers are willing to pay for the additional

costs of non-grid solutions in addition to grid. This view contrasts with that of GNESD (2012) that since grid is preferred by communities over non-grid, the monthly payments made to the concessionaires are discontinued when customers acquire grid GNESD (2012), It is not uncommon to find customers that that have access to both grid and non-grid systems.

Where the systems are being utilized, these are being used optimally in terms of the services for which they were originally intended, which are lighting, media and telecommunications.

The KES concessionaire has a consultancy company in Cape Town that does surveys for it in order to gauge customer-satisfaction with these systems. This company will then provide feedback to the KES shareholders. Feedback suggests that customers are generally satisfied with the systems as an interim measure although they would generally prefer for more services to be enabled, such as heating.

Learners also benefit from an educational point of view through the availability of lighting.

5.3.4. Non-grid technology impact on stakeholders

5.3.4.1. Customer Education

End-user or community education is imperative in the deployment of the SHS systems. The issue of the non-grid systems being misused or vandalized can be addressed through user education which DOE, the municipalities, local government and other stakeholders are busy with. This includes educating users about the fact that solar home systems, although limited, are a good source of electricity where the grid alternative is not yet available.

People tend to think that if they accept solar home systems then they will never receive grid. Education in this respect is important so that communities are made aware that non-grid is a temporary solution while grid is not available and that when grid arrives the solar home systems will be removed.

Non-grid technologies offer value that needs to be sold. Communities will normally be accustomed to and be comfortable with candles, paraffin, gas, etc., therefore they will sometimes resist non-grid systems (Thom, 2000). The human spirit does not like change; so there is a need to sell these clean technologies to these communities through education.

5.3.4.2. Multiple Fuel Use

There are many households with access to electricity that are using other sources of energy (Thom, 2000). This is a common uniqueness in South Africa. The reasons for this differ. They can be due to the increasing poverty levels in the country. Some poor households can't afford to buy electricity (Cook, 2011; DOE, 2012a); they would rather utilize old reliable energy means such as wood, paraffin and so forth. Approximately 26% of the South African population would rather utilize other sources of energy in addition to electricity due to issues of affordability; this trend is higher in traditional rural areas or in households with a low living standards measure (DOE, 2012b).

Another issue is culture. Culturally it is easier for these communities to cook using for instance, paraffin and in this instance the influencing factor is not necessarily the affordability of the energy supply (Thom, 2000).

As part of the non-grid concessionaire contract, the concessionaires must avail energy stores which are local to their area of operation. These stores should provision other energy products such as liquid petroleum gas (LPG), cook-stoves, etc. (DOE, 2012a; GNESD, 2012). This is opening up multiple fuel-use. When customers visit the stores to pay for the service fee, they can also purchase other fuel-sources.

The KES concessionaire attempted to market the efficient cook-stoves, but the uptake was not good. This links back to the research by Chaurey et al. (2012) which talks about a number of countries refusing to take up cook stoves, except China and Cambodia, because cook-stoves for these countries meant a culture change; a proper needs-analysis from these countries had not been done.

The non-grid concessionaires will usually have one or two energy stores per municipality. In KZN, KES currently has 3 energy stores and there are plans to open another 2. In the Eastern Cape there are currently 4 stores and KES is planning to open 1 more.

Due to the benefits of the non-grid electrification programme, in the period between 2001 and 2011, consumption levels of paraffin (kerosene) have reduced. This aligns to the information from the Census 2011 report (Statistics South Africa, 2012).Coal consumption in households has also decreased. Multiple fuel-use can never be completely eradicated but the levels can be reduced through alternatives such as SHS systems. It is worthwhile for all households, not just the poor, to consider an energy mix that is energy-efficient. Choice is a good thing; people need to begin to appreciate energy, including electricity in its different guises.

Looking at energy in general, the best-for-use energy source needs to be utilized each time. Even if households have access to electrification, they must consider other energy sources which might be a bit more efficient than electricity in certain situations, such as LPG for example. Therefore, co-existence of these technologies is recommended. Government is encouraging the increase in LPG usage because it is a cleaner energy source. LPG might have a big role to play, even with the advent of grid. The Nura concessionaire company views itself as an integrated energy utility that provides of a wide variety of energy products, thereby enabling the use of multiple energy sources.

Policies such as the Free Basic Alternative Energy (FBAE) promote multiple fuel-use as well (DOE, 2006). The Energy Policy (DOE, 1998) had indicated that the multiple fuel-use trend would decrease over time. This pertained to the energy sources that are harmful to the health of individuals or have an adverse impact to the environment. A new form of multiple fuel-use is taking shape where households want choice between grid electrification, renewable non-grid electrification, LPG and so forth.

The end-goal of DOE is for the whole of South Africa to be a grid-electrified nation, but in the meantime, the non-grid solutions are being rolled out to

provide a minimum dignified service level connection to areas where grid currently cannot reach.

5.3.4.3. Stakeholder Collaboration

When there are plans to install non-grid systems for a community, there are community awareness initiatives that occur. The planning phase will normally involve the communities which then presents them with an opportunity to influence the process. Prior to rollout, the communities are involved again as they are targeted for the marketing campaigns. The situation in South Africa then differs from the findings by Chaurey et al. (2012) that sometimes communities are not sufficiently involved in the planning process for these systems. However, there are situations in South Africa where sufficient community engagement is lacking and the process can be improved.

In certain situations, communities will utilize the electrification project platform to raise other issues that they might not be content with. Some communities will even view the electrification service as a lower priority compared to other services such as water and sanitation. Therefore, proper engagement and planning with the communities needs to occur so that there's an agreement on how all these services will be delivered.

Politics can play a huge role in the non-grid technology process. Some politicians who view non-grid as an inferior technology will discourage the deployment of these systems in their areas (DOE, 2013).

In KwaZulu Natal, the KES concessionaire has 16 000 active installations out of a total of 23 000 while the Nura concessionaire has 20 000 operational units to-date. The KES concessionaire was awarded a contract that is funded by the German Development Bank, KfW, in the Eastern Cape (DOE, 2012a). KES operates in 2 districts in the area. The intention there was to install SHS systems for 30 000 households in those areas. The work by KES was supposed to have commenced in 2006 and finished in 2011; unfortunately, due to some delays, the work only commenced in 2008 and the 2011 deadline could not be achieved. These delays were caused by issues like lack of buy-in from the municipalities or from the communities. Part of the problem is that people were

expecting a system that does everything; including cooking, refrigeration and ironing.

5.3.5. Conclusion

DOE through INEP is in the process of deploying renewable energy systems for the poor in hard-to-reach rural areas where non-grid is currently not feasible. The focus is on the installation of solar home systems (SHS systems). These systems are not meant to provide the full suite of electricity services, but a limited number of services in the interim, which are lighting, access to media and telecommunications. There are a number of challenges that need to be addressed, such as the financial sustainability of the concessionaire business model.

The financial sustainability of the concessionaires is impacted by issues of FBE payments from the municipalities which are not tightly regulated. Not all the customers pay the monthly service fees and some of the communities misuse and vandalize these non-grid technologies. DOE is working on an enhanced model for the non-grid programme that should potentially resolve these issues. Through user education, customers will be made to understand why it is imperative that they accept these non-grid technologies in the meantime. They need to be made aware of when they to expect to be grid connected (through integrated planning) and must take proper care of the non-grid systems in the meantime. Although efforts are in progress to increase customer awareness, these need to be elevated. The communities need to be engaged early on in the electrification process as they might have a different view as to which services need to be delivered first in conjunction with electricity.

The issue of customer service fee payments is an important one as well. Customers need to be made aware that if there is non-payment, these systems can be repossessed, which has financial implications both to the customer and the concessionaire. Secondly, they need to be aware that the financial sustainability of the concessionaires partly depends on them paying the service fees and this benefits them because they will continue to get service.

If the FBE process can be improved and more controlled, the concessionaires would get their payments on time from municipalities and this would increase their financial sustainability. Customers would not be inconvenienced by situations where the cost of their service-fees is erratic based on whether the municipalities made the FBE payments or not.

5.4 Discussion pertaining to Proposition 2

5.4.1. South Africa's electrification programme status

5.4.2.1. Electrification programme achievements

The South African electrification programme is viewed as one the most successful electrification programmes not only in Africa but globally (Bekker et al., 2008). This is in terms of the number of connections that have been achieved since 1994 and the progress to-date. Ever since the post-apartheid government took over the programme, Eskom has managed to perform well in terms of the connection targets that have been set each year. Since 1994, approximately 5.4 million connections have been achieved. Although South Africa did not manage to reach the universal access target by 2012, the country's performance has been good compared to the initial target that was set by government through the Reconstruction and Development Programme (RDP). The initial target was 2.4million and South Africa has doubled this initial target, albeit over a longer period.

The target of achieving universal access by 2012 was an ambitious and an onerous one from the start. It is highly probable that had the EDI been formed as was originally intended, South Africa would have been at a better percentage than the 87% (DOE, 2012b) that the country has so far achieved but would still have not been able to reach the universal access target because of the challenges of electrifying rural areas and the financial sustainability of some of the electrification projects.

Electrification in South Africa is now at 87% (DOE, 2012b), which is above-average when compared to most African countries (Pillot et al., 2013). If

government had not pushed for the electrification programme the way that it did, there is a probability that the targets to-date would not have been achieved. Most of the work pertaining to the low-hanging fruits (in urban areas) has already been done, what remains are the rural and informal settlement connections.

The fee-for-service model by DOE to install SHS systems in remote, rural areas was selected as it is ideal for areas where there is no nearby banking facilities, as also mentioned in the literature. This is the prevalent situation for some rural areas in South Africa.

5.4.2.2. Electrification backlogs in South Africa

The electrification backlog currently is 3.4 million. Approximately 3.1 million formal households are to receive grid connections and 300 000 formal households are to receive non-grid connections (DOE, 2013). This rollout of 300 000 units conflicts with the view by Gaunt (2004) that renewable or non-grid technologies should be discounted in the large-scale proliferation of electricity access.

The new target for electrification access in South Africa by DOE is 92% for 2014; which is quite ambitious. Madzhie (2013) indicates that this target is being revised. Electrification in itself is a difficult undertaking and that should be taken into consideration. The new target for universal access in South Africa is 2025 (DOE, 2013; RSA, 2013; Statistics South Africa, 2013).

INEP had to take over the responsibility of electrifying new households in addition to its responsibility of addressing the backlogs. This was due to the EDI which has been inefficient over the past 10 years or so (Madzhie, 2013; Salga, 2014).

The current rate of electrification is such that INEP is not able to provide the required level of focus to the hard to-reach rural areas because electrification is still revolving around grid connections as households in urban and peri-urban areas keep increasing. There needs to be a balance so that a greater emphasis is placed on non-grid connections as well. INEP is not denting the backlog per

se; it is merely keeping it constant. Energy access to rural areas, especially the remote ones which are far from the grid, needs to be addressed differently from urban areas and peri-urban areas.

Therefore, the electrification backlog has kept on piling up over the years. Sometimes in attempts to curtail the backlog, DOE or the municipalities will contract Eskom to do the work. The challenges to electrification for the poor in South Africa can only be understood if taken in the context of the whole electricity value chain looked at holistically from generation to distribution.

5.4.2.2. The Municipality challenges

The municipal contracting processes are not efficient. These can result not only in delays to the electrification work but also in increased costs due to inefficiencies. This is not to say that Eskom is 100% efficient, but the municipality performance can do with some major improvements. This is sometimes caused by a flawed IDP which can lead to incorrect scoping of work. A flawed IDP can sometimes be the result of a lack of integrated planning by the electrification role players.

The municipalities are faced with difficult procurement processes. It normally takes a municipality a long time, approximately 9 months, to get a contractor on board. This will normally imply that municipalities then have only have 3 months to deliver, as delivery is expected within the financial year (financial cycle of 12 months). Staff turnover is also high (Salga, 2012a), particularly at senior management level.

Additionally, internal municipal processes can be quite politicized. Processes will be put in place to prevent external influence or any fraudulent activities by enforcing governance or auditing processes; unfortunately these steps sometimes slow down progress.

Municipalities are faced with a resource problem with regards to man-power, which includes lack of skilled resources. This raises a situation where there is a gap in terms of skilled officials that can produce quality work. Therefore the

challenge of electrifying deep-rural, low-income areas and the huge backlogs faced become daunting looking at the resource problem.

In some instances, managers who manage large, higher-revenue municipalities where there is less stress will sometimes earn more than managers who are at the same level, but who are managing smaller, difficult, lower-revenue municipalities. This has a ripple effect in that good resources will not be attracted to the smaller municipalities where they are needed the most; the opposite is also true.

Rural municipalities are not geared enough to take forward the task of electrification, at this point in time. There's a lack of capacity. In some municipalities there are resources that perform dual, if not more roles. It's an extensive scope for a single individual. The resources working towards electrification need to be increased drastically nation-wide if the universal access goal of 2025 is to be reached.

In some instances, changes in political leadership can cause delays. For example, a tender can be issued for design-work to be done for an area. If a political change occurs during that time, this might cause a disturbance to the already on-going electrification work. The tender process can sometimes be halted due to different reasons such as the de-prioritization of an area, the need to modify the design or the need to change the electrification technology choice.

5.4.2. Funding towards the electrification programme

5.4.2.1. Government funding

The amount of money that has been allocated by government towards electrification in South Africa is amongst the highest in the world. For the financial cycle 2013/14, over R4billion was allocated towards electrification. Government funding towards electrification is actually stagnant now, it is not increasing, and the adjustments made are inflation-related. For distributors, this implies that they can electrify as many as they did the previous year; therefore there isn't any acceleration in the rate of electrification. Therefore, the backlog

of 3.4million households is not being addressed and it might actually be increasing as the input costs (such as hardware costs) towards electricity continue to escalate. Looking at the last 5 years the distribution hardware costs (input costs) have increased by between 15% and 18% per annum.

Eskom is getting paid real costs for electrification while the municipalities are paid a flat electrification connection rate. Eskom also does most of the backbone and design work. To obtain enough funding from DOE, the municipalities are expected to provide accurate information on their IDPs as these provide information pertaining to the number of households to be electrified, amongst other things.

Africa, not necessarily just South Africa, relies on outsiders to finance and invest in energy projects and it is about time internal resources are made available for such initiatives.

The government FBE subsidy does make a difference in the electrification process for the poor. However, concessionaires like Nura and KES cannot survive on government subsidies alone. The government FBE payment process to the concessionaires through the municipalities is currently inefficient.

5.4.2.2. Public/Private Partnerships

For the Nura concessionaire, shareholder funding has assisted greatly in keeping the company afloat. For instance, between 2006 and 2010, there was no funding for non-grid forthcoming from government and in 2008 funding was received from the concessionaire shareholder which enabled the company to install 2000 solar home systems that had been repossessed from the non-paying customers.

Nura indicates that the issue of service-delivery should not be the responsibility of government only. Public/private partnerships are imperative in order to reach the deep rural areas with SHS systems (DOE, 2012a). Additionally, there has recently been a growth in the involvement of local private companies in the electrification process. The conditions of the PPP partnerships need to be clear, in terms of job-creation, localization, etc. The monitoring of the deployment of

the renewable systems needs to be in place to increase the likelihood of success (Hailu, 2012).

5.4.3. Approach to energy poverty alleviation in Africa

Africa's focus, through organizations like NEPAD, is to enable energy or electrification access not only in South Africa but the whole of Africa through the prioritization of infrastructure energy projects. Additionally, Africa has to be revolutionary in a number of aspects such as the approach, the source of energy (i.e. renewable, biomass), in mobilizing resources and in the creation of a conducive environment for investment towards energy in order to reduce energy poverty in Africa. Programmes such as the Sustainable Energy for All (SE4All) also have a focus on the deployment of renewable energy sources in developing countries (United Nations, 2013).

5.4.4. Government monitoring and integrated planning

GNESD (2012) indicated that it is not clear what other monitoring the Department of Energy does besides monitoring the number of non-grid systems installed. The New Household Electrification Strategy stipulates that DOE (INEP) currently reports on delays in projects, not necessarily on the root-causes of issues or on progress verification. This is due to limited INEP resources. This aligns to what Zomers (2003) stated that the enforcing of regulation in electrification programmes is often limited due to insufficient human resources. DOE is working on resolving this situation (DOE, 2013).

DOE, with the assistance of Eskom, the municipalities and other role-players, decide on which areas should be grid-electrified and which ones should get non-grid connected. Different factors are taken into consideration, such as the cost to connect and the planned commercial activities for that area, for example.

The lack of integrated planning amongst the different stakeholders in the non-grid electrification process is a challenge. The concessionaires depend on the municipalities to share their IDP plans, which sometimes does not occur

timeously. The concessionaires rely on the municipalities to give direction in terms of the non-grid areas to focus on.

In the process of refining the electrification plan, DOE and INEP should also focus on enabling essential services in areas that get non-grid electrified, such as the schools, clinics and the police stations.

The New Household Electrification Strategy will ensure the creation of a regional master plan (DOE, 2013) which will entail a coordinated approach in deciding which areas will be the responsibility of Eskom, the municipalities or the concessionaires and the order in which the different areas will be electrified. Countries that have utilized master planning successfully include Brazil, Mexico and Peru.

The non-grid concessionaires will sometimes attempt to avoid situations where grid and non-grid connections occur simultaneously in the same area by investing time and funds towards identifying non-risk areas where Eskom is not likely to encroach anytime soon. This takes up a lot of the concessionaire's time. Through integrated planning, this type of information should be readily available to all stakeholders. The Energy Policy (DOE, 1998) does state that due to the many stakeholders that play a role in the energy sector, complex relationships need to be managed. Additionally, this scenario does not adhere to DOE (2012a) which indicated that there should be proper consultation amongst the involved stakeholders before non-grid installations commence, which apparently is not always the case.

Previously, there have been instances where there were unforeseen clashes between Eskom and the concessionaires with regards to grid and non-grid installations. The negotiations with all the relevant stakeholders for the installation of non-grid solutions can take years to finalize with the communities, the municipality and the concessionaires. When such clashes occur, the pertinent area can experience a set-back with regards to its electrification process. This can sometimes confuse communities to the point where they decide they no longer want the non-grid technology; not knowing that grid might take a few more months or even years to be implemented. According to the

New Household Electrification Strategy by DOE (2013), lack of planning and coordination is one of the bigger challenges faced by the non-grid programme.

Fortunately these types of issues have been resolved through a cabinet resolution that was taken mid-2013. Such issues have delayed the non-grid process somewhat.

5.4.5. Global outlook to electrification

5.4.5.1. Benchmarking against other countries

DOE and other entities like Eskom, does regular benchmarking against countries which have similar conditional issues to South Africa; such as India, Bangladesh, Vietnam, South America, Peru and Brazil. South Africa also engages with different professional entities and inter-governmental groups to investigate other models that can be adopted. The country is also playing leading roles in other initiatives such as the SE4All by the UN (United Nations, 2013); therefore there is a level of exchange occurring with other countries.

Other countries that are doing well with their electrification programmes have adopted models that are different to South Africa and their electricity supply industries look different. Most of them have privatized their electrification business within the energy industry.

Although there are a number of different sectors that private investors get attracted to in developing countries, electrification of poor rural communities is not one of them (Zomers, 2003). This type of business is not viewed as financially sustainable. In South Africa, for example, payment levels and the consumption levels of poor communities are quite low. Only with a large and varied customer base can financial sustainability be achieved as that enables cross-subsidization. Private companies that will invest in the electricity sector in rural areas usually require grants from government to be sustainable, otherwise there is no profitability.

In most instances, electrification will not make financial sense; and this is a worldwide phenomenon. It is a money-loss business but a very important social component that must be done.

In other countries, the process of electrification is handled by external parties who develop master plans to be implemented to achieve electrification. The funders for these electrification projects are sometimes philanthropists who normally want their consultants to assist in implementing the work. Sometimes the consultants are not intimate with the country as they might not understand the culture. Due to this, once the consultants leave, some of these electrification projects become dormant.

5.4.5.2. Energy Initiatives impacting the African continent

5.4.5.2.1. Global projects

The Sustainable Energy for All (SE4All) initiative by the United Nations (UN) is aiming for energy access for all by 2030, which is quite ambitious. Eskom is spear-heading this initiative, alongside the American utility, Duke Energy (United Nations, 2013). The New Partnership for Africa Development (NEPAD) organization joined hands with the United Nations Development Programme (UNDP) in 2013 to form what is called Africa's response to SE4All which was presented to the United Nations by the CEO of NEPAD.

The position was that Africa welcomes the SE4All initiative and that the focus areas for Africa need to be prioritized. This is because Africans know what needs to be done in Africa and the gaps that need to be filled. NEPAD has developed an action plan which will help African governments to develop action plans to assist them in fulfilling the objectives of the Se4All programme.

NEPAD is also assisting governments to develop investment prospectus. This will be provided to the investors thereby providing them with information on how their interests will be taken care of should they decide to invest in Africa.

5.4.5.2.2. Africa projects

The South African Energy Policy (DOE, 1998) and the mandate of NEPAD do acknowledge the importance of renewable energy sources in filling the electrification or energy source gaps. Renewable energy includes mini/micro hydro, large hydro power-generation, solar, wind, biogas and biomass, to name a few. NEPAD is busy with a number of initiatives which are aimed at enabling renewable energy resources in Africa. These are the PIDA programme, the All-Africa Renewable Energy programme and the Sustainable bio-energy programme.

The Programme for Infrastructure Development in Africa (PIDA programme) is aimed at infrastructure development in Africa. This is a framework which will ensure that Africa will have achieved 60% of energy access on average by 2040. Some countries are currently above 95% while some are below, the objective is for the whole of Africa is to reach 60%, not just for electricity but for any energy source. This target of 60% access by 2040 conflicts with the Sustainable Energy for All programme target by the UN which stipulates that everyone will have energy access by 2030 (United Nations, 2013).

The All-Africa renewable energy programme aims to work with African countries to assist them with their renewable energy projects in order to ensure progress through the provisioning of the relevant expertise. This programme will also assist African countries on how to position themselves best to attract funding. The bio-energy programme focuses on promoting the sustainable use of bio-energy which aims to strike a balance between food and energy access for the poor. In South Africa, most South Africans support renewable energy sources, such as wind, water and solar (DOE, 2012b). Rural area electrification has mostly focused on solar energy but other renewable energy sources for these areas need to be focused on as well.

The sustainability of these renewable energy programmes by NEPAD alleviates pressure from governments from having to provide huge capital investments into such programmes. In South Africa, DOE is planning to increase the annual electrification budget to enable universal access by 2025 (DOE, 2013). Over time, investing in renewable energy can potentially reduce the budget

government has to allocate towards energy projects. Vast renewable energy resources are available in the African continent; the utilization thereof will cut massively on fossil-fuel use. In the SADC region alone, countries like South Africa lead in the utilization of renewable energy, there's also Namibia, Botswana, who are also making inroads.

Before the advent of bio-ethanol in Brazil, there was high unemployment levels, food poverty and the country was importing a lot of fuel. With the introduction of sugar plantations and bio-ethanol production, food security and the number of jobs have increased drastically whilst the fuel-imports have reduced. NEPAD is partnering with Brazil in order to impart their bio-ethanol expertise to the African continent.

5.4.8. Conclusion

There is an electrification backlog of 3.4 million households that the electrification programme must still address in South Africa. Better integrated planning and more attraction of private investment are imperative in ensuring that the backlogs are addressed and that the new universal target of 2025 is reached.

The New Household Electrification Strategy by DOE (2013) aims to assist municipalities in areas where they are experiencing challenges such as the insufficient man-power issues. Additionally, DOE plans to request for an increase in the electrification budget of an additional R500 million annually. With integrated planning, the availability of resources and proper monitoring and reporting, the 2025 universal access target should be possible.

5.5 Conclusion

The South African electrification programme still has a while to go before universal access to electricity can be achieved, which is targeted for 2025. A lot of preparatory work needs to be done to ensure the success of this target, as

opposed to the 2012 target which was not realized due to a number of contributing factors.

INEP as the custodian of this programme needs to ensure that there are improvements in integrated planning and stakeholder collaboration in order to alleviate some of the issues that are currently being experienced. Additionally proper resourcing and monitoring mechanisms will be key. If the electrification programme is running smoothly and the proper policies and processes are in place, that it will be easier to attract private funding into the sector as investors will have the assurance that their interests will be well taken care of.

All the entities that play a role in the electrification of poor communities play a vital and important role. These are DOE (INEP), Eskom, the municipalities, the fee-for-service concessionaires and so forth. Therefore it is important that all these stakeholders are on board and are well-equipped to deliver on the universal access mandate.

The additional funding that DOE aims to obtain to enhance the funding for the programme will make a difference.

The involvement of the rural communities in the non-grid electrification process cannot be over-emphasized. INEP will have to raise more awareness within the communities with regards to the benefits of the non-grid systems so that they can be integrated seamlessly into the communities. This should curtail negative sentiment amongst communities and the municipalities pertaining to the solar home systems. The quality of the systems to be installed is crucial as well because customers will not pay for systems that are not working. Customers have also been requesting better-capacity non-grid systems that will enable additional services such as cooking and refrigeration for example. As the current fee-for-service programme matures, INEP should use the lessons learnt to make the process better and perhaps in the future it should be possible to deploy better technologies for these communities.

Customers need to be educated that accepting an SHS system does not imply that they will not be grid connected later; they need to understand that rejection of an SHS system will not necessarily fast-track grid availability because INEP

is working on an integrated national plan in terms of which areas to electrify, with which technology and when. These awareness campaigns are on-going but they need to be more wide-spread.

Additionally, communities might have a different view as to which service would like to have delivered first, in some instances water and sanitation is rated more highly than electricity.

Government funding towards the non-grid programmes is currently not adequate. The fact that municipalities are not paying the FBE to the concessionaires regularly is not helping either. Lack of FBE payment is an inconvenience to the customers as well. Government needs to focus on expediting the process of awarding contracts to fee-for-service concessionaires and streamline the fee-for-service FBE process.

Customers need to be encouraged to pay the service fees on a regular basis to avoid instances where the SHS systems are repossessed and to enable the concessionaires to be financially sustainable.

DOE realized that grid electrification might take some time to reach certain rural areas due to issues such as lack of profitability or the rough terrain in some of these areas. Therefore, the solar home system programme was initiated to ensure that in the meantime, the poor rural communities are able to experience social and economic development through obtaining services such as lighting, media access and telecommunications that these renewable technologies provide. The findings of this research are that communities mostly do identify and recognize the value of these systems as an interim measure, while they await the deployment of grid in their areas. The communities have also requested that these systems be enhanced to provide more services like cooking if possible.

6. CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter discusses the conclusions with regards to the context, the background and the literature review of this research. Recommendations are then provided to the stakeholders that were identified to be the beneficiaries of this research who are government, Eskom, the municipalities, the fee-for-service concessionaires, the private investors, the rural end-user communities, the unemployed youth and the entrepreneurs or NGOs

6.2 Conclusions of the study

The bulk of the electrification backlogs in South Africa remain in the poor rural areas. The rate of progress is slow compared to when the electrification programme commenced. There are challenges that need to be dealt with which include increasing the efficiency of the Electricity Distribution Industry, addressing the challenges in the non-grid renewable energy programme and attracting investment towards rural electrification projects.

South Africa has vast renewable energy resources which the country has not even begun to tap into. These need to be piloted in the country in a revolutionary way. Continuing with the “business as usual” approach will not work in electrifying the remaining rural areas that are still un-electrified (Zomers, 2003). The deployment of mini-grid systems is currently not recommended by DOE due to a number of challenges that were experienced when these systems were tested in South Africa. One of the challenges was the security of the equipment. This equipment is quite expensive and it is impossible to keep on replacing it as theft incidents keep occurring. South Africa can also learn from other developing countries that have deployed mini-grid, such as Nepal, on how this technology can best be implemented.

There are on-going investigations to acquire better and more affordable renewable energy technology solutions for the poor.

There are still deficiencies to the integrated planning that is taking place amongst the different stakeholders that are responsible for providing non-grid electrification for the poor. All stakeholders must collaborate closely if the electrification programmes are to succeed (Zomers, 2003). The sharing of information needs to occur timeously to avoid any complexities. In providing non-grid electrification for poor communities, essential services such as clinics and police stations should be electrified as well.

Initial electrification needs are satisfied by these SHS systems, but over time as the communities develop, demand is likely to grow. This is the expected result since socio-economic development is one of the reasons why electricity or energy-for-all is essential. Therefore government needs to have a policy that addresses this growth in a phased approach.

Due to challenges mentioned to non-grid electrification, INEP is currently overwhelmed with the accountability of addressing backlog connections in addition to new household connections. The backlogs are not reducing at the required rate. DOE is planning to request for an increase in the electrification budget, this should enable INEP to achieve the goals of universal access by 2025. A lot of the focus is still on grid connections; new households are always being built and rural electrification has therefore had to take a back-sit. INEP needs to give greater attention to renewable energy electrification of rural areas since 300 000 connections are planned for 2025 whilst the country currently sits at approximately 65 000 SHS connections. This is imperative as it is part of the universal access plan.

The delays in non-grid installations in rural areas are sometimes caused by a change in political leadership, especially if technology choices are different from those of the out-going leadership. Such transitions need to be enabled to occur smoothly.

Some of the municipalities require assistance from government with regards to resources (especially man-power) and the relevant expertise to streamline their

processes. The issue of salary-discrepancies between high and low-revenue generating municipalities needs to be addressed as well. This will ensure that municipalities are able to attract the expertise and skills they require the most. The same quality deliverables are expected from the municipalities regardless of the magnitude or profitability of the area they are responsible for. The resource challenges forces some roles within the municipalities to play dual roles. This needs to be addressed as soon as possible.

Privatization of the electrification industry in South Africa has been recommended as one of the ways in which government can introduce efficiencies into the sector. This is the model followed mostly by international communities.

International investors are sometimes reluctant to invest in electrification programmes such as the non-grid systems for the poor in rural areas because of the perceived lack of profitability. Government needs to enhance the current business model so that it is more attractive to both local and international investors by streamlining the current processes. Government subsidies have a huge role to play in the process.

In most instances, electrification is not a business that makes financial sense; it is normally an important social component in any country that will only make sense if there exists a broad-based customer base where cross-subsidization can occur.

South Africa should continue to leverage the expertise from the SE4All programme by the UN and the NEPAD renewable energy programmes to fast-track the deployment of renewable energy in the country. South Africa could learn from Brazil's experience in power production using bio-energy; this has the potential of creating more jobs and reducing fuel imports into the country.

Government needs to fast-track the process of releasing funding to the non-grid concessionaires to increase their financial sustainability and the FBE process between the municipalities and the concessionaires needs to be fast-tracked. The cross-subsidization of refuse removal, water services and other services from electricity sales-revenue by municipalities needs to be relooked by

investigating other revenue sources; this incorporates reviewing FBE (Salga, 2014). Between 2006 and 2012 there were a few non-grid installations for some concessionaires. Concessionaire shareholders had to come in to assist financially.

For a long time African countries have depended on outsiders to assist with electrification programme funding. It's about high time Africa looked internally for resources.

Youth cooperatives should be formed in these concessionaire areas where the youth get trained in basic infrastructure maintenance. This can alleviate some strain from the distributors and create more jobs.

South Africa has a common uniqueness of multiple fuel-use. This is due to a number of reasons such as affordability and cultural preferences. The non-grid concessionaire programme has assisted in the reduction of other fuels such as coal and paraffin, which implies a positive health impact on individuals as well as being friendlier to the environment. Multiple fuel use can never be completely eliminated; it will only increase as communities utilize the best energy source for use. Co-existence is more likely to occur than complete domination by grid. LPG is a cleaner energy source and government is encouraging its use.

Non-grid customers that have recently been grid-connected sometimes don't want to release these non-grid systems. This might indicate a trend where customers prefer different energy sources for different uses. Such a situation where a customer has both grid and non-grid is currently not advisable as there are still households without electricity. Once universal access has been achieved, different energy sources such as grid, renewable energy, LPG, etc., should be available options to households. This should reduce energy costs and curtail the adverse environmental impact.

The success of the non-grid systems is not only measured by utilization but also by the value such utilization brings to communities. These systems are utilized for all the services for which they were intended which are lighting, media and telecommunications. These systems are enablers to better education, businesses and job-creation, amongst other benefits to the rural communities.

The non-grid SHS systems are sometimes viewed as inferior to grid, they get stolen, misused and vandalized. These can get rejected by both communities and political leaders. One of the reasons is that energy from them is not always available as they depend on the availability of the sun. This all links back to training of the communities and other stakeholders about the benefits of these systems and for them to be made aware that grid will still be deployed, in time.

Non-grid customers are mostly satisfied with this technology as they await the advent of grid connections. They do sometimes request that these non-grid systems be enhanced to provide more services like cooking. Enhancement of these systems is something government can look into. Perhaps better systems of a more permanent nature can be installed. The cost of the solar home systems is reducing; therefore better-capacity systems should be more affordable for the poor in the future.

Such electrification programmes require early engagement with the rural communities in order to obtain their buy-in as some of them might rank other services, such as water, as higher in priority than electricity.

Not all the non-grid systems that have been installed are being used. Part of the reason is lack of maintenance. This leads to some customers not paying the monthly service fee. Part of the concessionaires' revenue comes from the service fees that customers pay, proper maintenance has to be done for customers to continue paying the service fees.

South African customers are normally not good in paying for electrification services. This is mainly due to the fact that they view the electrification costs as being too high. This issue needs to be addressed.

6.3 Recommendations

Government

The recommendations to government pertaining to fast-tracking the electrification process for the poor communities is that policy implementation monitoring and enforcement needs to be more stringent (Zomers, 2003). FBE

payment to the fee-for-service concessionaires by the municipalities needs to be improved or the way the funds are transferred to the concessionaires needs to be enhanced to ensure progress.

Government through INEP must ensure that there is clarity amongst all stakeholders in terms of which areas are earmarked for grid and non-grid electrification so that clashes between the utility Eskom and the municipalities/concessionaires do not happen. This entails ensuring that this information is planned and made available timeously.

Government needs to enable a sustainable business model for the concessionaires by ensuring that the awarding of contracts and the releasing of funds to the concessionaires is done on time.

Rural communities need to be educated by government on what government's intention is pertaining to the deployment of the non-grid systems. They need to understand the consequences of misusing these technologies and the impact if they don't pay their service fees. The engagement with the stakeholders needs to occur early in the electrification programme process so that the opinions of the communities can be heard as well.

Although the current stance is that non-grid technologies are interim while grid has not reached certain areas, government needs to investigate the possibility of deploying systems that can enable more services like heating and cooling. This will obviously have a cost impact and it needs to be analysed accordingly. This could potentially imply that newer systems might be more permanent in nature as they offer more capacity.

Job-creation for the local communities, especially the youth, should be encouraged in these fee-for-service contracts. Government should also encourage entrepreneurship in these rural areas through any means possible. Additionally, through these private partnerships with the concessionaires, government can entice communities to participate in the non-grid programmes through provisioning incentives like local scholarships or bursaries for example.

If government policy can include components into the fee-for-service contract which enforces that part of the ownership of the concessionaire company must belong to the rural communities, this will increase the likelihood of these systems succeeding and the communities taking better care of them.

Government needs to assist the municipalities in streamlining their processes in order to introduce efficiencies when they execute the electrification programme processes.

Eskom

Eskom needs closer collaboration with INEP, the municipalities and the concessionaires so that planning is done in an integrated manner and that information is shared timeously.

Private investors

Private investors can do more in monitoring progress of the installations, the utilization and the value these non-grid systems are bringing to the communities.

The maintenance process should also be improved to ensure that customer faults are addressed as soon as possible. This is directly proportional to revenue.

The investors should continually do research that will assist South Africa to deploy the best quality non-grid systems but at an affordable price.

End-user communities

The communities must be involved from the beginning of the electrification programme process so that they can influence how the programme unfolds in their area. This will also assist them to understand the financial and other implications of these systems.

End-user communities need to dedicate time to understand what the non-grid technologies are about and the benefits they will bring and they should discourage misuse and vandalism of these non-grid systems.

The unemployed youth

The youth should mobilize youth groups or cooperatives that can get trained in providing basic maintenance for these non-grid technologies.

The youth can also be entrepreneurial and utilize the opportunities that non-grid electrification brings to focus on other types of businesses.

The Municipalities

Municipalities need to come up with a plan that will ensure that they are provided with funding for other services that go hand-in-hand with electrification, such as water. This is so that they will not need to utilize FBE for purposes other than what it was intended. At the end of the day, all these services are important for the well-being and the quality-of-life of these communities.

There should be more collaboration in planning amongst the municipalities, Eskom, INEP, the communities and the concessionaires because it seems that the success of the fee-for-service scheme depends on these entities working together.

Entrepreneurs/Non-governmental organizations

Entrepreneurs/NGOs should leverage the availability of electrification in rural areas through these non-grid systems by creating more productive businesses as electrification enables longer operational hours in a day.

Entrepreneurs/NGOs can use these opportunities to create other initiatives that will improve the lives of the rural communities such as agricultural projects and hand-crafts.

6.4 Suggestions for further research

Why renewable energy sources can assist with load-curtailment

How energy conservation can be used to reduce energy poverty for the poor in South Africa.

How energy efficiency can be utilized to reduce energy costs for the poor.

Should the Free Basic Alternative Energy subsidy promote only the cleaner energy sources?

How can sustainability be introduced for the non-grid model in developing countries like South Africa?

How can government reduce the rate of service delivery protests through the deployment of non-grid solutions?

Exploration of multiple energy sources to fulfil disparate energy needs within the household.

What community programmes or business initiatives can be pursued in rural communities that are enabled by the availability of non-grid electrification?

Is the success of an electrification business model directly proportional to the level of development in an area, either rural or urban?

Are rural area electrification programmes mostly successful when they are done from a Corporate Social Responsibility or philanthropically point of view where socio-economic benefit as opposed to profitability is the benefit?

What is the right customer-mix that would enable an electricity utility to be financially sustainable and how can this be applied to a whole country so that the whole electricity sector is financially viable?

REFERENCES

Adkins, E. Oppelstrup, K. Modi, V. (2012). 'Rural household energy consumption in the millennium villages in Sub-Saharan Africa', Energy for Sustainable Development, 16 (3), pp. 249-259, 19 March 2014, from http://0-www.sciencedirect.com.innopac.wits.ac.za/science/article/pii/S0973082612000221

Bekker, B., Eberhard, A., Gaunt, T., & Marquard, A. (2008). 'South Africa's rapid electrification programme: Policy, institutional, planning, financing and technical innovations', Energy Policy, 36(8), pp. 3125-3137, 20 October 2013, from http://dx.doi.org/10.1016/j.enpol.2008.04.014

Bazilian, M. Nussbaumer, P. Rogner, H. Brew-Hammondc, A. Foster, V. Pachauri, S. Williams, E. Howells, M. Niyongabo, P. Musaba, L. Ó Gallachóir, B. Radka, M. & Kammend, D.M. (2011). 'Energy access scenarios to 2030 for the power sector in sub-Saharan Africa', Utilities Policy, 20 (1), pp. 1-16, 2 March 2014, from http://0-www.sciencedirect.com.innopac.wits.ac.za/science/article/pii/S0957178711000774

Business Dictionary. (2014). Busines Dictionary Retrieved 12 March, 2014, from http://www.businessdictionary.com/definition/concessionaire.html

Bryman, A. (2012). Social Research methods, (Fourth ed.). New York: Oxford University Press Inc.

Chaurey, A., Krithika, P. R., Palit, D., Rakesh, S., & Sovacool, B. K. (2012). 'New partnerships and business models for facilitating energy access', *Energy Policy, 47 (1)*, pp. 48-55, 20 October 2013, from http://dx.doi.org/10.1016/j.enpol.2012.03.031

Chellan, N. (2012). Understanding Rural Development from an Energy Perspective–Case Study of the Mnweni Rural Village in the Province of KwaZulu-Natal in South Africa Retrieved 21 August, 2013, from

http://led.co.za/document/understanding-rural-development-energy-perspective-case-study-mnweni-rural-village-province

Chow, J.T. (2010). Assessment of Solar Home Systems (SHS) for isolated rural communities in Vanuatu using Project Lifecycle/Sustainability framework. Master's degree report, Michigan Technological University, Michigan.

Cook, P. (2011). 'Infrastructure, rural electrification and development', Energy for Sustainable Development, 15 (3), pp. 304-313, 14 February 2014, from http://0-www.sciencedirect.com.innopac.wits.ac.za/science/article/pii/S0973082611000548

Davidson, O., & Mwakasonda, S. A. (2004). 'Electricity access for the poor: a study of South Africa and Zimbabwe', *Energy for Sustainable Development, 8*(4), pp. 26-40, 06 August 2013, from http://dx.doi.org/10.1016/S0973-0826(08)60511-6

Dekker, J., Nthontho, M., Chowdhury, S., & Chowdhury, S. P. (2012). 'Economic analysis of PV/diesel hybrid power systems in different climatic zones of South Africa', *International Journal of Electrical Power & Energy Systems, 40*(1), pp. 104-112, 06 August 2013, from http://dx.doi.org/10.1016/j.ijepes.2012.02.010

DOE. (1998). White Paper on the Energy Policy of the Republic of South Africa Retrieved 27 September, 2013, from http://www.gov.za/documents/download.php?f=142157

DOE. (2006). Free Basic Alternative Energy Policy Retrieved 10 February, 2014, from http://www.nersa.org.za/Admin/Document/Editor/file/Electricity/Legislation/Policies/Free%20Basic%20Electricity%20Policy.pdf

DOE. (2008). Electricity Pricing Policy (EPP) of the South African Electricity Supply Industry Retrieved 10 February, 2014 from

http://www.energy.gov.za/files/policies/Electricity%20Pricing%20Policy%2019Dec2008.pdf

DOE. (2011). Integrated Resource Plan for 2010–2030 Retrieved 14 September, 2013, from http://www.energy.gov.za/IRP/2010/IRP_2010.pdf

DOE. (2012a). Non-grid Electrification Policy Guidelines Retrieved 08 February, 2014, from http://www.energy.gov.za/files/policies/electrification/NON%20GRID%20ELECTRIFICATION%20POLICY%202012.13.pdf

DOE. (2012b). A survey of energy-related behaviour and perceptions in South Africa, The Residential Sector, (pp. 1-89). Department of Energy, Pretoria.

DOE. (2013) A new household electrification strategy for South Africa. Department of Energy, Pretoria.

Eskom. (2013). Message from the Minister of Public Enterprises, Mr Malusi Gigaba, on the occasion of Eskom's celebration of its 90th anniversary on 01 March 2013. Eskom Magazine an Essential Special Publication, 2013,12-14.

Gaunt, C. T. (2004). 'Meeting electrification's social objectives in South Africa, and implications for developing countries', Energy Policy, 33 (10), pp. 1309-1317, 21 August 2013, from http://0-www.sciencedirect.com.innopac.wits.ac.za/science/article/pii/S0301421503003756

GNESD. (2012). Off-grid Solar Home System Programme South Africa Retrieved 10 January, 2014, from http://energy-access.gnesd.org/index.php?option=com_content&view=article&id=109:non-grid-solar-home-system-programme&catid=3:projects&Itemid=24

Hailu, Y. G. (2012). 'Measuring and monitoring energy access: Decision-support tools for policymakers in Africa', Energy Policy, 47(1), pp. 56–63, 14

October 2013, from http://0-www.sciencedirect.com.innopac.wits.ac.za/science/article/pii/S0301421512002704

Kouassi, H., & Pineau, P.-O. (2011). 'Financing Challenges for Electricity Projects in Sub-Saharan Africa: Reviewing Old Models and Exploring New Ones', Journal of African Business , *12*(3), pp. 347-367, 20 July 2013, from http://0-web.b.ebscohost.com.innopac.wits.ac.za/ehost/detail?sid=bf88e219-0cb0-46ef-87d3-3ca6e86fd1fa%40sessionmgr111&vid=1&hid=128&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=eoh&AN=EP67651998

Holliday, J. (2013). 'Rural Electrification in South Africa: Design Challenges, Considerations and Choices', *Innovations, 36*(8), pp. 3125-3137, 21 August 2013, from http://www.smith.edu/events/docs/collaborations/2013/presentations/32_Holliday,JenniferProceedings.pdf

International Energy Agency. (2013). Energy Poverty Retrieved 12 September, 2013, from http://www.iea.org/topics/energypoverty/

Lemaire, X. (2011). 'Non-grid electrification with solar home systems: The experience of a fee-for-service concession in South Africa', *Energy for Sustainable Development, 15*(3), pp. 277-283, 06 August 2013, from http://dx.doi.org/10.1016/j.esd.2011.07.005

Madubansi, M. & Shackleton, C.M. (2006). 'Changes in fuelwood use and selection following electrification in the Bushbuckridge lowveld, South Africa', Journal of Environmental Management, 83(4), pp.416–426, 06 August 2013, from http://0-www.sciencedirect.com.innopac.wits.ac.za/science/article/pii/S0301479706001514

Madzhie, L. (2013, 13 June). Integrated National Electrification Programme (INEP) Retrieved 12 February, 2014, from

http://www.cityenergy.org.za/files/resources/energy_courses/Lufuno%20Madzhie_Integrated%20National%20Electrification%20Program.pdf

Mouton, J. (2001). How to Succeed in your Master's & Doctoral Studies (First ed.). Pretoria: Van Schaick Publishers.

National Treasury. (2013) Estimates of National Expenditure, Budget 2013 (pp. 1-42). National Treasury, Pretoria.

Pillot, B., Muselli, M., Poggi, P., Haurant, P., & Hared, I. (2013). 'Solar energy potential atlas for planning energy system non-grid electrification in the Republic of Djibouti', *Energy Conversion and Management, 69*, 131-147.

RSA. (2013). Millennium Development Goals Country Report 2013, (pp. 1-139). Republic of South Africa, South Africa.

Salga. (2012a). The Electrification Indaba Report, (pp. 1-19). South African Local Government Association, Pretoria.

Salga. (2012b). Report on new electrification Roadmap for South Africa, (pp. 1-11). South African Local Government Association, Pretoria.

Salga. (2014). Analysis of Basic Service Governance and the Role of Local Authorities in Improving Delivery, (pp. 1-10). South African Local Government Association, Pretoria.

Sotkiewicz, P. M. (2006). 'Energy Services for the Urban Poor in Africa: Issues and Policy Implications', *African Studies Quarterly, 8*(3), pp. 88-89, 22 July 2013 from http://0-web.a.ebscohost.com.innopac.wits.ac.za/ehost/pdfviewer/pdfviewer?vid=4&sid=ed00d844-5ebe-401c-885d-5fc26d57ba74%40sessionmgr4001&hid=4209

Statistics South Africa. (2012). Census 2011 Statistical Release Retrieved 25 October, 2013, from http://www.statssa.gov.za/publications/P03014/P030142011.pdf

Statistics South Africa. (2013). Energy 2002–2012 In-depth Analysis of the General Household Survey data, (pp. 1-104). Statistics South Africa, Pretoria.

Thom, C. (2000). 'Use of grid electricity by rural households in South Africa', *Energy for Sustainable Development, 4*(4), pp. 36-43, 06 August 2013, from http://dx.doi.org/10.1016/S0973-0826(08)60262-8

Tinto, E.M. & Banda, K.G. (2005). 'The Integrated National Electrification Programme and political democracy', Journal of Energy in Southern Africa, 16(4), pp. 26-33, 08 February 2014, from http://www.erc.uct.ac.za/jesa/volume16/16-4jesa-tinto.pdf

United Nations. (2013). Sustainable Energy for All Retrieved 12 September, 2013, from http://www.sustainableenergyforall.org

Waindi, I. O., & Khalid, A. (2011). 'Renewable Energy in East Africa: An Introductory Evaluation Using a Systems Approach to Assess Alternatives to Providing Electricity', Journal of African Business, 12(3), pp. 387-418, from http://0-www.tandfonline.com.innopac.wits.ac.za/doi/abs/10.1080/15228916.2011.621854#.UzYzBk1DHIU

Yumkella, K (2013). Now More Than Ever, Africa Needs Modern Energy . New African, May 2013, (pp. 88-89).

Zomers, A. (2003). 'The challenge of rural electrification', Energy for Sustainable Development, 7(1), pp. 69-76, 06 August 2013, from http://0-www.sciencedirect.com.innopac.wits.ac.za/science/article/pii/S09730826 0860349X

APPENDIX A

Actual Research Instrument

Interview Questions

1. What are the deficiencies in the South African institutional context, if any, that have led to the current challenges in the electrification process for the poor? What can be done or is being done to address this problem?
2. Are there investigations being done to benchmark against other developing countries that are currently busy with similar electrification initiatives?
3. Are the non-grid generation technologies adding value for the poor? If so, is there empirical evidence to substantiate this?
4. What efforts are being put in place to ensure long-term sustainability of the non-grid generation technologies for the poor? What is being done to address the limitations of such systems? What about the quality of these systems?
5. What are the measures of success of these non-grid technologies? Utilization versus installation?
6. Would an electricity industry franchise model be considered where electricity connection and support services are brought closer to the customer?
7. Are there plans to get the end-user communities involved on the planning, deployment and maintenance phases of these electrification programmes such as the fee-for-service schemes?
8. What is being done to address the issue of multiple fuel-use among the poor? What is the long-term strategy with regards to this phenomenon?
9. What are the necessary inputs into designing an electrification programme for a poor community? How are the technology choices made? Are fuel-biographies taken into consideration?
10. Are public/private partnerships effective in the electrification process?

APPENDIX B

Consistency matrix

Research problem: Identify and investigate the gaps or bottlenecks in the South African electrification programme, with emphasis on the poor in rural areas. This will take into account the reality that some poor rural communities are still without electricity access. Amongst those that do have access, some are utilizing multiple fuels for their energy needs. Consequently, elucidation and optimization of role integration in expediting and streamlining of the electrification process, from planning to maintenance, needs to be done to enable sustainable business models.

Sub-problem	Literature Review	Hypotheses or Propositions or Research questions	Source of data	Type of data	Analysis
The first sub-problem is to examine factors leading to some poor rural communities not having access to electricity. For poor communities that do have access to electricity, to explore the need for multiple energy sources and the contributing factors to this phenomenon. This will incorporate the investigation of the deficiencies in the electricity solutions being deployed.	Dekker et al. (2012),DOE (2006), DOE (2012a), DOE (2013), Chaurey et al. (2012),Chow (2010), Cook (2011), Davidson and Mwakasonda (2004), GNESD (2012), Holliday (2013), Lemaire (2011), Madubansi and Shackleton (2006), Madzhie (2013), Thom (2000), Zomers (2003), Yumkella (2013)	There is a need to examine factors leading to some poor communities not having access to electricity. For poor communities that do have access to electricity, to explore the need for multiple energy sources and the contributing factors to this phenomenon. This will incorporate exploration of the limitations in the electricity solutions being deployed and the issue of affordability.	Semi-structured interviews Documentation & texts Research articles	Qualitative data	Thematic analysis Coding Memos

Research problem: Identify and investigate the gaps or bottlenecks in the South African electrification programme, with emphasis on the poor in rural areas. This will take into account the reality that some poor rural communities are still without electricity access. Amongst those that do have access, some are utilizing multiple fuels for their energy needs. Consequently, elucidation and optimization of role integration in expediting and streamlining of the electrification process, from planning to maintenance, needs to be done to enable sustainable business models.					
Sub-problem	**Literature Review**	**Hypotheses or Propositions or Research questions**	**Source of data**	**Type of data**	**Analysis**
The second sub-problem is to clarify how an integrated approach to electrification for the poor in rural areas can be enabled by identifying issues of collaboration amongst disparate stakeholders from the planning to the execution phases of the electrification process that restrict sustainable business models.	Bekker et al. (2008), Chaurey et al., 2012, Cook (2011), DOE (1998), DOE (2012a), DOE (2013), Madzhie (2013), Pillot et al. (2013), Salga (2012a), Salga (2012b), Salga (2014)	There is a need for an investigation of an integrated approach to electrification for the poor, by exploring the issues in the collaboration of disparate stakeholders from the planning to the execution phases of the electrification process, which should ideally enable sustainable business models.	Semi-structured interviews Documentation & texts Research articles	Qualitative data	Thematic analysis Coding Memos