ALTERNATIVE INSTITUTIONAL ARRANGEMENTS OF ACCELERATING THE IMPLEMENTATION OF RURAL ELECTRIFICATION IN NAMIBIA

A research paper submitted in partial fulfilment of the requirements for the Degree of Masters of Public Policy and Administration

OF

THE UNIVERSITY OF NAMIBIA
Faculty of Economics and Management Science,
Department of Politics and Administration Studies

AND

THE INSTITUTE OF SOCIAL STUDIES (ISS),
The Hague in The Netherlands

BY

S. MUYENGA-MUYENGA

APRIL 2007

SUPERVISORS: **Prof. Dr. F. Becker (UNAM)**
Dr. S. Tankha (ISS)

ABSTRACT

At the beginning of the new millennium, it was estimated that about one fourth of the world's population (1.6bn people) have no access to electricity; the majority of those live in developing countries. Sub-Saharan Africa sits on some of the most significant potential fuel reserves in the world. Research suggests that, globally, no more than 20%, in some countries less than 5% of the population (2 % in rural areas) has access to electricity. In sub-Saharan Africa, only about 8% of rural people enjoy access to electricity. Namibia's White Paper on Energy (1998) reports that approximately 30% (national aggregate) of Namibia's households were connected to electricity in 1997.

Access to electricity is a pivotal enabler and precursor for sustainable development. It is without doubt an essential infrastructure prerequisite for e.g. economic growth, poverty alleviation, social transformation, transportation, health as well as environmental quality. In acknowledging the notable efforts that the Namibian has undertaken in electrifying settlements with specific focus on all active sectors of the economy, it is of concern that wider access to energy and economic sustainability of energy could only be provided at a slow pace. Facing the enormous task to supply electricity countrywide, NamPower, the state-owned power utility in partnership with the Ministry of Mines and Energy, is considering various options aiming at accelerating the implementation of rural electrification supply in Namibia.

This study examined alternative technical options and funding possibilities, considering alternative institutional arrangements relating to funding of rural electrification in Namibia as well as identifying appropriate alternative technologies. The evaluation process includes the analyses of similar rural electrification programme in South Africa, Zambia and Botswana. In these countries, new approaches to energy infrastructure development seem to have been successful in extending rural electrification to wider network coverage. In the context of Namibia, institutional problems that have been experienced in implementing the rural electrification programme were evaluated and the findings entered the formulation of the Rural Electrification Distribution Master Plan 2000 and 2005, respectively.

In order to obtain an insight into new institutional arrangements with specific focus on funding and appropriate technologies for rural electrification, the study draws from results offered by three case studies conducted in South Africa, Botswana and Zambia. In addition, cross references to lessons learned from renewable energy technology applications, successfully implemented in other parts of the developing world, are introduced to the investigation. This secondary research is aiming to crystallise the experiences gained during reform of energy supply in the countries, aforementioned. Departing from these findings, the study examines Namibia's Rural Electrification Distribution Master Plans (2000; 2005) in order to identify areas that require alternative institutional intervention so as to increase the level of access of electricity in rural areas.

This research was supported by limited structured interviews, conducted with resource persons that are considered experts in the many fields of the power supply and distribution in Namibia; the institutions targeted were mainly NamPower and the Ministry of Mines and Energy. Documentary information/data were collected from financial institutions that supports or provide micro-loans for solar PV such as Bank Windhoek, First National Bank of Namibia and Konga Investment.

The outcome of the study indicates that there are several institutional problems hampering the implementation of the rural electrification programme notably:

- a lack of financial and skilled human resources,
- lack of role clarity in the public sector and the electricity distribution industry,
- limited knowledge about the rural households income and energy use patterns,
- inadequate policies/a less priority on power sector reform programme,
- limited financing and the business not attractive for private investment initiatives,
- limited applications of alternative technologies such as solar power, wind power,
- low electricity demand and consumption that make the distribution thereof commercially not viable and not sustainable,

- high cost of grid extension and connecting individual consumers that many a times are dispersed, inaccessible,
- limited financing resulting from the business not attractive for private investment initiatives,
- limited applications of alternative technologies such as solar power, wind power.

The study also analysed the Energy Policy and identified several issues that requires to be revisited such as:

- electrification fund has not yet been created as per the provision of the Policy and there are no clear strategies as how it will be implemented and administered,
- access to electricity will not necessarily address direct benefits by the local communities as the proximity model used in the Rural Electricity Distribution Master Plan provides for a 500m free connection and thereafter prospective applicants for connection are required to acquire or pay for a supply of a transformer. This is a serious impediment to process of rural development and poverty alleviation.
- The Energy Policy need to be aligned with the current socio-economic circumstance as well as incorporate the objectives and goals of Vision 2030 which was formulated five years thereafter.

The study suggested several institutional options that need to be considered in order to accelerate the rural electrification program:

1. government should increase the annual budgetary allocation to rural electrification,
2. concessional loans where applicable and affordable should be considered in addition to other international development funding which has been made available for off-grid electrification,
3. local stakeholder should be involved in the planning and execution of rural electrification particularly when it comes to off-grid technology applications,
4. Incentives should be considered to attract private sector investment in rural electrification. A conducive environment for private sector participation should also be created in line with the provisions of the Energy Policy,
5. the establishment of the Electricity Fund should be accelerated,

6. at policy level there is a need to revisit the Energy Policy f 1998 in order to address some inadequacies of the current policy instrument,
7. Government should consider in consultation with financial institutions the possible establishment of micro-financing schemes at local level to facilitate the provision of needed capital particularly for off-grid renewable energy technologies,
8. the Regional Electricity Distribution companies should assume certain responsibilities of contributing to the rural electrification program.

It's the author's believe that studies of this nature can and should contribute to resolving obstacles that have impeded the swift implementation of the rural electrification programme. Findings of this study likely enhance the body of knowledge on the subject matter and possibly stimulate an academic participation in public sector policy processes through the informed provision of data aiming at strengthening policy making processes in Namibia.

TABLE OF CONTENT

Title Page	i
Abstract	ii
Table of Content	vi
Acknowledgement	ix
Dedication	x
Declaration	xi
CHAPTER 1: INTRODUCTION	
1.1 Introduction	1
1.2 Problems Statement	2
1.3 Research Questions	4
1.4 Research Objectives	6
1.5 Research methodology	6
1.6.1 Study approach	6
1.6.2 Structured interviews	8
1.6.3 Sample method	8
1.6.4 Sample size	8
1.6.5 Significance of the study	8
1.6.6 Limitation of the study	9
CHAPTER 2: LITERATURE REVIEW	10
CHAPTER 3: RURAL ELECTRIFICATION IN NAMIBIA – A SITUATIONAL ANALYSIS	
3.1 Rural Electrification in Namibia – A Situational Analysis	19
3.1.1 Country Profile	19
3.1.2 Energy Policy Framework	20
3.1.3 Energy Sector Perspective	21
3.2 Rural Electrification	24
3.2.1 Funding of rural electrification	25
3.2.2 Progress made with increasing electricity access level	27
3.2.3 An overview on the progress made since 2000	32

CHAPTER 4: CASE STUDIES

4. Case Studies 34

4.1 An African Energy Profile 34

4.2 Rural Electrification – the case of South Africa 38

4.2.1 Country Profile 38

4.2.2 Energy Profile 38

4.2.3 Electrification 39

4.2.4 Challenges and constraints of the grid electrification program 41

4.2.5 Design of off-grid electrification in South Africa 43

4.2.6 What can be learned from the South African experience? 43

4.3 Rural Electrification – the case of Zambia 45

4.3.1 Country Profile 45

4.3.2 Energy Sector Profile 46

4.3.3 Electrification 47

4.3.4 Lessons that can be learned from the Zambian experience 49

CHAPTER 5: CONSTRAINTS AND PROSPECTS OF ACCELERATING THE IMPLEMENTATION OF RURAL ELECTRIFICATION IN NAMIBIA

5.1 An Assessment of the Energy Policy Framework 50

5.1.1 Energy Profile objectives in context 50

5.1.2 Achieving the Energy Policy objectives 51

5.1.3 Impact of the restructuring of the Electricity Supply Industry 53

5.2 Financing rural electrification 54

5.3 Technology options 56

5.4 Other institutional arrangements 58

CHAPTER 6: SUMMARY AND RECOMMENDATIONS

6. Summary and Recommendations 62

LIST OF TABLES

Table 1	Access to Electricity	11
Table 2	Rural Access to Electricity by Region	12
Table 3	Density per Country	20
Table 4	Demand Growth Scenarios for Namibia	23
Table 5	Transmission Line Length and Voltage Level	24
Table 6	Source of funding	26
Table 7	Estimated allocation to financing rural electrification	27
Table 8	Electrification needs of rural localities by 2000	28
Table 9	Electrification needs for rural localities by 2005	28
Table 10	Actual Connections completed between 1991 and 2005	29
Table 11	Access to Electricity by 2005	30
Table 12	Access to Electricity of farms in Namibia's	31
Table 13	Direct and Proximity access for all the regions	32
Table 14	Comparison of Actual versus planned connections	32
Table 15	Comparative Assessment: grid and off-grid programme	33
Table 16	Comparative analysis of case studies	(*inset*)
Table 17	Access to electricity level in South Africa	40
Table 18	Extend of electrification in South Africa by 1999	40
Table 19	South Africa's institutional arrangements	44
Table 20	Institutional arrangements for rural electrification in Zambia	48
Table 21	PVC and SWH systems used in Namibia	57

LIST OF FIGURES

Figure 1	Geographical area of Namibia	20
Figure 2	Own Generation & Import	20

ANNEXURE

ANNEXURE A: Interviews with officials from Rural Electrification Section: 69

ANNEUXRE B: Interviews with officials Renewable Energy: MME 70

ACKNOWLEDGEMENT

This desk research report was conducted under what one could describe as "technically challenging", considering that a policy and development planner by training ventured into conducting an analysis of largely technical issues. There are several people that in many ways played a significant role in shaping the discourse of this undertaking. Writing although a solemn exercise for many, I took it not only as an academic obligation towards fulfilling the requirements for the MMPA, but most importantly to enhance my skills and competencies in analysing policy issues, writing academic papers as well as contribute to enriching our source of data for future references by other scholars, participating institutions in rural electrification in Namibia and other interest groups.

It is within that context that I extend my deepest appreciation to a host of individuals and institutions that provided vital information and data. Firstly, I would like to acknowledge the tremendous assistance I received from Prof. F. Becker, my UNAM supervisor – there is just something I will obviously take along with me on the journey for conducting future academic research studies which I learned from him. Secondly, I wish to extend my sincere gratitude to the person who shaped my subject choice, the spirited mountaineer, Dr. Sunil Tankha. Lastly, I wish to thank officials from NamPower: Rural Electrification Section under the leadership of Mr. Karl-Heinz Wagner, Mr. K. Kavetune and Mr. N. from the Ministry of Mines and Energy who provided useful statistics and other relevant data on rural electrification and the programme on renewable energy in Namibia. To my Project Leader (Kudu Power Project Team), Ms. M. van der Merwe, a big thank you for having granted me time from our hectic work schedule to conduct my research. My colleagues at the Project: Saara, Gerson, Johann, Gouws, Harriet and Ice-D, your valuable support is immeasurable. Linda Lehmann, you have been a star during my trials and tribulations during the course of my Masters studies.

It may be a drop in the ocean of world research data on the subject matter but I just hope that there will be those that will find time to look at it with a critical eye to critique it or learn something valuable from it.

DEDICATION

This Research Report is dedicated to my mom and dad, who invested heavily in my studies over the years. Their tireless contribution to my pursuit of academic excellence is undeniably the biggest support I have received in my life. Their believe that "*Ghukonentu Liparu*" (Knowledge is Life) continue to be the moral strength of my desire to continue striving to reach the top of the academic ladder.

DECLARATATION

I, Muyenga-Muyenga Simon, declare that this research report is my own original work and that all sources have been accurately reported and acknowledged. This thesis was submitted jointly to the University of Namibia and the Institute of Social Studies (ISS) in The Netherland, and it has not been previously in its entirety or in part been submitted at any other university in order to obtain academic qualification.

Signed,

Muyenga-Muyenga S. Date: 22 March 2007

ABBREVIATIONS

SADC	Southern African Development Community
SAPP	Southern African Power Pool
ESI	Electricity Supply Industry
BPC	Botswana Power Company
ZESCO	Zambia Electricity Supply Company
NamPower	Namibia Power Corporation
UN	United Nations
MDG	Millennium Development Goals
PSR	Power Sector Reforms
IPP	Independent Power Producers
GDP	Gross Domestic Product
EU	European Union
REDMP	Rural Electricity Distribution Master Plan
REDs	Regional Electricity Distributors
NDP	National Development Plan
MW	Mega Watts
kV	kilo volts
DRC	Democratic Republic of Congo
HV	High Voltage
GTZ	Gesellschaft fur Technische Zusammenarbeit
EIB	European Investment Bank
UNDP	United Nations Development Plan
GEF	Global Energy Fund
MME	Ministry of Mines & Energy
AFDB	African Development Bank
GNP	Gross national Product
NER	National Electricity Regulator
ANC	African National Congress
RDP	Reconstruction Development Program
NEF	National Energy Forum
DBSA	Development Bank of Southern Africa

DME	Department of Minerals and Energy
PV	Photovoltaic
SIDA	Swedish International Development Agency
EIB	European Investment Bank
SHS	Solar Home Systems
NEPRU	Namibia Economic Policy Research Unit
CENORED	Central-Northern Regional Electricity Distribution

CHAPTER 1

1.1 Introduction

Sub-Saharan Africa sits on some of the most significant potential fuel reserves in the world, yet it is estimated that no more than 20%, and in some countries as low as 5%, of the population has access to electricity, falling to under 2% in rural areas. In Africa, about 75million households are estimated to lack modern energy services[1]. In sub-Saharan Africa, only about 8% of rural people have access to electricity[2].

Demand for electricity is growing rapidly throughout Africa particularly in the Southern African Development Community (SADC) Region where the power demand has been increasing by 3% per annum (SAPP Annual Report 2003), fuelled by the relative political stability and the prevailing conducive environment for foreign direct investment. It is however disappointing that a large percentage of the continents' population still has no access to electricity albeit the visible efforts that Governments are doing in electrifying urban settlements with specific focus on the active sectors of the economy. The lack of access to sustainable energy remains one of the main challenges facing Africa in particular which accounts for about a third of the 1.6bn people around the world that does not have access to electricity. This is a worrisome picture to both developed and developing countries.

Electricity provides a safe and clean source of heat, light, power which in turn plays an important role in the fulfilment of developmental goals and human rights (ESI, 2005). Poor people must have access to modern energy services if global poverty and inequalities are to be reduced (Morris in ESI, 2005). Access to modern energy services is therefore an essential ingredient for social and economic development to occur, there is an inherent need to address the links between energy, and poverty reduction by promoting access to energy services linked directly to socio-economic development sectors.

---

[1] Taken from a paper by Jurrie Willemse presented at a ISES Seminar on Rural Electrification in Africa, Pretoria, South Africa,

[2] WEC, 1999; UNDP, 2002; GNESD, 2004

However, despite the desire and efforts that are being made to redress the imbalances and apparent inadequacy as far as access to energy services are concerned, the fundamental challenge remains that of the insufficient infrastructural development to cater for the increased power demand in the region. Financial investment in the energy sector has been very slow and marginal. There is therefore an impeding need for new infrastructure. In most parts of Africa, there is an inability to finance the operation and expansion of the electricity system which has resulted in low level of performance and a situation which currently faces the SADC region where power demand is fast surpassing power capacity. In order to facilitate more investment, it has been argued that market principles should be adopted and standardised to introduce effective competition.

Commercial and contractual commitments need to be clearly understood and respected by all parties, and there is a growing call from investors and development partners for good governance, commercialisation and privatisation of state entities. Others have pressed for effective regulatory frameworks, which allow/permit cost-reflective tariffs which too many poor countries see as a political constraint as many of its citizens can just not afford competitive pricing, required by the energy sector to fuel continued investments in new infrastructure.

In the Namibian context, the restructuring of the electricity supply industry (ESI) in Namibia started in 1998 with the promulgation of the White Paper on Energy under the custodianship of the Ministry of Mines and Energy. This process was driven by the desire to primarily ensure security of power supply. Although the restructuring process is seen by some sectors as slow, less-beneficial to the end customer due to steady tariff increases as well as decline in generation supply compared to a significant increase in power demand, the changes in the ESI have been fundamental in many respects as will be further explained in Chapter 4.

Although Namibia has one of the most reliable transmission networks in the SADC Region, only approximately 30% of Namibia's households had access to electricity by 1997[3]. Although official data from the Master Plan that was recently completed in

[3] Rural Electricity Distribution Master Plan for Namibia – Baseline Report, August 2000

2004 has not yet been publicly released, there has been a slight increase in the number of households that have been connected. More than 75% of urban households use electricity compared to less than 10% of rural households. The national aggregate electrification level is about 34%, (Rural Electricity Distribution Master Plan, 2000).

Rural electrification is largely seen as a fundamental concern to the majority of the electorate in Namibia. Yet this program of providing access to electricity to the majority of the Namibians, is perceived by certain sectors of society as possibly a low-profile priority compared to other developmental projects envisaged in the National Development Plan I & II as well as Vision 2030.

There are therefore compelling reasons to acknowledge the importance of research on rural electrification in Namibia, so as to assess whether the program providing access to electricity to all Namibians is working well and whether it is sustainable in the long-term given the complexity of sourcing adequate funding. Needless to say, this study has attempted to analyse several variables in the policy framework as opined in the White Paper on Energy for Namibia with specific reference and focus on rural electrification.

Chapter 4 provides an insight of regional and international experiences of other developing countries as how rural electrification has worked in their respective environments and what lessons Namibia can learn in accelerating its program providing wider access to its people. Chapter 5, on the other hand analyse and put into context the Namibian experience since 1991 and it identifies several funding and technology options that have been implemented in pursuance of meeting the 2010 target as outlined in the White Paper on Energy. Chapter 6, will focus on drawing all the experiences as well as academic reviews in relation to identifying appropriate alternative funding, technologies and other institutional arrangements for rural electrification in Namibia in view of the current generation supply shortages being experienced in the SADC region.

1.2 Problem Statement

The implementation of the rural electrification program of Namibia which started in 1991 has been slow considering that by 2000, less than 10% of rural household have

access to electricity[4]. Whilst acknowledging the efforts from the Namibian Government through the Ministry of Mines and Energy with technical support from the state-owned power utility NamPower, it remains of concern that the process of providing wider access to electricity in rural areas in particular is likely to fall short of the target of increasing electricity access to 25% by 2010.

Given the numerous institutional problems that Namibia has experienced in implementing the rural electrification program, the need to vigorously look at alternative institutional interventions can not be over emphasised. Private sector investment, public-private partnership, consumer levies and other funding options have worked in some countries whilst other appropriate technologies other than the conventional grid extensions have been success stories in countries such as Argentina, Kenya and Zambia[5]. The source of the conventional funding for the rural electrification program in Namibia has remained NamPower, Government of Namibia through the Ministry of Mines and Energy as well as grants from Namibia's development partners. Inadequate funding in an environment where inflation has steadily been in the increase, the volatility of the Namibia Dollars against major trading currencies, price increases of equipment and other associated costs, could possibly describe the slow pace at which the rural electrification program has been implemented. In addition to the funding and technology options, there could be other possible alternatives or mechanisms that can be considered to accelerate the implementation of the program.

This study attempted therefore to identify several alternative institutional arrangements that could be considered in accelerating the rural electrification program.

1.3 Research Questions

Given the constraints as highlighted above in providing access to electricity particularly in rural areas in Namibia, this study focused primarily on three (3)

[4] MME - Rural Electrification Distribution Master Plan 2000

[5] Haanyika Charles presented a comparative case study on rural electrification policy and institutions in a reforming power sector at the Parliamentary Forum on energy Legislation and Sustainable Development in Cape Town, South Africa (5 – 7 October 2005),

fundamental issues with reference to the implementation of the rural electrification programme in Namibia:

- What have been the major shortcomings and constraints of the existing rural electrification programme?
- What viable funding options have been or can be considered to accelerate rural electrification and where can such funding be sourced?
- What are the other appropriate technologies that are affordable, sustainable (in terms of operational efficiency, accessibility to spare parts, maintenance) that can be considered?

The study also examined the Rural Electricity Distribution Master Plan of 2000 and 2005 respectively as well as looked at several other secondary issues in relation to the rural electrification programme in Namibia inter alia:

- How many rural households had access to electricity in Namibia as at the end of 2005?
- Are there institutional and policy issues that requires review/reconsideration to meet the target set to connecting at least 25% of rural household to the national grid by 2010[6]?
- Review of the renewable energy program with specific reference to the application and relevance of identified technology options.
- What measures or alternative institutional arrangements that can be considered in speeding up the rural electrification programme in addition to the funding and technology options?
- What lessons can be learned from countries that have implemented rural electrification in the region and elsewhere with specific focus on:
    - electrification network (transmission extension network),
    - type of technology used for rural electrification,
    - funding arrangements of rural electrification,
    - policy intervention that were considered and/or implemented?

[6] Target set by the Namibian Government to connect rural household to the national electricity grid by 2010.

1.4 Research Objectives

The primary objective of this study was first to identify institutional problems/constraints that have contributed to the slow pace of rural electrification in Namibia and to identify possible alternative arrangements which can be considered to speed up the process.

1.5 Research Methodology

This study was largely desk research based and conducted in a more qualitative approach by mainly using existing relevant literature materials. The purpose of the study was to examine the principle provisions of the Energy Policy relating to access to electricity and the target set of achieving a 25% access level by 2010. The Energy Policy was compiled during the completion of the second phase of the rural electrification programme which at the time focused on providing access to electricity targeting major settlement areas in all regions of Namibia through primarily a grid-based extension.

This study also noted invariably the uniqueness of Namibia's landscape which is one of the least populated countries in Africa. Hence the cautious approach in doing a comparative study with other countries in the region that have embarked on a similar electrification program. The experiences drawn from the case studies highlighted in this study is of immense importance to enhancing the body of knowledge in understanding the complexities of rural electrification and to put into context what lessons can be learned from other countries.

1.4.1 Study approach:

For the purpose of drawing lessons and experiences from neighbouring cpountries that have implemented rural electrification, this study looked at two **case studies** drawn from South Africa and Zambia. The choice for selecting these case studies was based primarily on the following criteria:

- South Africa and Zambia share common borders with Namibia,
- The state power utilities in South Africa (Eskom), Botswana (BPC), Zambia (ZESCO) and Namibia (NamPower) are members of the Southern African

Power Pool (SAPP) which is a regional grouping of all state utilities within SADC,

- Namibia trades through import/export of electricity with Zambia (import), Botswana (export) and South Africa (import),
- The socio-economic conditions in Zambia and South Africa are relatively similar to those in Namibia.

Invariably, a comparative analysis can be drawn between these countries, despite the critique that South Africa has a much bigger economy than Namibia, the power generation capacity and power demand is incomparable to that of Namibia. However, the similarities highlighted above in addition to the current cooperation agreements and other instruments of joint coordination at both utility and Government level reinforce the comparative edge that both countries can learn from each other. To a large extent the experiences of South Africa and Zambia with regard to the implementation of rural electrification in their respective countries can be vital lessons to Namibia given the socio-economic, demographic and cultural dynamics that exist between these countries.

As will be seen in Chapter 4, several other reference areas have also been made by highlighting albeit in brief, experiences from other developing countries where rural electrification has been implemented such as Mexico, Peru, Thailand, Kenya, Zimbabwe and Chile. Noting that most of grant funding for rural electrification in developing countries comes from Western Europe, several brief references to selective case studies have been included particularly on how renewable technologies have been implemented in Europe. Several of these technologies were replicated in some parts of the developing world and yielded mixed results which indicate as a matter of caution that not every success story somewhere can yield similar results more so, when prevailing conditions are not similar.

1.4.2 Structured interviews

Order to obtain in-depth analysis from resource institutions and individuals that are involved in rural electrification as well as renewal energy, interviews were held with resource persons from the Ministry of Mines and Energy, NamPower and other

experts that have extensive experience and involvement in renewable technology applications and the provision of funding. Data collected from these interviews collaborated largely literature materials that were collected and analysed for this study.

1.4.3 Sample Method

In order to have a coherent, accurate, reliable and validated data was collected, it was deemed imperative that an appropriate sampling method is applied. For this desk-based research, triangulation sample method was applied in determining and selecting the sample population. This method implies the combination of more than one sample method. This method allows for the utilisation of both probability and non-probability sampling techniques (Mendall, Ott and Scheafer, 1984). In the former type of the samples the probability of each respondent will be known, in this case, the officials administering or those that are involved in the rural electrification program either at policy, administrative or technical level.

In the non-probability samples, the selection of respondents may not necessarily be known, and these will be informants that will be interviewed at random basis to supplement/complement where information gaps may exist during the data collection and analysis process.

1.4.4 Sample Size:

Considering that the focus of this study is looking at identifying alternative institutional arrangements for accelerating rural electrification, the sample size was relatively small and to a large extent confined to institutions that are to a larger degree involved in rural electrification. Moreover, the bulk of the data collected was extensively sourced from documentary sources, case studies and other relevant materials. For the structured interviews officials from NamPower and the Ministry of Mines and Energy were contacted to provide further detailed information as well as personal expert opinion on the implementation constraints and prospects of the rural electrification program in Namibia.

1.4.5 Significance of the study

There are few studies that have been conducted on rural electrification in Namibia other than the extensive Rural Electricity Distribution Master Plans of 2000 and 2005 respectively as well as those conducted on solar and other off-grid technologies as part of various pilot studies. Studies of this nature are important instruments to contribute to resolving obstacles that have impeded the swift implementation of the rural electrification program. Findings of this study likely enhance the body of knowledge on the subject matter and possibly stimulate an academic participation in public sector policy processes through the informed provision of data aiming at strengthening policy making processes in Namibia.

1.4.6 Limitations of the study

The scope of the study included analysing several technical reports on rural electrification which provided useful insight as far as the implementation of the programme is concerned with special focus on the choice of technologies used. Certain technical application, which included calculations of proximity formula were an inhibiting factors during the collection and analysis of the data.

The second limitation was that of time. For that reason, the study focused primarily on documentary sources and views/opinions from institutions and resourceful people involved in rural electrification at the Ministry of Mines and Energy, NamPower and to a lesser extent Regional Councils as overseers of this program at regional level.

CHAPTER 2

LITERATURE REVIEW

Rural electrification has over the decade been the subject of numerous authors and the theme at various forums around the world. The grim reality of rural electrification or rather the lack thereof, in the third world more so in southern Africa, is the inadequate infrastructural development compounded by a lack of funding as well as institutional inefficiencies, low priority on the policy agenda for inclusion of rural electrification. Although rural electrification have undeniable benefits for socio-economic development particularly in the areas of agriculture (agro-processing and irrigation projects for example), reduction of environmental degradation, minimize rural-urban migration, huge potential to improve service delivery particularly in areas of education and health systems, many countries have not yet fully taken advantage of what rural electrification can offer. Where such a program has been implemented, there have been inconsistencies, low policy priority, inadequate funding, lack of appropriate alternative technological solutions, and non-receptiveness as results of culture inertia.

Access to modern energy services particularly electricity, is a key stimulant of socio-economic development. It has been argued by scholars of the social sciences that electricity whether it is used to provide higher quality of lighting for rural homes which still largely rely on traditional sources, power small vaccine refrigerators in clinics and other infrastructures for essential services or pump water for irrigating small agricultural plots, the availability and utilization of even small amounts of electricity can make dramatic changes in the live of people even in the remote rural areas. Access to modern electricity is also crucial in efforts to fulfill the United Nations (UN) Millennium Development Goals (MDGs). Considering that about 1.6 billion people of the world's population still have no access to electricity today, demonstrate the humongous challenge in realising the United Nations Millennium Development Goals (MDGs)[7]. This is exacerbated by the fact that an estimated

[7] UN Millennium Declaration, Resolution 55/2 adopted by the General Assembly in 2000; www.un.org/mellenniumgoals

1.2billion people live on less than US$1 a day[8], moreover, the first MDG to halve extreme poverty and hunger by 2015, poses a serious challenge to the energy industry, Governments and society at large.

Table 1: Access to electricity in developing world

	1970 (m)	**1980 (m)**	**1990 (m)**
World population	3600	4400	5300
Developing country rural population	2600	3000	3200
Rural residents with access to electricity	610	1000	1400
Rural residents without access to electricity	2000	2000	1800
Percentage (%) rural access to electricity	23%	33%	44%

Although most investment in rural energy development has been in modern energy systems, not enough electricity has reached rural areas. Investment in electricity infrastructure need to rise well above present levels and significant efforts are needed to reform and restructure the electricity sector. Although globally, it has been determined that the number of households with access to electricity has more than doubled since the 1970's, this increase just kept up with population growth, and the number of people without access to electricity did not decline significantly as anticipated. In Mexico, which has relatively one of the highest rate of electrification by international standards, with about 95% of the population having electricity connection by mid-1990's, however in absolute terms, the remaining un-electrified segment of the population still comprises over a million households and about 80% of these are in rural areas[9].

In many of the case studies conducted in Africa, access to electricity, defined as the number of electricity connections, has more than doubled over the past decade, more so in Ghana, Mali and South Africa[10]. The experience in Tanzania, suggest that

[8] Attacking Poverty, World Development Report 2000/2001, Oxford University Press, 2000
[9] Data contained in a comparative study on Philosophies in Rural electrification in Cuba, Mexico and South Africa by Dorothee Reinmuller, presented at a SEPCo Workshop, 17 November 2002
[10] World Bank Group, Report 306/05, 2005; Power Sector Reform in Africa: Assessing Impact on Poor People. The case studies were conducted in six African countries: Ghana, Mali, Namibia, South Africa, Tanzania and Uganda and examined power sector reforms in these countries.

private participation and reforms alone have not produced dramatic acceleration in access to electricity. Tanzania's two-year management contract was designed primarily as an interim measure toward preparing the state-owned utility for privatisation and unbundling; its target was essentially to instil commercial discipline rather than increase. However, electrification actually continued to increase during the management contract period although not to the extent as has been the case in other countries (ibid).

Table 2: Rural access to electricity by region

Region	**1970**		**1990**		**Increase in population with access to electricity**
	Population	*Access*	*Population*	*Access*	
North & Mid-East Africa	77m	14%	108m	35%	27m
Latin America	121m	15%	125m	40%	32m
Sub-Saharan Africa	222m	4%	340m	8%	18m
South Asia	579m	12%	836m	25%	140m

Source: World Bank (1998), Foley (1992)

The above table indicates the estimated growth in access to electricity that has taken place mainly in the aforementioned regions during the period 1970 – 1990. The situation sketched in *table 2*, highlights the inequities around the world in terms of the provision of access to electricity with Sub-Saharan Africa with a population of 340m by 1990 only had 8% of its citizens having access to electricity compared to the rest of the developing regions of the world. Energy access has always been a key tool against poverty. Globally, energy access, particularly in rural areas, has remained static with the number of people living in un-served areas remaining unchanged in the last 25 years, (REEP, 2006). Decentralized energy is a suitable weapon in the battle against poverty, partly because it is often the only possibility in regions that will never acquire the necessary infrastructure for on-grid, centralized energy, as they are too remote (ibid). In many cases, even if the grid was extended to rural areas this would be inadequate, as the grid is unreliable in many developing countries. Many countries

in the developing world are unlikely to opt for grid extension in rural areas largely due to the associated cost for infrastructure development, maintenance, low demand and the in-affordability of electricity to the rural poor in particular, (Karekezi, 2003). In another study conducted by Haanyika (2005) on rural electrification policy, he identified several factors that affect the implementation of rural electrification particularly in developing countries:

1. Economics of electrification
2. Low electricity demand and consumption
3. High cost of grid extension and connecting individual consumers (dispersed households)
4. Limited financing (RE low on priority list)
5. Inadequate policies (basis/importance)
6. Weak institutional frameworks
7. Limited application of alternative technologies (focus on grid extension)
8. Power sector reforms (PSR)
    - Liberalization, IPPs, commercialization, structural & ownership changes, independent regulation

When electrifying a rural settlement for instance where electricity was previously inaccessible, there is a multitude of obstacles, of which are related to the issues highlighted above but more so it relates to behaviour, established practices, tradition and culture as well as socio-economic set-up of the receiving community. The entry of electricity presupposes a mind set which cannot be mobilised without educational and training schemes that must be regarded as integral parts of the electrification process[11]. Providing wider access to electricity to rural areas in particular, should consider not only the strategic value of such a service but the acceptance and utilisation thereof by the recipient communities.

Haanyika further states that rural electrification in many parts of the developing world was spiralled by social, environmental and economic reasons. Some governments have based their programmes on explicit political objectives so as to ensure improved

[11] Taken from the abstract of Anders Norsdtrom, on Access to Electricity – An approach to sustainable reduction of rural poverty

rural political stability and electoral support. Many a times, social and economic objectives have been combined and this in some instances led to conflicting objectives for utilities tasked the responsibilities of implementing or coordinating the rural electrification program. Norstrom (1999) argues that financial logic indicates that electrification should focus first on those areas with high economic growth potential and lowest cost. Given such a premise, urban electrification would receive higher priority than rural electrification. This situation is also evident in Namibia where before 1990; emphasis was placed largely on electrifying urban settlements whilst rural areas where more than 80% of the population live remained secondary on the priority list of electrification. Hence, rural electrification of settlements in Namibia only started in 1991 which was later followed by the extension of the rural electrification program to other parts of the country but still targeting mainly government installations.

As will be seen from the two case studies drawn from Namibia's neighbouring countries namely, South Africa and Zambia, the facets and characteristics of rural electrification in Africa and elsewhere in other parts of the developing world, is not much different from each other. Many rural areas are typically dependent on off-grid electricity systems, especially in areas that are far remote and have a low density to justify or meet an acceptable criterion for grid extension. Extension of the grid is largely driven by commercial, financial and technical principles. Connection to the conventional electricity grid is deemed economically/commercially unviable and not sustainable due to the low electricity consumption/demand measured against the capital cost of grid expansion and connection. Supply of grid electricity to rural areas is mainly taken on the basis of Government's meeting their developmental goals such as poverty reduction, improvement of the quality of life of citizens, enhancement of the provision of social services such as education and health.

From a commercial point of view, it has been proven that it is uneconomical to invest in electrifying small villages where power demand is so low, considering the cost of investment in transmission lines, poles, transformers, and other associated infrastructure let alone the cost of maintenance and operation of the system. In contrast, grid supplies is generally seen as the cheapest option in areas with high load densities, as well as in areas nearer to the grid making the extension capitally less

expensive compared to extended long transmission line. There is now consistent focus on looking at renewable energy as an appropriate technology for electrifying rural areas which for reasons augmented earlier are commercially unviable for grid connection. In many countries on the African continent more so in southern Africa, rural population is dispersed in individual villages or clusters of villages), this leads to a pattern of remotely located low-density electricity demand, which is not amenable to the grid extension model of providing renewable energy[12]. As it will emerge from the case studies selected, the off-grid electricity systems are possibly one of the option that is being considered by many developing countries where the pattern and demographic of rural areas justify rural electrification by use of off-grid technologies rather than conventional grid electricity supply.

Rural electrification programs have typically concentrated on connecting rural villages and remote areas to a national grid mostly owned and operated by the public utility. The rationale behind such an approach is to incrementally extend the grid to eventually reach rural settlement areas. As stated earlier, the connection of rural areas to the national grid is largely dependent on whether such rural settlements meets a number of criteria such as population, number of government installations, strategic importance of the settlement, envisaged economic development initiatives/projects and its proximity to the grid.

Noting that grid-connection is likely not to address the policy targets as far as wider provision of electricity particularly to those in remote rural areas concerned, experience has demonstrated that there is a need to converge technology, policy and finance as well as human capacity[13]. It has also been proven that commercial renewable energy and energy efficiency technologies exist and can meet the needs of developing country markets. The challenge is to transfer the experience base to the African market.

[12] CORE International, 2002, A Desk Study Report – Rural Electrification Options in Zambia – USAID energy and Environment Training Program

[13] Taken from an E&Co paper presented to the ISES seminar on Rural Electrification in Africa. E&Co is a South African based firm which aims to promote a transition to a New Energy Paradigm that is based on the implementation of clean, economically sound energy projects that reach rural as well as urban populations in developing countries.

With regard to financing, the requirements for viable project and enterprise finance in developing country settings are becoming clearer. In Africa however, there is still a need to demonstrate the commercial viability of renewable energy technologies as well as the ability of the rural people to pay for such energy services.
In understanding the inequities in the provision of electrification particularly in developing countries, it is important to note the power sector reforms that have taken place in several developing countries which in many facets had major impacts on rural electrification. In Africa for instance, prior to the reforms in the late 1980's and early 1990's, the power sector was characterised by state ownership and monopolies.

According to Haanyika (2005), a review of literature (World Bank, 1993; Bacon& Besant-Jones, 2001; Wamukonya, 2003a; Bhagavan, 1999; Ranganathan, 1992; Kessides, 2004) indicates that proponents of Power Sector Reforms (PSR) such as the World Bank argued that PSR would bring about improvements in the power sector thus availing more resources to rural electrification. It was thought then, that liberalisation would introduce new private players in the market with potential for competition, increased investment and introduction of new management and technical skills (ibid).

The World Bank in several other studies undertaken during the 1990's on PSR propelled the unbundling process to amongst others stimulate privatisation and commercialisation of state utilities as well as introduce regulations to facilitate independent regulation of the power sector, embrace transparency, public participation and fair rules for all stakeholder in the sector, (World Bank, 1993; World Bank, 1996). It has also been argued that reforms further provides an opportunity for policy makers to change institutional arrangements that have failed to facilitate increased access to electricity in rural areas, (Haanyika, 2005:3). Utilities as agents of rural electrification have limited capacity to integrate rural electrification and their focus in a reformed environment is driven by commercial principles.

By 2004 nearly all developing countries had implemented PSR with Latin America taking the lead with most of the countries in that region implementing reforms in the 1980's and early 1990's (GNESD, 2004). Rural electrification was integrated in the PSR approach only in the 1990's considering that investment in the extension of the

grid to rural areas with low demand for electricity was seen as a social investment which is not in commercial terms an attractive undertakings for reformed utilities as well as new entrants in the power sector. Reforms in Sub-Saharan Africa have been quite diverse with some countries taking significant measures while others were more cautious and slow to reform with only 20 countries in the region that initiated PSR by 2001, (Karekezi & Kimani, 2002). Although rural electrification was part of most of the reform process in several countries, only few placed meaningful emphasis on implementing rural electrification program, (Haanyika, 2004). As for Asia, it is evident that countries there long recognised the need for expansion of electricity services to rural areas ad by the time of implementing the market reforms, most of the countries had established electrification bodies with supportive legislation, (TERI, 2004). In Latin America, studies by Jadresic, Covarrubis and Reiche (in Haanyika, 2005), show that Peru, Argentina and Chile made significant increases in rural electrification levels following the implementation of reforms. Chile, for instance increased access to electricity in rural areas from 53% in 1992 to 76% in 1999. The achievement was based on decentralised decision making and local participation, public-private partnerships, competition and the use of appropriate technologies, (Jadresic, 2000). Argentina launched a programme to give concessions for rural off-grid systems by competitive bidding. A similar program is being implemented in South Africa (*see Chapter 5*).

While PSR have worked very well in Latin America and Asia, case studies on electrification in Africa by GNESD (2004), show that market oriented reforms affected the rate of rural electrification negatively, (Haanyika, 2005). The rural electrification rate in Kenya reduced from 16.1% in 1993 to 7.7% in 2001; overall access was 5.5% in 2001 whilst access in rural areas was only 0.8%. Zambia recorded no significant improvement in the level of access to electricity in rural areas between 1990 and 2000 and the access level remained at about 2% (Haanyika, 2004). On the other hand, South Africa using a somewhat different approach to electrification managed to increase electrification levels from 36% in 1994 to over 66% in 2001, (ibid). In Namibia, despite the current backlog, it achieved a relative increase from 7% in 1998 to 16% by 2005.

In summary, the market reforms ad commercialisation driven by the PSR approach has refocused the interest of public utility to revenue and profitability. In SADC, this is more evident in Namibia, Botswana and South Africa where the reforms of the electricity supply sector is yielding an increase in the access to electricity although still below the projected figures (particularly for Namibia and Botswana).

CHAPTER 3

RURAL ELECTRIFICATION IN NAMIBIA – A SITUATIONAL ANALYSIS

3.1 COUNTRY PROFILE

Namibia gained independence in 1990 from South Africa the then colonial administration of South-West Africa. It has adopted at independence a parliamentary democratic system of governance. Its economy is predominantly based on mineral resources with the mining industry accounting of about 70% of export earnings and contributes about 12% of the GDP. Fishing and agriculture are the other pillars of the Namibian economy with beef and fish as the primary export products to South Africa and the EU. Tourism is currently regarded as the fasted growing sector with a projected average growth of 3% over the past decade. Namibia is ranked 89th in the world in terms of per capita GNI and it has the highest unequal income distribution in the world.

Namibia is regarded as having one of the best and well maintained road, rail and telecommunication infrastructures in Africa and assumingly has the widest infrastructural distribution in southern Africa with particular reference to telecommunication as well as electricity distribution network after the regional economic giant, South Africa.

Namibia territorial area of about 823 680km has one of the lowest density/sparsely populated country in Africa. This demographic landscape poses a major challenge to Namibia's economic competitiveness in the region in terms of economic of scale for most of the products locally produced which have to compete with imported goods mainly from neighbouring South Africa. In addition, the nature of Namibia's landscape with its long transmission lines is a major challenge for the energy sector where power consumption and demand is one of the lowest in the region. This is also a technical constraint which has a major impact on the commercial viability of extending grid electrification to remote rural areas with very low demand considering the capital cost versus the revenue to be generated.

Figure 1 – Geographical area of Namibia

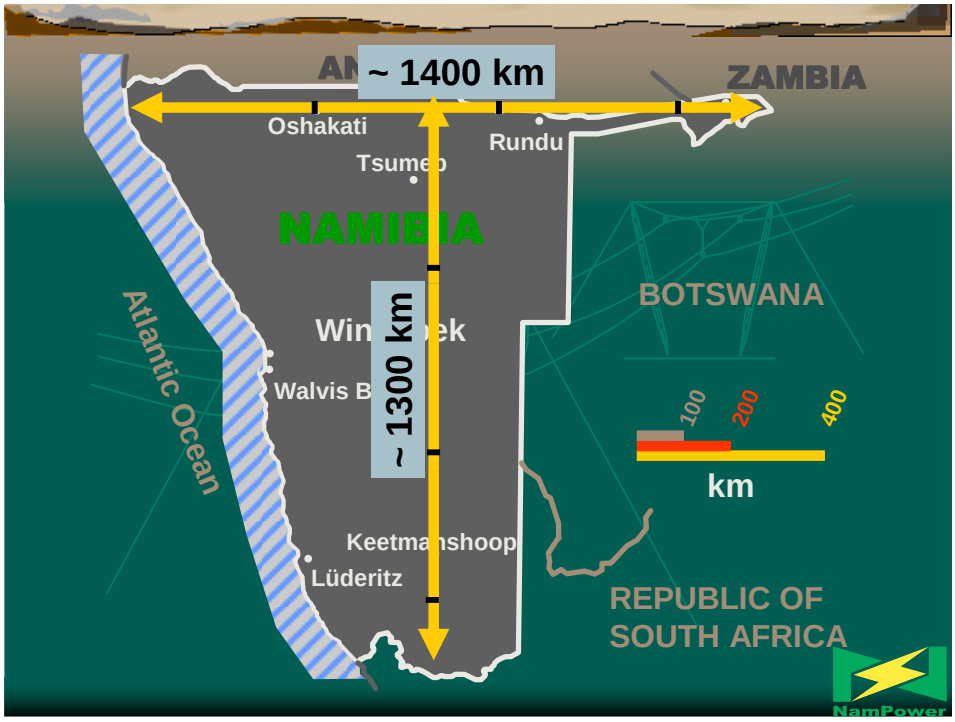


Table 3: Density per country

Country	Density	Size – square km
Namibia	**2.3 persons/km2**	**825 400 km2**
South Africa	**32 persons/km2**	**1219 900km2**
Nigeria	**114 persons/km2**	**923 800km2**
Japan	**327 persons/km2**	**377 800km2**

3.2 Energy Policy Framework

Prior to independence, the energy policies of the colonial South African government were supply oriented. At independence, the Namibian Government pursued a more balanced energy policy, which also includes demand-oriented initiatives such as an active rural electrification program, (Glauco De Vita, et al, 2005). The two main energy policy objectives of the National Development Plan (NDP 1) which was proceeded by NDP 2 were focused on self-sufficiency in electricity, and the implementation of the rural electrification programme by 2010, (ibid).

The White Paper on Energy which was promulgated by Cabinet in 1998 as Namibia's Energy Policy and it has been the backbone of the Electricity Supply Industry (ESI)

restructuring process. The Energy Policy laid down the institutional framework for the changes that have taken place since 2000. The first Rural Electricity Distribution Master Plan (REDMP) was carried out in 2000 which identified that about 2855 rural localities in Namibia of which 87.1% of them were not electrified.

Prior to the Electricity Supply Industry reforms that started after the promulgation of the Electricity Act which eventually provided policy directives for the establishment of the Regional Electricity Distributors (REDs), much of the electricity distribution in Namibia was undertaken by municipalities, and wholesale power supplied by the state-owned utility, NamPower. With the formation of the Electricity Control Board as per the provision of the new Electricity Act of 2000, the new regulator brought NamPower and municipal distributors under a single regulatory authority.

3.3 ENERGY SECTOR IN PERSPECTIVE

3.3.1 Generation and power demand growth

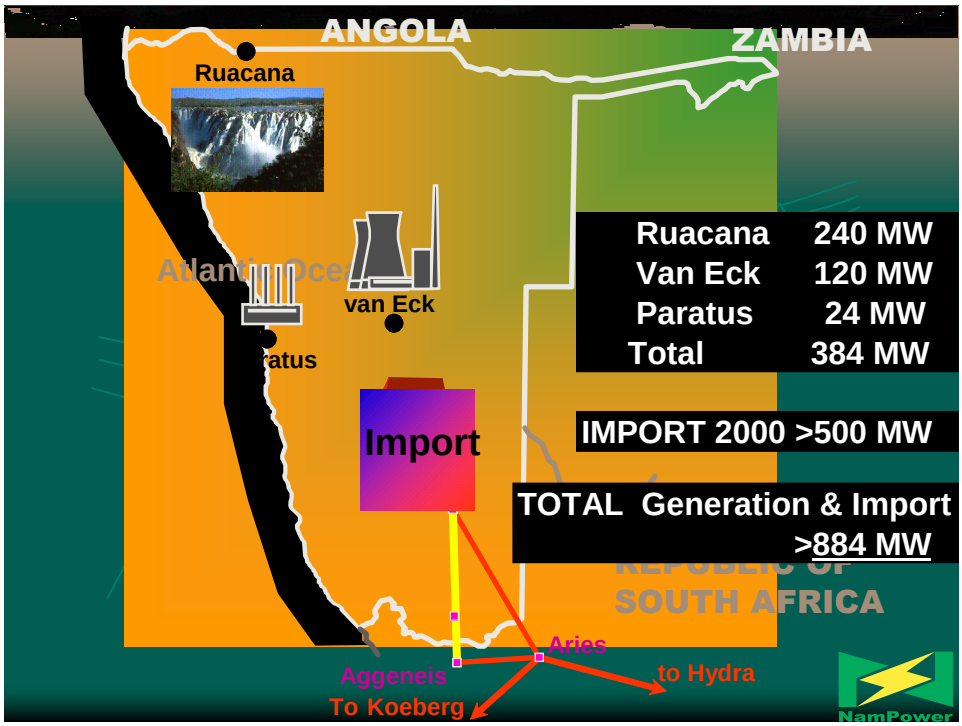
Namibia's main generation sources of electricity are the thermal, coal-fired Van Eck Power Station outside Windhoek with an installed capacity of 120MW; the hydro-power plant (run-of-the river scheme) at Ruacana with an installed capacity of 240MW as well as the much smaller diesel-powered Paratus Power station at Walvis Bay with an installed capacity of 24MW. A second diesel-fired power station is located at Katima Mulilo with a capacity of 3MW and only supplies power to the town of Katima Mulilo and surrounding areas serving as a peaking and stand-by power station. This power station is not connected to the national grid notably due to the 500km distance between Rundu and Katima Mulilo, therefore power for the Caprivi region is sourced from ZESCO in Zambia.

There are about 120 000 domestic users who constitute about 91% of all customers but accounts for only 45% of the total power demand in Namibia. There are about 1 150 industrial and mining users of electricity who account for about 26% of the total

power demand whist the balance is made up of 10 000 commercial users[14]. This scenario of a low power demand provides a relative low investment return for NamPower although the company has remained profitable due to its financial strength resulting from its returns on financial assets rather than fixed assets.

Namibia imports about 50% and at times two-third of its energy needs from neighbouring South Africa through the 400kV interconnection from Aries (South Africa) to Auas outside Windhoek via Kokerboom (outside Keetmanshoop). In order to meet the increasing demand of electricity estimated at a growth rate of 3% per year as well as ensuring security of power supply, Namibia is considering the development of a 800MW Combined Cycle Gas Turbine Power Plant outside Oranjemund as well as the development of a 400 – 500MW hydro-power scheme at Baynes in the lower Kunene River Basin.

Figure 2 – Own Generation & Import

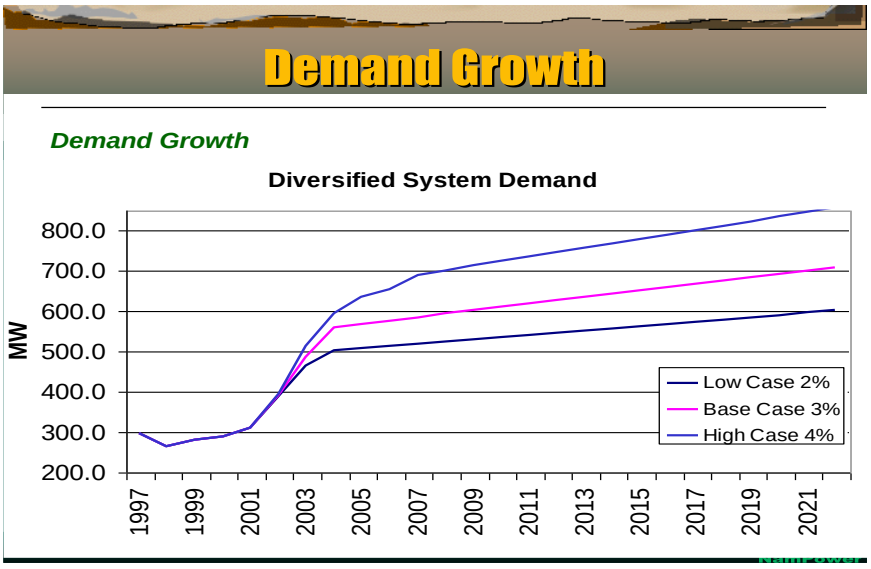


Source: NamPower (undated)

[14] Data taken from a study on Power Sector reforms: Assessing the Impact on Poor People and verified with data from NamPower.

For the interim, the Namibian power utility embarked on the transmission interconnection Caprivi Link project which will enable Namibia to import about 200MW from Zambia as well as allow trading with Zimbabwe and DRC through a wheeling arrangement with Zambia.

Table 4: Demand Growth Scenarios for Namibia



Source: NamPower, 2004

Transmission network expansion

Relatively, Namibia has one of the longest transmission networks in Africa given its vast landscape with a small population. This poses several technical challenges and constraints:

- Very long lines and at times lightly loaded causing voltage problems,
- A unique near 50Hz resonance problem causing voltage problems if left unchecked,
- Long interconnection to the Eskom system and cause dynamic stability problems with the 240MW Ruacan Hydropower Station,
- A largely radial fed HV system – it has no back-up system if the HV fails.

Table 5: Transmission line length and voltage level

Voltage level	Length of transmission line
400 kV	720km
330kV	521km
220kV	1645
132kV	946
66kV and below (33/11)	11924

Source: Rural Electricity Distribution Master Plan, 2000, 2005

The table above exclude the new transmission extensions commissioned during 2005 such as the Omaere – Ghanzi 132kV line (km), Auas – Namib 220kV (km) as well as other smaller voltage lines. By comparison, Namibia's transmission network has nearly similar features as those in developed countries; however Namibia has much less MW generation output and power demand. As illustrated below, the capital cost for setting up the infrastructure for the national transmission network makes transmission prices far higher than those in developed countries with similar transmission line lengths.

In summary, the energy profile summarized in the sections above illustrate the challenges that Namibia is facing with regard to investing in securing adequate power supply. The huge capital investment that NamPower has made towards strengthening its transmission network and the search for new energy generation sources had an impact on the implementation of rural electrification. The priority for any given country is to secure reliable power supply thereafter increases the accessibility of the service.

In summary, the energy profile highlighted above indicate the situation in which Namibia find itself where in the absence of new generation infrastructure, the country will continue to be a net importer of electricity which could pose a major impediment to electrification efforts. The target of reaching the 25% access level by 2010 is therefore seriously threatened by the inadequate availability of power once South Africa surpass its generation capacity by the end of 2007, considering the increase in power demand fuelled by rapid economic developments taking place there.

3.4 RURAL ELECTRIFICATION

At independence, Namibia's national grid was largely confined to major urban centres with smaller towns which were served by isolated diesel-powered power stations. Access to electricity was subsequently low particularly in rural areas prior to the commissioning of the rural electrification program which started in 1991. The Ministry of Mines and Energy as mandated by the Government of the Republic of Namibia spearheaded the electrification program with financial and technical support from NamPower. During the first phase of the rural electrification program, the main focus was to cover all major rural settlements. These main centres and settlements comprise institutional, commercial and domestic infrastructure, including at least some of the following: schools, clinics, hospitals, churches/mission stations, police stations, agricultural extension centres/offices, post offices, telecommunication infrastructure, commercial outlets, water supply infrastructure as well as formal and informal housing[15].

The rural electrification program started by covering Omusati, Ohangwena, Oshana and Osjikoto for the period 1991 – 1993 and was later followed by western Kavango during 1992 – 1993 and eastern Kavango (1993 – 1994). Thereafter, settlements in Otjozondjupa, Omusati, and later Karas andHardap during the period 1994 – 1995 and 1995 – 1998 respectively. The Caprivi region which is not connected to the national grid was covered during the second phase which took place in 1997.

3.4.1 Funding of rural electrification

The first phase of the rural electrification program was co-funded by the Government of the Kingdom of Norway. Other financial support came from grants and other concessional loans sourced from development partners mainly from Europe. The rural electrification program started shortly after independence in 1990 with the first grant support that came from the Norwegian Government and German Agency for Technical Cooperation (GTZ) and later with concessional loans from the European Investment Bank (EIB). The formative years of the rural electrification program focused on electrifying rural settlements of the most populated settlements in the

[15] Based on data contained in the Assessment of two Namibian Solar Home System Programmes: Socio-economic and technical evaluation, and comparison with grid electrification for the period 1996 – 2001 which was conducted by EMCON and NEPRU as commissioned by MME, PE and GTZ

northern regions and were later extended all other rural areas in other parts of the country. The major financiers of the rural electrification program over the years have been mainly:

Table 6: Source of funding

Funding Institutions	**Type of Funding**
• Development agencies (Norway, GTZ, UNDP/GEF)	• Grants (soft loans being considered)
• Ministry of Mines & Energy	• Budget allocation
• NamPower	• Balance sheet financing
• Konga Investment (MME funding)	• Revolving fund for solar systems
• Bank Windhoek (MME/GEF/UNDP)	• Public-private partnership (subsidized financing)
Source: compiled by author	*- (data collected from various reports)*

After the first assessment carried out as part of the Rural Electricity Distribution Master Plan of 2000, the Namibian Government projected that an annual investment of about N$50m will be required to realise the electricity target of 25% by 2010 for rural areas. However, budget allocation for the financial years 2000/1 – 2004/5 varied around N$20m – N$25m annually which was about 50% less than the projected investment needed to keep the electrification program on course.

NamPower on the other hand as the state-owned utility which was the technical executing partner of Government and co-financier of the rural electrification program injected during the period 1996 – 1999 about N$10m annually primarily covering the electrification of the commercial farms. This annual allocation was increased marginally to N$12.5m annually for the period 2000 – 2005. According to information obtained from the NamPower officials interviewed as part of this study, the European Investment Bank (EIB), Swedish International Agency (SIDA) and the African development Bank (AfDB) availed a loan subsidy of about N$200m for the rural electrification program to be redeemed over a period of 20years. This credit facility was part of the financing arrangements agreed upon for the 400kV inter-connector between Namibian and South Africa.

Table 7: Estimated Allocation to financing rural electrification

Funding Institutions	Approximate figures
• Development agencies	• Figures could not be obtained
• Ministry of Mines & Energy	• N$290m (1995 – 2005)
• NamPower	• N$110m (un-verified)
• EIB/AfdB/SIDA	• N$200m (credit facility) (*still available*)

Data collected from MME & NamPower records

3.4.2 Progress made with increasing electricity access level

By 2000, when the first Rural Electricity Distribution Master Plan was compiled to assess electricity access as well as plan the extension program forward, most if not all urban towns, peri-urban and other settlements in rural areas connected to the national grid with an electricity access in urban areas of about 75% whilst access in rural areas is about 12%. These figures still fall short of the targets set for 2010 of 25% (rural) and 95% (urban). According to the Rural Electricity Distribution Master Plan of 2000, the national aggregate electrification level is around 34%.

Table 8 and Table 9, below highlight the actual number of connections completed since 1991 until 2005 and the actual cost of reticulation. Analysing the date contained in the Rural Electricity Distribution Master Plan of 2000, it is difficult to determine the pace at which rural electrification program was implemented considering that the national official target was only assumed during the formulation of the White Paper on Energy Policy. Needless, to say, the Master Plan provides a useful guide in determining the pace of connection of rural areas to the either the grid or through provision of off-grid energy technologies.

Table 8: Electrification needs of rural localities - 2000

Region	Total Rural Localities	Total Un-electrified Localities	Future Grid connected	Off-Grid Areas
Kunene	290	285	247	38
Omusati	328	289	289	0
Oshana	182	152	152	0
Ohangwena	309	250	250	0
Oshikoto	285	245	245	0
Kavango	613	522	509	13
Caprivi	126	118	109	9
Erongo	110	100	90	10
Otjozondjupa	162	139	88	51
Omaheke	219	200	200	0
Khomas	26	16	13	3
Hardap	61	44	37	7
Karas	144	126	126	0
Total	**2 855**	**2 486**	**2 355**	**131**

Source: Rural Electricity Distribution Master Plan, 2000

Table 9: Electrification needs of rural localities - 2005

Region	Total Rural Localities	Total Un-electrified Localities	Future Grid connected	Off-Grid Areas
Kunene	914	897	128	769
Omusati	493	449	191	258
Oshana	200	160	107	53
Ohangwena	551	507	228	279
Oshikoto	591	551	170	381
Kavango	858	779	218	561
Caprivi	131	109	43	66
Erongo	327	306	52	254
Otjozondjupa	453	427	105	322
Omaheke	475	450	78	372
Khomas	62	43	18	25
Hardap	497	481	129	352
Karas	307	270	76	194
Total	**5 858**	**5 429**	**1 543**	**3 886**

Source: Rural Electricity Distribution Master Plan 2005

Table 10, indicate the total number of rural localities that were electrified as at year 2000 and it also highlight areas that requires future grid connection and those that are to be served by off-grid energy technologies.

Table 10: Actual Connections Completed between 1991 and 2005

REGION	Number of Connections	Value of reticulation cost (N$)	Mean cost per connection (N$)
Caprivi	3 832	5 028 469	4 849
Erongo	388	4 583 871	12 733
Hardap	375	2 317 849	7 136
Karas	1 237	6 525 715	10 009
Kavango	2 125	13 342 037	7 946
Khomas	90	1 053 406	11 763
Kunene	1 390	13 382 542	10 723
Ohangwena	2 510	18 731 000	11 840
Omaheke	927	8 623 757	10 559
Omusati	2 628	22 565 375	12 794
Oshana	2 016	12 522 078	6 787
Oshikoto	1 710	11 811 731	10 370
Otjozondjupa	1 085	7 634 809	7 059
TOTAL	**20 313**	**128 122 639**	**7 031**

Source: MME: Rural Electrification Distribution Master Plan 2000

According to the Rural Electricity Master Plan 2005, the cost of the rural electrification program as per the table above amounted to about N$ 128.1 million for the reticulation of the villages at an average connection cost of N$ 7 031 per connection. For the period 2001 - 2005, an additional 10 452 rural connections were provided and this translate to an average of 2 090 connections per annum. This is nearly double the average connection per annum made during the period 1991 and 2001 of 1 174.

An analysis of the Rural Electricity Distribution Master Plan 2000 and 2005 respectively revealed the following:

- For the period 1991 – 2000, 2013 households were connected to the electricity grid,
- For the period 2000 – 2005, the total number of localities electrified doubled compared to the period 1991 – 2000,
- estimated access level to electricity in rural areas stood at about 16%,
- The projected annual growth is significantly less than the projected growth of 3% needed to meet the 2010 target of 25% access level to electricity in rural areas,
- the number of off-grid areas increased from 131 in 2000 to 3 886 localities identified in the Master Plan 2005,

Table 11 - Access to Electricity by 2005

Region	2001 Census	Additional Rural Connections after 2001	Total in 2005
Caprivi	3 490	1 165	4 655
Erongo	19 960	500	20 460
Hardap	7 729	209	7 938
Karas	7 712	298	8 010
Kavango	3 368	1 400	4 768
Khomas	40 649	37	40 686
Kunene	2 745	304	3 049
Ohangwena	1 409	1 323	2 732
Omaheke	3 456	778	4 234
Omusati	1 499	1 419	2 918
Oshana	5 742	1 266	7 008
Oshikoto	4 121	668	4 789
Otjozondjupa	10 636	1 085	11 721
TOTAL	**112,516**	**10,452**	**122,968**

Another key element that the electrification program targeted was the connection of commercial farms to the national grid which was primarily funded by NamPower. According to data collected from NamPower which was collaborated by the Rural Electricity Master Plan findings, there are about 10 850 farms in Namibia of which the majority are within the commercial areas. According to the Master Plan 2005, access to electricity by a farm is defined as any farm to which or through which a distribution line of 33kV or less exists. It's estimated that connecting a farm to the distribution grid can cost between N$30 000 – N$35 000. Further to the earlier definition of access to electricity, considering that transmission lines and distributions lines runs through most commercial farmlands, it can therefore be deduced that a total of 2 988 of the 10 853 farms in Namibia have access to electricity which then translate into access level of about 27.53%[16]. This access level is comparatively higher than the average access for other rural settlements areas.

[16] The data/statistics were obtained from the Rural Electricity Distribution Master Plan 2005 and were verified with officials from NamPower that were responsible for the electrification of commercial farms.

Table 12: Access to Electricity of farms in Namibia's Commercial Farming Regions

REGION	Number of Farms	Number with Access to Electricity	Percentage with Access to Electricity
Erongo	637	127	19.94
Hardap	2319	564	24.32
Karas	1827	188	10.29
Kavango	45	0	0.00
Khomas	1206	529	43.86
Kunene	752	64	8.50
Omaheke	1214	534	44.00
Oshikoto	371	131	35.31
Otjozondjupa	2482	851	34.29
TOTAL	**10,853**	**2,988**	**27.53**

Source: Rural Electricity Distribution Master Plan 2005

One aspect that the Rural Electricity Distribution Master Plans included in the studies was the proximity calculations of households to the transmission or distribution grids. The cost of rural electrification is increased as a result of the distance that needs to be covered from the transmission grid to the point of connection at the settlement. According to the Master Plan 2000 & 2005, direct access can be defined as all households located within 500m from existing transformers. Proximity access is defined as the number of households within a distance of 10km from existing distribution lines. These measures can be used to approximate the rate at which access to electricity can be expected to grow if the revised plan is implemented as per the roll-out provided for (ibid).

Table13, indicate the direct and proximity access as determined in 2005 through the second Rural Electricity Distribution Master Plan and the projection for 2010. According to NamPower officials interviewed, the proximity calculations is an important element for the determination of future grid extensions as well as identifying areas that are to be targeted for off-grid electrification. This gives a clear projection as what the level of access to electricity is likely to be by the year 2010 and it also assist planners in determining whether the projected pace can be realised under the current institutional arrangements or whether new intervention measurers are required to speed up the process, (EMCON in Rural Electricity Master Plan, 2005).

Table 13: Direct and Proximity access for all the Regions and the total Country: 2005 and 2010

Region	2005					2010				
	Direct		Proximity		Total	Direct		Proximity		Total
	Number	%	Number	%	%	Number	%	Number	%	%
Caprivi	4 655	25.7	1 563	8.6	34.4	5 150	26.0	1 724	8.7	34.3
Erongo	20 460	70.7	770	2.7	73.4	20 559	66.6	828	2.7	69.3
Hardap	7 938	52.2	498	3.3	55.5	8 042	52.1	632	4.1	56.2
Karas	8 010	49.1	456	2.8	51.9	8 149	46.9	468	2.7	49.6
Kavango	4 768	14.5	8 403	25.5	40.0	7 224	19.8	7 175	19.7	39.5
Khomas	40 686	59.4	13 191	19.2	78.4	40 732	48.9	28 047	33.6	82.5
Kunene	3 049	22.6	1 264	9.4	32.0	3 268	22.1	1 377	9.3	31.4
Ohangwena	2 732	6.9	9 803	24.8	32.7	5 868	13.2	8 640	19.4	32.6
Omaheke	4 234	29.6	1 309	9.2	38.78	6 216	38.4	1 530	9.5	47.9
Omusati	2 918	7.2	12 114	29.9	37.1	5 896	13.5	9 435	21.6	35.1
Oshana	7 008	22.1	5 275	16.6	38.7	8 266	16.6	4 556	13.2	36.6
Oshikoto	4 789	14.5	7 270	23.5	38.9	6 539	19.0	4 556	13.2	32.1
Otjozondjupa	11 721	41.4	930	3.3	44.7	12 023	37.0	977	3.0	40.0
TOTAL	**122,968**	**32.0**	**62,846**	**13.8**	**45.9**	**137,932**	**32.3**	**69,945**	**12.4**	**45.2**

Source: Rural Electricity Distribution Master Plan, 2005

3.4.3 An overview on the progress made since 2000

An assessment of the projections made in the Rural Electricity Distribution Master Plan 2000 reveals that from the projection it made of electrifying 602 localities by 2005 and a total of 17 402 connections countrywide (including rural settlements), only 11 042 connections were completed by 2005. As earlier stated, in a nutshell, the 2005 target was based on targeting the 2010 targets for both localities and rural settlements. The table below as populated from the Master Plan 2005 findings, there is from a face value a basis as stated in the problem statement that the pace of rural electrification has been slow considering that the variance between planned and actual connections is significantly high.

Table 14: Comparison of Actual versus Planned connections: 2000 to 2004

Connection Type	Planned	Actual
Localities	602	148
Households	11 042	5 874
Businesses	4 880	2 374
Schools	338	114
Health Facilities	142	31
Boreholes	1 000	270

Source: MME: Rural Electricity Master Plan 2005

According to the summary in the Rural Electricity Distribution Master Plan 2005, "this is an indication that there was a slight underestimate of the number of households and businesses per locality and, less so, for schools and boreholes". A more theoretical assessment would however indicate that its was not just a matter of inadequate or ambitious planning but it was due to a number other factors such as the cost of connection increased with the weakening of the N$ against major international currencies such as US$ and Euro, equipment price increases, increased investment in security of power supply (investigation of new power generation sources such as Kudu, Baynes, Popa Hydro, Orange river mini-hydro as well as the Caprivi Link interconnection).

Table 15: Comparative assessment of grid and off-grid program

GRID	OFF-GRID
• Grid extension started 1991	- *Off-grid started in 1996*
• Target: socio-economic centres	- *Target: individual households*
• More than 2500 connections made (more than 500 villages electrified)	- *about 1000 solar systems installed*
• Approximate cost to date: N$290m	- *approximate cost to date: N$6m*
• Average cost per connection: N$8500	- *average cost per connection: N$8000*
• Beneficiaries do not pay capital cost	- *Beneficiaries pay capital cost* in *instalments (subsidized)*
• Beneficiaries pay for continuous consumption	- *Beneficiaries do not pay* consumption *cost*
• Limitless consumption	- *Limited consumption*

Data collected from officials at Ministry of Mines and Energy

CHAPTER 4

CASE STUDIES

4.1 AN AFRICAN ENERGY PROFILE

To better understand the dynamics of rural electrification in Africa and why several programs aimed at providing access of electricity to rural areas have not yielded the needed results, its important to conceptualise several underlying factors of power generation inadequacy, transmission infrastructural problems, funding, power demand scenarios, tariff and reform problems that in one way or another continue to be a stumbling block.

Although Sub-Sahara Africa has one of the largest potential fuel reserves in the world, it is worrying to note that the sub-continent still has the lowest access to modern energy. Nigeria is the world's 13th largest oil producer, with proven crude oil reserves and natural gas reserves estimated at 31.5 billion barrels and 4.5 billion cu m respectively, yet its effective generating capacity is less than 4 000MW for a population estimated at 120million. The sub-Saharan sub-continent possess some of the largest water courses in the world (Nile, Congo, Niger, Volta and Zambezi), and whilst hydroelectricity is by far the single largest source of electricity in a number of countries, yet these resources remain largely untapped[17]. It is estimated for example that:

- Cameroon has hydro potential of up to 115 000 MW and yet it installed hydro capacity currently stands at less than 800MW.
- The Democratic Republic of the Congo has a hydro potential which is by far the highest in Africa and one of the highest in the world. The Inga Dam (in the DRC) has for instance a hydro potential of 40 000MW of which about 95% remains unexploited. The hydro potential in the DRC is theoretically estimated at 1 400 TWh per year of which 55% is regarded as technically feasible. This is more than sufficient to meet the whole of sub-Saharan Africa's electricity consumption which currently is less than 100TWh per year (ibid).

[17] PriceWaterHouseCoopers (PWC) commissioned a desk study titled "Sub-Saharan Africa's Energy conundrum in 2004

- Apart from hydro potential, the region has vast energy potential in the form of bio-mass, geothermal, wind power, solar, etc but only a few countries have attempted to invest and exploit these energy sources.

One of the major technical obstacles is the region's generating capacity and transmission networks which were build mostly in the 1950s and 1960s and have by far outlived their economic lifespan. As a result of under investment in rehabilitating/refurbishment as well as continuous regular maintenance of these infrastructures, technical and non-technical losses exceed 20%, there are also constant power outages and power surges which are common features in many countries in the region. In addition to the technical constraints, there is the inadequate funding of the state owned power utilities which largely are monopolies and constrained by lack of access to investment capital. Tariffs are too low to recover the capital cost of running and maintaining the generation and transmission infrastructure.

This grim reality is one of the fundamental constrain to accelerating the provision of electricity the majority of the citizens in Sub-Saharan Africa in particular. The private sector has little appetite for investing in the energy sector particularly electricity because of several deterrents:

- Significant investment required for rehabilitation and catch up maintenance,
- Uneconomic and unbalanced tariff structures, which render electricity systems financially unstable, although reform is progressing well in many countries,
- Lack of creditworthy customers, be it government owned institutions, struggling industry, financially weak domestic consumers, or cash strapped distribution companies,
- Small markets, with the exception of Nigeria and the opportunities presented by the two regional power pools, one fledging and the other putative[18]

Whilst noting the un-affordability of grid extension, many developing countries have started placing much emphasis on renewable energy (RE) due to their technical

[18] Africa's only well functional power pool is the Southern Africa Power Pool (SAPP) which comprises of the 12 SADC states: Namibia, South Africa, Mozambique, Angola, Lesotho, Swaziland, Botswana, Zambia, Zimbabwe, Malawi, DRC and Tanzania. There is also progress in establishing the West African Power Pool (WAPP) which has been under discussion for over 20years.

applicability for providing electricity in remote rural areas far from the grid. However, despite the technical feasibility and gradual reduction of cost factors, there are several constraints to the applicability of renewable energy[19]:

- A lack of government support and commitment, toward policies to encourage renewable energy technology based in renewable energy systems,
- Cost disparities between grid connected and off-grid renewable applications,
- Insufficient incentives for private companies and investors to participate in the development and delivery of renewable energy,
- Inadequate regulatory functions applicable specifically to grid-connected and off-grid systems,
- A lack of creative public and private sector alliances to develop market based solutions to renewable energy,
- Undefined and ill-targeted subsidies and an absence of mechanisms to remove subsidies once the programs are sustainable,
- Difficulties for central government ministries and planners to actively involve local leaders, village chiefs, and town officials in renewable energy planning in order to facilitate locally driven strategies rather than central planning imposed policies and programs,
- Low regard for the explicit recognition of the value of linkages between rural electrification and rural development at the central planning level, and lastly,
- Inadequate programs for customer education, public participation and acceptance, and political acceptance of the role of rural electrification in economic development.

Despite these constraints briefly highlighted above, most of the countries mainly those in the Southern Africa Power Pool (SAPP), which is Africa's only functional regional power pool, there is steady progress on the road to reform. There are several reform initiatives taking place in Africa ranging from unbundling of the energy sector, tariff reform, and the establishment of regulatory frameworks, establishment of Independent Power Producers (IPP) and other restructuring efforts aimed at attracting much needed investment to exploit the largely untapped energy potential in the region.

[19] Summarized from the Case Study Report – Impact of power sector reforms on the poor

At regional level, the Southern Africa Power Pool has been vigorously addressing the energy situation in the region which was brought about by the lack of adequate investment in power generation. For the past 10 years or so, no new power station was built in any of the member states of the Southern Africa Development Community (SADC). The power demand in the SADC region has been increasing at a rate of about three percent per year, (SAPP, 2004). Unfortunately, there has not been a corresponding increment of investment in power generation during the same period. As a result, the power demand is expected to exceed the generation surplus capacity by 2007. This is a serious challenge for the SAPP to keep pace in providing new generation capacity with the rising demand and most importantly to avert a potential power crisis.

The total installed capacity in SAPP is about 53,000MW and the available or net capacity is about 45,000MW. South Africa alone generates about 38 000MW of this capacity. The generation mix in the SADC region produces about 74% from thermal plants, 20% from hydro, 4% nuclear and 2% gas and diesel, (SAPP, 2003; Eskom Annual Report, 2003; NamPower Generation Master Plan, 2006). This effectively means that SAPP will have inadequate generation surplus capacity. It is important to maintain generation surplus capacity to cater for load forecast errors and unplanned outages of generation and transmission equipment. The continued diminishing generation surplus capacity in the SADC region would have a negative impact on the economies of the region and potential investors would be frightened.

In order to ensure that the region does not run out of adequate generation capacity, massive investments in generation projects are required. The SADC region as a whole should come up with ways of attracting the private sector into generation and transmission projects. Political support to the SAPP initiatives on generation expansion is required, together with the marketing of the SAPP generation projects in all SADC countries.

Invariably, investment in the energy sector within the region has focused primarily on securing security of power supply as well as strengthening transmission networks. In August 2005, Namibia hosted the second SADC Regional Electricity Investment Conference which places particular emphasis on attracting foreign and regional

investments in the energy sector. All the projects that were marketed at this forum which attracted major international energy firms, regional and international funding institutions as well as development partners were those of generation and transmissions. Focus on rural electrification is yet to receive similar attention and priority even though at national level there are efforts and other initiatives that are being implemented to ensure the provision of wider access to energy resources.

In the case studies selected for this project, specific reference will be drawn on what efforts are being done in accelerating access to electricity not only to urban settlements but also to rural areas so as to stimulate socio-economic developments in the region.

4.2 RURAL ELECTRIFICATION – THE CASE OF SOUTH AFRICA

4.2.1 Country Profile

South Africa which has a population of 45million was accepted back as a member of the international community in 1994 when it held its first democratic elections. South Africa follows a parliamentary democracy. It is largely regarded as the economic powerhouse in Africa and its GNI per capita stands at N$17 500 (US$2 500) and is ranked 95th in terms of the GNI purchasing power parity but preceded by its neighbours Botswana (ranked 84th) and Namibia (ranked 89th). As is the case in Namibia, South Africa has also one of the highest income disparities in the world where about 13% of the population owns the bulk of the wealth whilst the majority still lives in “third world conditions”. The South African economy is still driven by mining, agriculture and of late services contribute about 60% of the gross national product (GNP).

4.2.2 Energy Profile

South Africa has an installed electricity generation capacity of 40 000 MW with an extended national grid spanning some 281 000km of high voltage transmission and distribution lines. By comparison, South Africa has the single largest energy generation capacity as well as consumption demand in Africa. In SADC, South Africa’s generation capacity exceed three-fold the total generation capacity of the whole region combined. Latest statistics indicate that ESKOM the national utility

owns about 96% of South Africa's generation capacity as well as the entire transmission network[20]. Distribution however is shared among Eskom (60% of sales, 40% of customers) and 235 municipalities. The National Electricity Regulator (NER) was established in 1995 and is tasked with the responsibility of regulating the industry in South Africa of which approving tariff is one of those key objectives as per the South African energy policy.

4.2.3 Electrification

Access to electricity in South Africa is one of the highest in Africa with approximately 68% of the population (30.8million) having access. In urban centres about 80% have access to electricity whilst in rural areas it is about 50%[21]. As part of the electrification drive which started with the advent of the new South Africa in the early 1990s, the state-owned utility, Eskom set a target of connecting about 700 000 new households by 1997. In 1994 after the first multi-party democratic elections were held and won by the ANC, the new Government embarked on a Reconstruction and Development Programme which was popularly known by its acronym "the RDP" and set a national goal of electrifying 2.5million homes by 1999.

At beginning of 2000, the target set under the RDP was met and brought the total number of new connections in South Africa over a period of 10 years to 4 million which represented an increase in access to electricity from about one-third of the population to about 70% by the year 2000. The target group of the electrification program was providing access and subsequent connection to rural schools and clinics. As a result, 4 000 rural schools were connected to the grid. In addition to that, more than 2 000 schools and 2 000 clinics were identified for non-grid electrification. With financial support from international development partners, about 1 344 rural schools and 496 clinics in South Africa have been electrified by tend of 1999 through the use of photovoltaic (PV) systems[22]. In total, the grid-based electrification program added a load of 750MW to the grid. The National Electrification Forum (NEF) of 1991 –

[20] Data taken from ESKOM, Annual Report 2003
[21] Data taken from ESKOM, Annual Report 2004; DME, 2003; South Africa At a Glance, 2005
[22] Data obtained from SEPCo Document library and can be accessed on their website: www.ises.org/sepconew

1993 was a series of consultative forums which brought a wide spectrum of stakeholders in the area of electricity provision and consumption[23].

Table 17: Access to electricity level in South Africa

	Access to electricity	**Not electrified/ Backlog**	**Inhibiting Factors**
National	**72%**	**28%**	
Excl. KZN & EC	70%	30%	
Kwa-Zulu/Natal	64%	36%	Topography, high cost per connection, Lack of bulk infrastructure
Eastern Cape	55%	45%	

Table18:- Extend of electrification in South Africa by 1999

Province	**Percentage (%) Electrified**	
	Urban	**Rural**
Eastern Cape	84.17	31.94
Free State	82.65	60.28
Gauteng	75.08	53.70
Kwa-Zulu Natal	80.25	30.34
Limpopo	86.00	50.55
Mpumalanga	66.88	75.36
Northern Cape	82.55	74.75
North West	85.53	54.18
Western Cape	86.27	64.91
Total	79.81	46.29

Funding for the electrification program came mostly from Eskom either through direct investment in Eskom's own electrification projects or through transfers to an electrification fund that the National Electricity Regulator (NER) allocated to municipalities. Funding was also sourced through cross-subsidies from other customer

[23] Taken from an abstract of Kotze (2000, 2001) quoted in a report from SEPCo: sustainable energy policy concepts: www.ises.org/sepconew

categories. Funds were also provided by the Development Bank of Southern Africa (DBSA) which was channelled through municipalities. In 2001, the Government took over the responsibility of providing funds for the electrification program through a National Electrification Fund was created in the Department of Minerals and Energy. This initiative was funded by the National Treasury[24].

What is interesting from the South African experience is that:

- at a national policy level, it has been a policy directive that a portion of the capital cost of connections should be subsidized and households should pay only nominal connections fees. In later years, the subsidy eventually was extended to cover for the entire cost of connection as well as portion of the operating costs,
- The energy policy which was approved in 2003 direct local governments to identify poor electricity users with a record of consuming less than 150kWh of electricity monthly. Such households then qualify for a free allocation of 50kWh of electricity per month. This type of subsidy is referred to as "free basic electricity" (FBE) and is deemed to be adequate to meet households electrical needs for lighting, media access as well as kettle and ironing,

- However despite the aforementioned benefits, the revenue from the electrification particularly in the low-income groups has remained relatively low. At the beginning of the electrification program in South Africa, the authorities estimated that the average consumption of newly connected, low-income households would be 350kWh per month but the actual average after the connection was less than one-third of the estimated figures. The low consumption is as result of low-income households having less electrical appliances compared to medium and upper-income households.

4.2.4 Challenges and constraints of the grid-electrification program

It is encouraging to note how South Africa managed to implement what was initially regarded as an ambitious electrification program. The South African electrification

[24] Most of the data was collected from a World Bank case study on Power Sector Reform: Impact on the Poor and whereas other data came from another case study conducted by SELPCo which looked in rural electrification programs in South Africa, Cuba and Mexico.

program twined a grid-based and off-grid based electrification which yielded record connection as it exceeded the original targets. It is compelling to note the speed at which the electrification program was implemented considering the political stability at the time particularly during the period of inception of the program in 1990 – 1996/7.

Despite having exceeded the targets of connecting households to the national grid in particular, there were several challenges that faced the grid-electrification program (Kotze, 2000):

- The electrification program is not commercially viable, since operating costs requires subsidization,
- Financing such a program from inside the electricity supply industry places an undue burden on the utility (Eskom) and jeopardises the sustainability of the utility,
- Such financing (sourced from within the sector) is not transparent and is difficult to co-ordinate with other infrastructure investment programs,
- Rural areas are particularly costly and difficult to electrify,
- It is imperative to consider a suite of capacity differentiated supply options commensurate with load requirements in order to contain costs,
- Non-grid technologies should be used in all cases where electricity supply through a grid connection is too expensive.
- Substantial capital subsidies and soft loan funding are prerequisites to drive non-grid technology applications. In addition, tariffs need to be restructured such that operating costs are covered.

The latter two lessons that can be learned from the South African experience as summarised above indicate the challenges that many African countries are facing in widening the access to electricity to rural areas. The absence of well designed non-grid technologies remains an obstacle in accelerating rural electrification. The benefits of the electrification were much lower than initially anticipated. As earlier stated, access to electricity has been proven not to be the most important input for stimulating local economic development.

4.2.5 Design of off-grid electrification in South Africa

In addition to grid electrification, the Department of Minerals and Electricity (DME) recognised the importance of investing in off-grid electrification so that remote rural areas can also benefit from the national initiative of providing wider access to electricity. The off-grid electrification program in South Africa focused largely on provision of energy technologies that are affordable, efficient and effective in meeting the energy demands. This program was implemented in 1999 through a competitive tendering process and was divided in what is termed as off-grid electrification concession areas. Six consortia consisting of mainly private sectors entities were identified as the concessionaries (Nauman, Bank 2000, in SESPco bulletin). Five private firms were granted concessions to provide off-grid electricity services in specific remote and rural areas of the country: RAPS/NOUN, SolarVision-Renewable Energy Corporation of Norway, EDF-Total, Eskom-Shell Solar, and Renewable Energy Africa[25].

Off-grid service providers are now being encouraged to improve poor rural households' access to a range of fuels, such as gas or kerosene, in addition to solar home systems and mini-grid systems. The off-grid concessionary system was designed in such a way that about 50 000 households per concession area have to subscribe to electricity service of the concessionaire, in order to run it profitably for the concession holder. The concession holder was and appointed and commissioned to energise the area (region/concession area) including the marketing, installation, maintenance and after care sales service for Solar Heating Systems (SHS) on a commercial basis. The concession holder therefore enjoyed the monopoly advantage in a given concession area so as to enable them to run and manage the electrification system at commercial and profitable basis though still marginal compared to grid connection.

4.2.6 What can be learned from the South African Experience?

In summary, the South African electrification program highlights a number of issues than could be of relevance to Namibia (see table 16). At stakeholder level, one of the

[25] Taken from the case study report: Power Sector Reforms in Africa: Accessing the Impact on Poor People

various propellants of accelerating rural electrification is the extensive consultative process that the National Electrification Forum (NEF) in South African undertook during 1991 – 1993 by involving several stakeholders in the field of electricity provision and consumption. An important outcome of the NELF deliberations which was aimed at redressing the inequities in access to electricity in South Africa was the agreement between the electricity supply industry and Government to accelerate the household electrification program, (Kotze, 2000). This initiative substantially reduced the backlog experienced by the historically disadvantaged communities in both urban and rural areas, (ibid).

Table 19: South Africa's institutional arrangements for rural electrification

Institutional Arrangements	**Strategy/Benefits**
• Funding	• Eskom, National Electrification Fund, National Electricity Regulator, DBSA funds channelled through municipalities,
• Concession program	• 50 000 households demarcated in concession areas which was allocated to participating consortia comprising of Eskom and private firms
• Affordable technologies	• Combining grid and Off-grid
• Subsidization	• Portion of capital cost of connection were subsidized, • Cross-subsidy of certain categories of customers,
• Clear targets (Government directive)	• RDP – prioritisation of rural electrification
• Free basic electricity (FBE)	• Free allocation of 50kWh of electricity per month
Source: Author (*summary of case study*)	

Another conclusion that can be drawn from analysing the South African rural electrification process is that:

- The South African government prioritised programs of widening access to and affordability of electricity, (World Bank, 2000). As earlier stated funding for rural electrification was sourced independently from the power sector although Eskom, National Electricity Fund as well as Government injected considerable capital in the program.

4.3 RURAL ELECTRIFICATION – THE CASE OF ZAMBIA

4.3.1 Country profile

Zambia is a landlocked country with a land area of 740 000km2 with a population of 11million. Its is slightly smaller than its neighbour Namibia in the south-west and its other neighbours are Angola, Mozambique, Malawi, Botswana, Zimbabwe, Tanzania and the Democratic Republic of the Congo (DRC). It has therefore a multitude of foreign relations in the region due to the number of countries bordering with it. The Zambian economy is mainly based on agriculture and mining. Foreign export earnings are heavily dependent on the exports of copper, cobalt and zinc which combined account for about 85% of the country's exports earnings. Although Zambia is also endowed with a tropical upland geography with unlimited agricultural potential, commercial agro-industrial operations only started taking shape of late in an economy which for years was dominated by copper hence the naming of one of the provinces as "Copperbelt".

In spite of the significant potential in both mining and agriculture, Zambia is still ranked as one of the poorest countries in the world. However of late, it has started recording an annual growth of about 5%. With support from the IMF, World Bank and other international donors, Zambia has implemented a program of structural adjustment (commonly known as Structural Adjustment Programs – the SAP's), which focuses on both macroeconomics management and restructuring of specific

sectors of the country's economy[26]. Some of the reforms were aimed at reducing state participation in and control of economic activity.

4.3.3 Energy Sector Profile

Zambia has an installed generating capacity of 1776MW of which 1690MW is hydroelectric and approximately 86MW is thermal[27]. Biomass energy still represents more than 70% of final energy demand in the country, of the country's 1999 total of 4.6million TOE of final demand, about 3.6million TOE was firewood or charcoal[28]. Household used the majority of biomass energy, some 80% of the firewood and about 99% of charcoal. Zambia has reserves of coal and was once producing more than 500 000 tonnes annually although production has fallen of late due to the closing of a coal-fired power plant and the reduction in smelting operations.

Electricity on the other hand remains the prevalent form of commercial energy, with consumption equivalent to more than 500 000 TOE per year (7 773 GWh). Zambia has two power plants, the Kafue Gorge and Kariba North, and account for more than 90% of total power generation. The Zambian Government created the Copperbelt Energy Corporation and Kariba North Bank Power as separate companies as part of the privatisation program whereas the rest of the power sector assets are under the management of the national utility ZESCO. The Government has also approved private sector participation in ZESCO through concessioning, and currently it's looking for a transaction advisor that would help in identifying a concessionaire.

Considering that electricity tariff are one of the lowest by world standards, compounded by technical losses in transmission and distribution exceeding 15% and non-technical losses estimated at around 18 – 20%, revenues received by ZESCO are not sufficient to maintain the network infrastructure and extend the grid to new service areas (ibid). Consequently, internal cash generation for system expansion and rural electrification is almost nothing. Zambia's strength in the energy sector is the fact that it is a net exporter of electricity. Zambia exports electricity to Zimbabwe,

[26] Some of the data summarised from a Case Study conducted on selected African countries by CORE International Inc. – A USAID Energy and Environment Training Partner. The Desk Study Report – Rural Electrification Options in Zambia.
[27] SAPP Annual Report 2004, ZESCO 2005 (REIC – 2005)
[28] CORE International, Inc. 2002

South Africa, Botswana and north-east Namibia (the Caprivi region which is not connected to the Namibian grid).

4.3.4 Electrification

Although Zambia is regarded as a net exporter of electricity, it is estimated that less than 20% of its population has access to electricity and in rural areas the access level is as low as 2%. Contrary to the South African experience which has by far exceeded levels in other countries in the region, Zambia's rural energy needs is not much different from many other countries on the continent where rural areas remains largely neglected as far as electricity provision is concerned. The cost of electrifying rural areas through grid-connection in Zambia is higher than in high-density urban areas. Zambia has attempted to provide off-grid electricity to rural areas through the use of renewable energy such as PV systems. Off-grid technologies are therefore more appropriate for providing electricity to dispersed villages or clusters of villages which largely has a low demand making grid connection commercially unviable.

One of the principle objectives of the Zambian government is to increase access to electricity for its people through a program encouraging participation by the private sector. Zambia unlike Namibia has not yet embarked on a Rural Electrification Master Plan but there are discussions between the Zambian Government and SIDA (Sweden) to provide technical assistance for the preparation of the first Master Plan. One of the main focus is to investigate the utilisation of applicable renewable energy technologies including solar photovoltaic systems, micro hydro schemes, domestic production of ethanol from sugar cane, and a viable fuel wood program (CORE, 2002). Two policy instruments are in place, the National Energy Policy, 1994 and the Electricity Act, 1995 which were drawn up by the Ministry of Energy and Water Development (MEWD). Both these policy/legislative instruments were aimed at increasing access to electricity to households, and to develop cost effective electricity generating sites for domestic as well as export markets (ibid).

In a nutshell the following developments on rural electrification have taken place in Zambia:

- In 1998, a framework of incentives for private sector investors was developed. Private investors in rural areas are given better incentives than those in urban areas,
- In 2000, seven projects were funded to extend electricity to seven provinces in Zambia. These projects were funded by the Zambian Government under financing from several bilateral donors,
- The Zambian Government established a Rural Electrification Fund (REF), financed by putting a levy on electricity supplied by ZESCO. This Fund however provide limited resources of about US$5 million annually, for addressing rural electricity requirements of the country,
- Zambia has started considering the extension of rural electrification by introducing renewable energy technologies,
- Twenty three (23) rural electrification projects had been completed by 2000, of which sixteen (16) projects involved extending the national electricity grid with funds from the World Bank. Seven projects where funded by the Government supported by the installation of solar photovoltaic equipment in remote rural areas targeting schools and rural health centres,

Table 20: Institutional arrangements for rural electrification in Zambia

Institutional Arrangements	**Strategy/Benefits**
• Funding	• Rural Electrification Fund (REF) • SIDA – pilot solar PV project
• Electrification projects	• Swedish Government • Energy Services Companies – solar electricity services to 400 homes, funded by Swedish Government
• Affordable technologies • Subsidization	• Embarking on grid extension through renewable technologies • Combining grid and Off-grid • Portion of capital cost of connection

	were subsidized,
• Clear targets (Government directive)	• Cross-subsidy of certain categories of customers,
• Free basic electricity (FBE)	• RDP – prioritisation of rural electrification • Free allocation of 50kWh of electricity per month
Source: Author (*summary of case study*)	

4.3.4 Lessons that can be learned from the Zambian experience:

Looking from the abovementioned projects that the Zambian Government initiated as part of the rural electrification program, it can be deduced that funding sourced from development partners such as the Swedish Government, SIDA, World Bank and other institutions played a catalyst role in the implementation of the program.

Although Zambia has one of the lowest access to electricity level in the region, recent developments with support from international development partners as part of the reform process in that country, there is several lessons that could be of relevance to the Namibian Rural Electrification program. Of interest from the literature material drawn from the Zambian experience, renewable energy technology applications have not been a major component of the rural electrification exercise and consideration of various off-grid energy technologies is still relatively a new phenomenon.

CHAPTER 5

CONSTRAINTS AND PROSPECTS OF ACCELERATING THE IMPLEMENTATION OF RURAL ELECTRIFICATION IN NAMIBIA

In the earlier sections, an overview was provided as to the current level of access to electricity in Namibia in comparison to for example South Africa which has exceeded its target in a record time. In this Chapter, the focus is on identifying and analysing in perspective the possible challenges that impedes the acceleration of the rural electrification program and what institutional arrangements should be strengthened or introduced to accelerate the rural electrification program in Namibia.

5.1 AN ASSESSMENT OF THE ENERGY POLICY FRAMEWORK

5.1.1 Energy Policy objectives in context

According to Haanyika (2005:10), some of the problems affecting the expansion of supply systems in rural areas relates to inadequate policy instruments that should drive the mobilisation of resources, stimulation of stakeholder participation, creating an enabling environment for private sector investment, independent regulation as well as the introduction of appropriate technologies.

The White Paper on Energy (1998) provide a broad-based overview what Government's policy objectives on electricity and that of improving access to electricity in both urban and rural areas. The Policy identified three key commitments which Government pledged in realising the objective of improving access to electricity, namely:

1. *Government will ensure that licenses for distribution of electricity in urban areas under the Electricity Act (2000), include provisions, such as electrification targets and a fair tariff structure, that facilitate increased access to electricity among low-income consumers;*
2. *Government is committed to continuing the rural electrification program using transparent planning and evaluation criteria for new projects;*
3. *Government will pursue alternatives to donor funding to mobilise sustainable levels of financing to continue the expansion and supply of electricity.*

Financing will be channelled through an electrification fund to be created for both grid and non-grid electrification projects.

In addition to the above, the Policy further states that "*Government will promote a dialogue with private investors and financiers with a view to facilitating economically viable and competitive investments in the electricity sector. It will also ensure the establishment of the necessary legal, regulatory, fiscal and environmentally frameworks to create a favourable investment climate*". Another key commitment under the Policy which Government committed itself was that it will cooperate with the electricity supply industry, the private sector and Namibian education institutions, to create a sufficiently skilled human resource base to sustain the management, operation and development of the electricity sector.

In analysing the above key policy commitments, it is important to note that the Energy Policy was formulated seven (7) years after the Rural Electrification program started as well as during the commencement of the first National Development Plan (NDP). Several institutional processes and reform in the energy sector took place shortly thereafter which in one way or another had an impact on the realisation of some of the objectives highlighted above. Part of the restructuring of the electricity supply industry included the establishment of:

- the Electricity Control Board (ECB),
- Regional Electricity Distribution companies,
- Single Buyer model (which is currently being reviewed),
- Premier Electric (Pty) Ltd, a subsidiary company of NamPower which took over the distribution functions from NamPower as the utility was now responsible for only the generation, transmission and trading of electricity (import and export).

5.1.2 Achieving the Energy Policy objectives

According to a study commissioned by MME, Premier Electric (Pty) Ltd and GTZ which was conducted by EMCON Consulting Group in association with NEPRU in 2003, the targets aforementioned as contained in the Energy Policy "…are ambitious when considering the extent and scope of the remaining electrification programme

and the escalating inflation rate since 1997". In realistic terms, the target is achievable under a given environment where resources are adequately provided. In a policy context, in many cases, policy results (may) differ drastically from the intended goal or objective, (Wissink, 1990). In this case, the policy framework provided key areas that were envisaged for implementation in meeting the set objective. Lynn (1980:9), describe the policy process as "that complex set of events that determines what actions government will take, what effects those actions will have on social conditions, and how those actions can be altered if they produce undesirable outcomes". In analysing Namibia's Energy Policy, there is a need to take into context the prevailing conditions in which the rural electrification process has been implemented. In this particular case, certain policy issues have not provided the necessary impetus in realising the intended results in the given time period. Lynn (1980:11) further augment that the point that an existing policy may create a demand for other policy, and therefore, no policy is ever complete. In fact, policy making is a changing and continuous process, (Theodolou, et.al, 1995). To a certain extent most of the policy commitments contained in the Energy Policy of 1998, have been realised to such as the establishment of a regulatory framework, the continuation of the electrification program, compilation of periodic electricity distribution Master Plans, identification of other funding sources in addition to the Government budgetary allocation, NamPower and donor sources.

However, it is yet to be seen to what extent Government has managed to create a favourable investment climate to attract private sector participation in rural electrification. The South African experience as discussed in Chapter 5 indicate that, private sector participation in rural electrification was achieved through the introduction of the concession approach as well as by allowing the private sector investors to operate their business participation in a commercially sustainable and return driven manner. This approach was however carried out by introducing subsidies so as to keep the provision of electricity to rural communities affordable. In the Namibian case, the Energy Policy makes provision of an Electrification Fund which has not yet been established. The Energy Policy made provision for the establishment of such an entity through which financing of grid and off-grid electrification projects where to be channelled. The electrification levy could have been a stimulant for the acceleration of the rural electrification program in Namibia.

Zambia and South Africa created Rural Electrification Funds and this allowed for subsidies to be made available to ensure the affordability of electricity to the poor who are largely confined to rural areas. The Energy Policy acknowledged that unless a sufficiently dedicated capital base is established, it will not be possible to continue with the electrification program. The current backlog is a testimony to the fact that not adequate funds have been made available over the years to keep the program on course of reaching the projected target of an annual growth of at least 2 – 3%.

With regard to capacity building, although the Policy is clear on this objective which is an essential variable in sustaining, managing and operation of the development of the electricity sector, the skills gap has not yet been adequately addressed. Several institutions only started investing in education through the awarding of scholarships and bursaries to students to pursue technical-oriented courses in the field of electrical engineering and others. NamPower, Energy Fund, NamCor, ECB and several local engineering consulting firms are current providers of scholarships. Even though there is considerable progress in the area of capacity building through the provision of opportunities for students to pursue academic studies, there has not been corresponding investment in local capacity building at rural level. The application of new renewable energy technologies in rural areas will require skills transfer, technology awareness so as to ensure that the electrification of rural areas can be accelerated. The Energy Policy is silent on this aspect.

5.1.3 Impact of the restructuring of the Electricity Supply Industry (ESI)

Another element that the Energy Policy did not fully address was the relation between the restructuring of the electricity supply industry and rural electrification. The establishment of the REDs had major impact on rural electrification as there was no role clarity between NamPower and these new entities as who should now be responsible for rural electrification. NamPower officials that were interviewed indicated that the ESI restructuring process had a major effect on the rural electrification and this contributed significantly to the current backlog. Noting that rural electrification is by and large economically not a viable business undertaking, the REDs with little capacity both in terms of financing, technical and human resource, are not in a position to assume such a responsibility of providing access to electricity to rural communities in their constituencies. NamPower on the other hand

is no longer in the distribution sector; hence it is difficult for it to commercially justify its investment in this sector whilst it's faced with looming electricity deficits. NamPower's priority is not to investment in huge generation and interconnection projects. These issues need to be addressed through a clear policy framework which will protect the interests of both stakeholders. One approach is to vigorously look at other alternatives of sourcing funding for rural electrification.

In summary, there is a need to revisit certain aspects of the Energy Policy particularly with reference to improving access to electricity, promotion of investment in the electricity sector, capacity building to alleviate resource constraints in the electricity sector, and to certain extent electricity sector governance.

5.2 FINANCING RURAL ELECTRIFICATION

During the past 15years of the implementation of rural electrification in Namibia, was hampered by several institutional constraints and challenges. Some of the constraints relate to technical, financial and other institutional barriers and they are amongst others[29]:

- a lack of financial and skilled human resources,
- lack of role clarity in the public sector and the electricity distribution industry,
- limited knowledge about the rural households income and energy use patterns,
- inadequate policies/a less priority on power sector reform programs,
- limited financing and the business not attractive for private investment initiatives,
- limited applications of alternative technologies such as solar, wind power, etc.
- low electricity demand and consumption that make the distribution thereof commercially not viable and not sustainable,
- high cost of grid extension and connecting individual consumers that many a times are dispersed, inaccessible, etc.

[29] NamPower Annual Report 2001; NamPower Business Plan 2003 – 2006; MME – Rural Electrification Distribution Master Plan 2005

- limited financing resulting from the business not attractive for private investment initiatives,
- limited applications of alternative technologies such as solar, wind power, etc.

According to feedback obtained from officials that were interviewed from the Ministry of Mines and Energy as well as NamPower, the slow pace of the rural electrification can be attributed to several institutional constraints such as:

- Inadequate funding,
- Lack of access to capital,
- Lack of private sector investment,
- Inadequate subsidies,

Central to the above stated constraints is the inadequate funding that has been injected in the rural electrification program. It has been highlighted in earlier Chapters that the high cost of electrification, low demand/consumption and limited affordability on the part of consumers renders rural electrification largely unprofitable and thus unattractive to private sector investments. Namibia with its unique landscape, dispersed and low population make rural electrification more expensive particularly with the utilisation of conventional grid extension. The rural electrification program is largely funded by the Government, development partners and NamPower. No private sector investments have taken place despite the reforms of the ESI which has made provisions for the promotion of non-public sector participation in the program. It is undeniable that public sector funding alone would be adequate to meet the needs of rural electrification considering that concessional loans and other funding arrangements from development partners are dwindling over time. To reach target set by the Energy Policy of 25% by 2010, Government projected in 1997 an annual investment of about N$30 million and more for the implementation of the rural electrification. For the 2000 – 2005 period, Government resolved to allocate annually N$50 million to the program but actual allocation has been ranging from N$20 – N$30 million a year. For private sector financing, rural electrification and distribution in general is widely regarded as a loss-making business which is usually left to state-owned utilities or government departments to implement due to high investment risks compounded by low profitability, (Haanyika, 2005; Kotze, 2001). The South African

experience suggest that despite the common belief and perception of commercial non-viability of rural electrification investments, there are strategies which can propel private sector participation and investments on the basis of still ensuring a profitable business. As for Namibia, there are several opportunities for private sector investment primarily in the area of off-grid electrification. Solar PV systems as the most common renewable technology used in Namibia, a conducive environment which provides for incentives should be created to encourage the private sector to get involved in the distribution, installations and maintenance of off-grid technologies. Where adequate technical capacities exist, the private sector can engage in research and development so that unique tailor-made technology solutions can be manufactured locally so as to reduce the cost of the products which in return will make it more affordable to the rural consumer.

5.3 TECHNOLOGY OPTIONS

Rural electrification in Namibia was largely based on grid-extension as explained in Chapter 4 of this study. Considering Namibia's landscape and the dispersed nature of the settlement areas both urban and rural, grid extension to remote areas will remain a costly option to undertake even if adequate financial resources have to be mobilised. According to Haanyika (2004), the management and operations of large and integrated power systems call for high levels of technical and management skills not readily available in developing countries currently facing rural electrification problems. Large power system operators are dependent on economies of scale as opposed to scope and therefore, when involved and given choices in rural electrification, the companies tend to focus on grid extensions even when non-grid technologies are technically viable, economically feasible as well as more environmentally friendly, (Ramani, 2002; Haanyika, 2005). What Namibia need is the investment in more economical and sustainable, affordable technologies that can be implemented with much ease in rural areas.

The Namibian Government through the Ministry of Mines and Energy with support from UNDP/GEF and NamPower is currently pursuing the renewable energy technology options of providing electricity access and actual connection to remote rural communities that are less likely to be connected to the grid. Renewable technology options such as solar photovoltaic, mini-hybrid and other technical

solutions are still under piloting and expensive due to the capital cost required to acquire and set them up. Several technology options have been identified in Namibia of which the following were piloted on:

a. Solar Photovoltaic systems
b. Solar Heating systems
c. Mini-hybrid technology

Table 21: PVC and SWH systems used in Namibia

Technology	**Funding**	**Benefits**	**Constraints**
PVC	MME – revolving credit through Konga Investments	Viable option for off-grid electrification, Low maintenance cost, Installation less complicated	High initial capital, Lack of skills in maintaining infrastructure in rural areas
SWH	GEF/UNDP/MME Bank Windhoek (Renewable Energy Fund)	Long-lasting (20yrs), electricity cost savings, essential tool for power demand management	High initial capital
Source: author			

The most common renewable technology that has been implemented in Namibia is the solar photovoltaic funded mainly by Government with support from various development partners. This program is executed through a revolving credit scheme managed by Konga Investments. Another program that the Ministry of Mines and Energy embarked upon with support from Global Energy Fund (GEF) and UNDP is the solar water heating system which has been used in many parts of Namibia over the past 20years. According to feedback obtained from officials in the Ministry of Mines and Energy, this technology option is expensive as it requires huge capital but it does however offers long-term savings on electricity costs. According to the analysis of the data collected and interviews held with officials in the Ministry of Mines and Energy as well as NamPower, there are several barriers that make investment in renewable energy difficult, which include amongst others:

- the un-affordability of the renewable energy technology by the rural consumers,

- lack of confidence in the new technology which has to compete with people's desire to have conventional electricity as well as other forms of energy such as biomass (fossil fuel),
- lack of access to other affordable renewable energy resources,
- technical problems and limited local expertise to service and maintain the infrastructure,

Off-grid electricity systems are desirable but these technologies are expensive for many rural communities in developing countries and the institutional constraints to the rural application of renewable technologies go beyond technological constraints. The best role for Governments in the area of off-grid is to restrict themselves to assessing and prioritising various technologies and focusing on consumer education, information dissemination, pilot project demonstrations, and building an overall political acceptance of these technologies at village/district level with extensive involvement of village/community leaders, farmers unions, and the local industry groups, (CORE, 2005).

5.4 NON-CONVENTIONAL INSTITUTIONAL ARRANGEMENTS

Given the current backlog of providing wider access to electricity in Namibia due to the various constraints that have been illustrated in various sections of this paper, such as low density demand, high infrastructure development and maintenance cost, low consumer acceptance, low levels of cost recovery/investment return, and the lack of finance, it has become imperative to identify other institutional arrangements in addition to the existing instruments in order to accelerate the rural electrification programme in Namibia. Rural electrification programme was designed along the conventional methodologies of primarily employing grid based technologies. Available literature analysed for this paper indicate that the conventional approach alone is not sustainable. A broader view of rural electrification needs to be adopted by energy planners, (CORE, 2005; Haanyika, 2004; World Bank, 2001; ITDG, 2000; Karekezi, et.al. 2003).

Studies conducted in other countries notably those commissioned by the World Bank and other international development agencies suggest that for investment in rural electrification to be meaningful and viable, it is important to consider new approaches

which in many instances are a combination of technology, financing, policy instruments and other non-conventional arrangements. The World Bank Report (2001), identified several issues that can be considered when planning or implementing rural electrification[30]:

- There is a need to identify economic limits to grid extensions as well as identify the economic potential of lowering cost options and alternative energy sources,
- Commercial viability of rural electrification should be determined to assure the sustainability thereof,
- A rational system of recovery should take into account capital investment costs, level of local contribution and participation, number and density of consumers in rural areas, the likely demand for electricity as well as determine the willingness to pay as well as assessing the payment capability of the recipient communities,
- The tariff regime should ensure that rural electrification program is financially sustainable and will not drain operational resources which could threaten the expansion of the program to other areas,
- The tariff structure set by the regulator need to ensure that any subsidies are fair, equitable and sustainable. A "good" subsidy schemes (when applied) enhances access for the poor (improving the quality of life/reducing energy expenses); sustains incentives for efficient delivery/consumption and must be practicable within the financial/human resource constraints of government and/or the power utility. Generally, experience elsewhere in the world has proven that successful subsidy programs encourage the rural electrification business. The envisaged Electrification Levy could be a useful mechanism of generating revenue that can be used to finance mainly off-grid technology applications in remote areas in Namibia.
- Construction/operating costs of rural electrification should be minimised as much as possible. Technology and available standards should be assessed

[30] Findings/analysis taken from various sources: World Bank Group Report on the Impact of power reforms on the poor; Africa Region Findings – No: 177, February 2001; ECB Transmission Pricing Methodology; NamPower Business Plan 1999 – 2003; Private Participation in Isolated Grids in Mozambique, Yuriko Sakairi, National Resources Forum, published in the UN Journal, Vol. 24, 4 November 2000; Case Study: Thailand's Approach to Rural Electrification Voravate T and Barnes D.F, April 2000

during the planning stage and where practically possible deploy low-cost equipment without compromising on technical quality. Innovative technologies/approaches and local suppliers should be considered. There are several other approaches of reducing connection costs.

- The provision of financing to spread the costs of connection fees over an extended period should be considered or alternatively connection rates can be lowered to make it affordable to the poor, so that the benefits of electrification may reach larger number of people. Arrangement for financial assistance for the credit/hire purchase of electrical appliances should be considered to make electrification meaningful. Providing access to poor people who cant afford to purchase electronic appliances will likely not see the relevance of being connected.

It should also be noted that projects are more likely to be viable and sustainable if local stakeholders are involved in their design and implementation. This analysis was collaborated by opinions obtained from officials from NamPower and Ministry of Mines and Energy who were interviewed for this study. The World Bank study suggests that one way to ensure the involvement of local stakeholders is by setting up Rural Electrification Committees to help assess the level of demand, educate consumers, and promote wider use of electricity. NamPower has over the years been drawn into conflicts with commercial farmers in particular during construction of transmission lines as they at times refused to provide right of way for the construction and maintenance of the electric lines running through their farms. In discourses around sustainable rural development ‘participation’ has become a widely advocated methodological principle for intervention practice, and a range of participatory methodologies, methods and techniques have been proposed in order to operationalize it, (Chambers, 1994a; 1994b). Participation of local communities in the rural electrification program either during the planning or execution process is vital. According to Pretty (1994), there are several distinct approaches to participation, namely, ‘participation by consultation’, ‘participation in information giving’, ‘self-mobilisation’ or ‘interactive participation’. The establishment of appropriate institutional and organisation procedures for project planning, financing, procurement of goods and construction services can help facilitate the successful implementation

of rural electrification projects in rural communities. The South African experience indicate the usefulness of establishing a Rural Electrification Committee which can assume certain facilitation, mobilisation, new technology promotions, assessment and monitoring responsibilities. In Zambia, emphasis is being placed on involving local communities in the planning and execution of rural electrification. Kenya, Ethiopia, Tanzania and Uganda have also introduced programs of ensuring the full participation of local communities, NGO's and the business sectors in the provision of electrification to the communities through the application of mainly off-grid energy technologies, (Holland, R, 1999, et al).

The Thailand experience indicates that the recipient communities can contribute capital or labour, thereby helping to defray the cost of the program[31]. The recently conclusion of the first phase of the Tsumeb – Oshivelo – Ondangwa railway project is a clear testimony of how capital projects can be accelerated by involving local communities in the execution thereof. As for rural electrification, labour-intensive activities can be contracted out to local institutions, groups or individuals on a fee-for-service basis similar to the existing "Food for Work" schemes.

In summary, the Namibian rural electrification program focused mainly on grid extension as in accordance with the projected connections contained in the Rural Electricity Distribution Master Plan 2000 and as revised in the Master Plan of 2005. Off-grid technologies have not been widely marketed; hence, the acceptance or application of such technologies in rural communities remains relatively low. It can therefore be argues that under the current institutional arrangements, the rate of rural electrification is likely to remain below the targeted annual rate of 3%.

[31] Taken from the Case Study conducted by Tuntivate Voravate and Douglas F. Barnes, April 2000 (draft report published on the World Bank website; www.worldbank.org) as part of the Africa Region Findings series).

CHAPTER 6

SUMMARY AND RECOMMENDATIONS

It has been well documented by several studies on rural electrification that as much as there is a desire from Governments, civic institutions, rural consumers and other interest groups to ensure the provision of access to electricity to the majority of rural people, this aspiration will for years remain evasive in achieving it. The provision of access to electricity in rural areas is still a challenge to many developing countries and it is more difficult for those that have inadequate human, financial and technical resources to speedily implement a rural electrification program.

Although the argument on the benefits of electrification is still inconclusive on this, there are several studies which this author supports, that electricity can stimulate development. It has to be acknowledged that rural folks who are mainly poor, with very limited rural economic development in their respective communities will most likely not derive much economic benefits from the rural electrification program. An important element that emerged from this study although it has not been the focus of this analysis is that a distinction should be made between provision of access and actual connection. The current grid extension as explained in the Rural Electricity Distribution Master Plans 2000 and 2005 respectively is based on a model which calculates or provide the basis of accessibility if a rural settlement within 10km proximity to a transmission and/or distribution line. Secondly, other pre-requisites includes inter alia:

- Existence of government installations such as schools, clinics, police stations,
- Existing or potential development activities in the area such as agricultural projects, mining, growing number of commercial activities,
- Population of the rural settlement (village size)

This study did confirm the assertions that:

- There is still a low demand for rural electrification in the region as evidenced by the information collected from the case studies,

- Grid extension may provide access to major rural settlements but will still fall short of reaching those in the remote and more less densely populated areas with limited economic activities to warrant massive investment in the extension of the grid,
- Grid extension will most likely not provide actual connection to the majority of those that have been provided with access, due to the proximity model used in determining who can qualify for energisation,
- Technology choices other than conventional grid, is limited and relatively new in the region. Under the current arrangements, solar PV, Solar Water Heating systems (SWH) and the mini-hybrid technology will most likely not propel the acceleration of the rural electrification process in Namibia. Additional non-conventional approaches (see p. 59 – 61) are required to complement grid and off-grid technology applications,
- The study also acknowledged the technical constraints posed by the geographical nature of Namibia's landscape which has a dispersed population settlement pattern making grid extension expensive and hence less economical given the low consumption demand.

The acceleration of the rural electrification program to meet the 2010 target of 25% rural access level to electricity is realistic but there is a need to address several constraints that have been identified in Chapter 5. From the case studies drawn from South Africa and Zambia as well as other experiences from other developing countries that have implemented rural electrification, this study identified several issues that require particular attention in ensuring that the rural electrification program is speedily implemented:

a. Government increase budgetary allocation for rural electrification,
b. A workable arrangement be agreed upon to ensure that NamPower's continue to investment in rural electrification under a new sustainable financing model which secures its commercial viability noting the low investment returns of rural electrification,
c. Create a conducive investment climate for private sector participation,
d. Encourage and involve local communities to participate in the planning and execution of rural electrification,

e. Skills and technology transfer to local communities and other local stakeholder should be encouraged,
f. Strengthen public awareness about the renewable energy off-grid technologies so as to increase acceptance and utilisation thereof,
g. At policy level there is a need to revisit the Energy Policy of 1998 to address the inadequacies of the current policy instruments,
h. Government should consider in consultation with financial institutions the establishment of micro-financing schemes at local level to facilitate the provision of capital to communities, individuals or local NGO's for the acquisition of primarily off-grid technologies,
i. The establishment of the Electricity Fund should be accelerated,
j. Government should consider introducing subsidies which can be financed through electricity levies,
k. A more conducive environment should be created to encourage private sector investment in rural electrification. The concession approach used by South Africa is a case in point that can be considered and modified (if need be) for application in Namibia. Private sector should commit to invest in rural electrification as part of their social responsibilities,
l. REDs should assume a certain responsibility of contributing to the rural electrification either through:
    - Direct investment in the provision of access, or,
    - Provide actual connection to rural consumers that are outside the 500m proximity to a distribution transformer. This could be accomplished through a subsidization scheme, revolving credit scheme, cooperative funding arrangement, distribution levy, etc.

This study also highlighted the importance of translating political will to actual commitment to provide an impetus in elevating the importance of rural electrification which is a catalyst for rural development and poverty alleviation. It is not good enough to have policy instruments that outline the targets that need to be achieved if no tools/aides are provided to ensure the implementation of programs to address the said policy objectives and goals. Commitment to rural electrification should also not be seen as a Government responsibility alone but it is task that should be performed

by all institutions in the private, public and civic sector. The target of 25% by 2010 is not ambitious as was described by the EMCON Report (2003); it is achievable under a given environment where resources are adequately provided.

In conclusion, although the study did not review in broader details the renewable energy program that the Ministry of Mines and Energy is facilitating, however, findings of this exercise highlighted several approaches that could complement the technology choices of both grid and off-grid rural electrification. Too much emphasis is usually placed on conventional electrification but little focus goes to other institutional arrangements that can facilitate rural electrification in a complementary manner. The Energy Policy of 1998 was the focal point of this study and it provides several policy objectives that need to be achieved as far as reaching the 2010 target of providing access to electricity to about 25% of rural communities. Many of the non-conventional approaches that have been identified emerged from the case studies and other literature analysed in this study. Namibia has a unique situation notably its low population density, low demand, inadequate own power generation sources and long transmission lines, several competing capital projects for scarce resources, and this make investment in rural electrification more difficult. The non-conventional institutional arrangements suggested in this paper, should be seen as complementary to grid-based technology solutions and these options have a spiral effect on the roll-out of both grid and off-grid energy technology applications. In a nutshell, the acceleration of the rural electrification program in Namibia shall require a combination of technology, funding and a list of the other institutional mechanisms highlighted in this section (*see section 5.4 and section on recommendations, p. 63 - 64*)

The policy intervention that has been proposed in this study, relates to the need to contextualise the incorporation of new approaches to rural electrification. The rural electrification programme needs to be refocused along the new discourse of the power sector reforms. As policy planners, the policy process should not be static but a continuous undertaking in search of new techniques, methodologies, approaches and new thinking.

REFERENCES/BIBLIOGRAPHY

Africa Energy Region Findings. (2001) 'Rural Electrification: Lessons Learned', Vol2, Pan-African Publishing House

Banks E. F. (2005) Comments on Electricity Deregulation, New York

Chambers, R. 1994a. Participatory Rural Appraisal (PRA): Analysis of Experience, World Development 22(9): 1253 – 68

Coakley J. Goerge, (2003) The Mineral Industry of Namibia, Windhoek

CORE International, (2002) Issues and Options for Rural Electrification in Zambia Report submitted to USAID, Washington, USA

Davis, G.B, and Olson, M.H. (1985) Management Information Systems: Conceptual Foundations, Structure and Development. McGrill Gill Publishers, New York

EMCON. (2003) Assessment of two Namibian Solar Home Systems Programmes: Socio-economic and technical evaluation, and comparison with grid electrification for the period 1996 – 2001, Windhoek, Namibia,

Ford Neil in Power Economics, Vol. 8 – Issue 4, April 2004: Financial Obstacles,

Green Donna. (2005) The Politics of Environmental Technology Choice for Rural Electrification in Northern Thailand, School of Social Science and Policy, University of New South Wales, NSW, Australia

Haanyika, Charles. (2004) Rural Electrification Policy and Institutions in a Reforming Power Sector. Resources for Infrastructure Development and Energy Studies, Lusaka, Zambia

Haanyika Charles. (2005) Comparative Case Study on Rural Electrification Policy and Institutions in a Reforming Power Sector' presented at the Parliamentary Forum on energy Legislation and Sustainable Development, Cape Town, South Africa,

Lynn, L.E, (1980) Designing Public Policy – A Casebook on the Role of Policy Analysis, Goodyear Publishing, California, USA

Karekezi Stephen (et al), (2001) 'Status of Power Sector Reforms in Africa: Impact on the Poor', African Energy Policy Research Network (AFREPREN), Nairobi, Kenya,

Karekezi Stephen (et al), (2003) 'Overcoming Barriers to the Use of Renewable Energy and Energy Efficiency Systems in the Reforming Power Sector of Eastern Africa',

Kotze P, (2000) 'Rural Electrification in South Africa' in SEPCo bulletin, March 2003

Munyuki Elijah, (2004) Financing Rural SADC's Access to Energy: The legal Aspects,

Nortsen Anders, (2001) 'Access to Electricity – An approach to sustainable reduction of rural poverty',

Pretty, J.N and Chmabers. R.L. 1994b. Towards a Learning Paradigm: New Professionalism and Istitution for Agriculture. Development and Change, Vol. 25, Number 3, July 1994

Pollit G. M. (1997) The restructuring and privatisation of the Electricity Supply Industry in Northern Ireland – will it be worth it? Sidney Susex College, Cambridge,

REEP, (2006) New Strategies in rural electrification,

SADELEC (2000) Study of Restructuring of the Namibian Electricity Supply Industry, Windhoek

Sparrow F.T; (1996) Modelling Electricity Trade in Southern Africa, Purdue University

Sechotlho Brian.(2002), 'Regulatory Framework for the Economic Regulation of the Electricity Supply Industry in South Africa' (A Discussion Document – unpublished),

UKPrice Water Coopers, Sub-Saharan Africa's Energy Conundrum

UNDP/World Bank Report, 2005, Power Sector Reforms: Assessing the Impact on Poor People, Washington, DC, USA,

UN Millennium Development Declaration, www.un.org

Willemse Jurrie, (2003) 'Rural Electrification in Africa' presented at an ISES seminar in South Africa,

Wissink, Henry, et.al. 1990. Improving Public Policy. Van Schaik Publishers, Cape Tow,

World Bank, Energy Sector Management Assistance Programme (ESMAP), Washington, DC, USA

World Energy Council, (2001) How Restructuring Assisting Liberalisation of Electricity Markets (Discussion Paper),

World Bank Report, 2002, Impacts of Reforms on Prices, Costs, Tariffs and Subsidies, Washington DC, USA,

World Bank Group, 2001, Africa Region Findings: Rural Electrification: Lessons Learned, Washington DC, USA,

ANNUAL REPORTS:

ECB Annual Reports, 2003; 2003; 2005,
NamPower Annual Reports (19998 – 2005)
SAPP Annual Reports (1999 – 2004)
MME: Rural Electricity Distribution Master Plan 2000 & 2005 (Vol. 1 & 2)
White Paper on Energy Policy, 1998: Government of the Republic of Namibia

ANNEUXRE A: Interviews with officials Renewable Energy: MME

- Background on the renewable energy programme in Namibia (reports, workshop materials, relevant books/magazine, other literature),
- Status report on the implementation of the renewable energy program,
- Funding options for renewable energy in Namibia,
- Technology options of renewable energy in Namibia,
- What are the current technical & commercial challenges of implementing renewable energy in Namibia,
- Other there case studies in the region or elsewhere where renewable energy technologies have been successfully implemented?
- What are the possible policy and other institutional options/recommendations is MME considering in accelerating rural electrification in relation to optimising the utilisation of renewable energy,

ANNEXURE B: Interviews with officials from Rural Electrification Section: MME

- What have been the major shortcoming and constraints of the existing rural electrification programme,
- What viable funding options have been or can be considered to accelerate rural electrification and where can such funding be sourced,
- What are the other appropriate technologies that are affordable, sustainable (in terms of operational efficiency, accessibility to spare parts, maintenance) that can be considered,
- How many rural households had access to electricity in Namibia as at the end of 2005,
- Are there institutional and policy issues that requires review/reconsideration to meet the target set to connecting at least 25% of rural household to the national grid by 2010,
- Is the target of 25% by 2010 realistic?
- What measures or alternative institutional arrangements that can be considered in speeding up the rural electrification program in addition to the funding and technology options?

Table 16 (a): Comparative analysis of case studies

COUNTRY PROFILE	SOUTH AFRICA	ZAMBIA	NAMIBIA
1. GEOGRAPHICAL DATA			
1.1 Land size ($km^{2)}$	1,221,037	740 724	823 680
1.2 Population (in million)	47	12	1.9
1.3 Density (people / km^2)	39	40	2.3
1.4 Political System	Parliamentary system	Parliamentary system	Parliamentary system
1.5 Neighbouring countries	Namibia, Zimbabwe, Botswana, Lesotho, Swaziland, Mozambique,	Namibia, DRC, Angola, Botswana, Malawi, Zimbabwe, Tanzania	Angola, South Africa, Botswana, Zambia, Zimbabwe
2. ECONOMY	Free market economy	Free market economy	Free market economy
2.1 GDP per capita	US$ 2,500	US$ 900	US$ 2,176
2.2 Key sectors of the economy	Mining, agriculture, tourism, industry (manufacturing)	Copper mining and processing, chemicals, horticulture,	Mining, agriculture, fishing, tourism
2.3 Inflation	± 5 %	± 19 %	±5%
3. ENERGY PROFILE			
3.1 Policy framework	Electricity Act, 2004 Energy Policy, 2003	Electricity Act (1995) National Energy Policy (1994)	Electricity Act (2000) White Paper on Energy Policy (1998)
3.2 Regulator	National Electricity Regulator (NER)	Zambia Electricity Regulator	Electricity Control Board (ECB)
3.3 Power Utility	ESKOM	ZESCO	NAMPOWER
3.4 Reform process	Commercialisation; deregulating monopoly; licensing of IPPs establishing open competition; extensive grid programme built into distribution reform; private concessions to extend rural access; regulatory framework introduced; electrification fund established	Privatisation; commercialisation; unbundling process	Commercialisation of NamPower; restructuring of electricity supply industry (ESI); establishment of regional electricity distribution companies (REDs); electricity regulator established as part of reform process
3.6 Single buyer Energy trading	Market energy trading	Vertically integrated	Single buyer
4. SAPP MEMBERSHIP	Member	Member	Member
5. GENERATION CAPACITY			
5.1 Installed Capacity	43 000 MW	1776 MW	393 MW
5.2 Generation sources	Coal-fired power stations, nuclear, hydro	Largely Hydro-power	Hydro-power, thermal, diesel
6. TRANSMISSION NETWORK	281 000 km of high voltage transmission and	Figures not available	15,756 km of high voltage transmission and

	distribution lines		distribution lines
7. **ELECTRIFICATION**			
7.1 Target	50 % by 2000	Figures not available	25 % by 2010
7.1 Access level (urban)	90 %	20 %	85%
7.3 Access kevel (rural)	60 % (estimated for 2005)	2 %	15% (estimate for 2005)
7.4 Technology application	Grid and off-grid technologies	Grid and off-grid technologies	Grid and off-grid technologies
8. **RENEWABLE ENERGY**			
8.1 RE technology	Solar (PV),	Solar (PV)	Solar (PV); mini-hybrid (pilot)
8.2 RE approach	Six concessions granted for five years to service identified areas; Grid extension used pre-payment technology,	Off-grid for remote rural areas	Arranged through funding agencies; applicants apply through MME, Konga Investment or participating Banks
8.3 Funding for Rural Elect.			
8.4 Funding sources	Off-grid program subsidized by Government	Off-grid funded with support from development partners	Off-grid funded with support from development partners (UNDP / GEF); Funding arranged through revolving credit and subsidized

Table 16 (b): Constraints and challenges for rural electrification

RURAL ELECTRIFICATION CHALLENGES	SOUTH AFRICA	ZAMBIA	NAMIBIA
1. NATIONAL CONSTRAINTS/CHALLENGES			
	• Concession program not targeting the needy,	• Population dispersed in villages and largely rural	• Population dispersed and largely rural
	• Concession not achieving the anticipated outcomes	• Little economic activities in rural areas	• Little economic activities in rural areas
	• Grid extension threatened by security of power supply	• Rural electrification competing with other priority development projects	• Rural electrification competing with other priority development projects
2. POLICY FRAMEWORK			
	Comparably policy prioritisation against other national development objectives	Policy priority level against other national development objectives	Policy priority level against other national development objectives
	Electricity regulator relatively independent	Electricity regulator not fully functional due to resource constraints and inadequate independence	Electricity regulator not fully functional due to resource constraints and inadequate independence
	Human resource constraints	Human resource constraints	Human resource constraints
3. FUNDING CONSTRAINTS			
	Reliance on government funding and subsidies	Reliance on government funding	Reliance on government funding
	Decline in development Funding	Development not adequately exploited for rural electrification	development funding not adequately exploited for rural electrification,
	Inadequate allocation but program well on course with available resources – manageable backlog	Inadequate budget allocation – backlog	Inadequate budget allocation – backlog, projected to be reduced by 2008
	Grid extension expensive	Grid extension expensive	Grid extension expensive
	Low tariff (moving towards cost-reflective)	Very low tariff (possibly one of the lowest in the region)	Low tariff (not yet cost-reflective)
	Rural electrification not fully attractive for private sector investment	Rural electrification not attractive for private sector investment	Rural electrification not attractive for private sector investment
	Relative low demand for power	Very low demand for power	Low demand for power
	Ability for rural consumers to afford	Ability for rural consumers to afford	Ability for rural consumers to afford
4. TECHNOLOGY CONSTRAINTS			
	Long transmission lines	Long transmission lines	Long transmission lines
	Minimal technical losses	High technical losses	Minimal technical losses
	Renewable energy costly at start-up	Renewable energy costly at start-up	Renewable energy costly at start-up
	New renewable technology not fully tested	New renewable technology not fully	New renewable technology not fully

		tested and implemented – many projects on pilot phases	tested and implemented -
	Limited affordable renewable technologies options in local market	Limited affordable renewable technologies options in local market	Limited affordable renewable technology options in the local market
	Technical resource constraints (manageable in medium term)	Technical resource constraints	Technical resource constraints
	Some electricity infrastructure ageing	electricity infrastructure need urgent rehabilitation/ refurbishment /maintenance	Some electricity infrastructure aging need gradual replacement through a refurbishment program

Table 16 (c): Alternative institutional arrangements for Rural Electrification

Alternative Arrangements for RE	**SOUTH AFRICA**	**ZAMBIA**	**NAMIBIA**
1. POLICY INTERVENTIONS			
	The South African Government undertook policy initiatives by establishing:	The following policy interventions/initiatives have been undertaken/considered in Zambia[1]:	Although the White Paper on Energy provided clear objectives for increasing access to electricity, there are certain policy interventions that are still required or need amendment/strengthening:
	1. National Electricity Regulator,	1. electricity projects to be fast-tracked for approval and classified as promoted projects,	1. Establish the Electricity Fund to be funded through consumer levies as earlier envisaged in the Energy Policy,
	2. National Electricity Forum	2. private companies to be allowed higher debt-equity ratios than typically required for such projects,	2. continue to revise regularly the Rural Electricity Distribution Master Plan through periodic assessment studies
	3. National Treasury was mandated to provide additional funding for rural electrification,	3. condition of dividend balancing by export earnings and equity, requirements which normally applies to foreign investment, be considered for relaxation for any investment in the power sector,	3. Regional Electricity Distributors be urged to invest and take part of the responsibility to provide connections to rural communities within the proximity of the transmission and distribution networks,
		4. reduction of customs duty for the import of power equipment for electricity generation and distribution projects,	4. develop approaches to encourage the participation of energy service providers, local banks and investors as well as energy equipment providers in rural electrification,
		5. tax holidays for foreign investors in power sector,	5. develop overall RE policy linked with governments rural development policy/programs

[1] CORE International, Inc, (USAID Energy and Environment Training Program): Desk Study Report – Rural Electrification Options in Zambia

2. FUNDING ARRANGEMENTS	The South African Government although it successfully implemented the first phase of the rural electrification initiative through the RDP, there is still a backlog that is being experienced. Financing options should be pursued that can accelerate the pace of electrification:	The Zambian Government identified the following financing options to fully implement its rural electrification program:	Financing options that the Namibian Government should pursue:
	1. increase government budget allocation,	1. Increase Government budget allocation to rural electrification	1. increase Government budget allocation to rural electrification,
	2. ensure sustainability of cross-subsidization,	2. increase and sustain multilateral and bilateral funding through a public sector – bilateral arrangements,	2. exploit sustainably the development funding made available for rural electrification through EIB, AfDB, SIDA, etc,
	3. continue to encourage private sector investments through the strengthening and clear monitoring of the concession model,	3. private sector investments	3. encourage private sector investments through the provision of incentives,
		4. design a series of limited time fiscal and financial incentives for private investors and technology/equipment providers/vendors,	4. design a series of limited time fiscal and financial incentives for private investors and technology/equipment providers/vendors,
		5. put in place a simplified structure for the provision of incentives to the private sector such as single entity empowered to grant the incentives;	5. identify approaches and strategy to encourage the involvement of local stakeholders in the planning and implementation of rural electrification,
		6. implement an aggressive public campaign to advertise/create awareness of the incentive program to attract private sector investment	
4. OTHER INSTITUTIONAL OPTIONS			
5. TECHNOLOGY OPTIONS	1. Grid extension: • grid extension still technically and economically viable for connection	1. Grid-connection: • Grid extension to rural areas along or in the proximity of	1.Grid-connection: • Continue with grid extension of rural areas within proximity of

	of rural communities within the proximity of transmission and distribution lines,	transmission and distribution grid, • Create a conducive environment for private sector participation in grid extension	transmission and distribution lines, • Create a conducive environment for private sector participation in grid extension
	2. Off-grid systems: • Modular, renewable energy power generation which is cost-effective, affordable, clean and have long-lasting low-load electricity, • Photovoltaic (solar) – Government approved the use of PV for 2000 clinics and 16800 schools in rural areas, • Installations of PV in 2.5m households and 100 000 small businesses to compliment grid extension,	2. off-grid electricity systems: • off-grid to cater for remote rural areas, low population with low demand density, • considered application of decentralised electricity systems such as small-diesel generators, solar home systems, biomass energy, wind energy, micro-hydro	2. off-grid systems: • Extend Solar home systems application for remote rural areas and those outside the proximity criteria for grid extension, • Mini-hybrid, • Wind energy, • Diesel generators (where above options not viable),