IMPACT ASSESSMENT OF NORAD-FUNDED RURAL ELECTRIFICATION INTERVENTIONS IN NORTHERN NAMIBIA, 1990-2000

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Ralf Tobich and partners, EMCON Consulting Group

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A team of experts under the leadership of Ralf Tobich (of Utility Consulting Southern Africa) conducted this impact assessment. Doufi Namalambo (of Consulting Synergies Africa) coordinated the fieldwork, and Uli von Seydlitz (of EMCON Consulting Group) provided data and administrative support to the project. Silje Pettersen researched and compiled the socio-demographic and micro-economic analysis sections, while Dr Hartmut Krugmann (of Southern Sustainable Development Corporation) provided valuable inputs during the inception and survey phases and undertook the environmental analysis. Ryan Anderson and Dr Mark Davis (of ECON Centre for Economic Analysis - Oslo) were responsible for the cost-benefit analysis. Ralf Tobich undertook the access-to-electricity analysis and analysed the institutional arrangements, and he also wrote the impact assessment summary and compiled this report.

EXECUTIVE SUMMARY

Namibia's national rural electrification programme (NREP) commenced shortly after the country gained its independence from South Africa in 1990. First targeting the most densely populated rural areas of northern Namibia, the programme progressed clock-wise around the country and has within the first 10 years reached rural communities in all regions. Since 2000, an integrated (covering grid AND off-grid options) rural electricity distribution master plan governs the electrification programme, prioritizing and scheduling the remaining unelectrified rural localities. Off-grid electrification approaches are becoming more viable as the cost per connection of grid electrification escalates with decreasing population density and increasing remoteness.

A strong government commitment, manifested through annual rural electrification budgets, and supported with donor (mainly NORAD) grant funding during the first 10 years, enabled rapid roll-out of the programme. An electrification philosophy of connecting all potential customers in a target locality was adopted, yielding higher than expected consumption levels and contributing significantly to the viability of providing an electricity service in rural areas.

Technology choices

A key success factor of the electrification programme was the introduction of pre-payment metering, a technology that enabled widespread electricity access in areas where conventional metering and billing infrastructure would have been difficult and costly to maintain. Rural customers welcomed the technology as it enabled greater personal control over electricity consumption than credit metering does.

Electrification costs

The total cost of the NREP to date amounts to N$543 million (N$341 million in real terms). N$310 million of this has come from government budgetary allocations, and NORAD has contributed about N$75 million between 1991 and 1998. Other contributions have come from NamPower (approximately N$120 million) and Northern Electricity (about N$17 million).

With about 30,000 rural household connections having been provided to date, the average cost per connection is about N$18,000. This cost includes the extensive medium voltage infrastructure.

While the capital costs of the NREP have been fully subsidized, the operational costs were only partially subsidized during the first ten years of the programme. In 2001, cost-reflective tariffs were introduced to cover the operational costs of rural electricity supply.

Operational challenges

Initial operational challenges were successfully met by way of a public-private partnership: a private company, ***Northern Electricity***, was contracted for a five-

year period to manage electricity supply services in northern Namibia, while the electricity supply industry (ESI) was being restructured. The company introduced appropriate operational procedures and management systems, with a strong focus on fiscal control, customer service and community development.

Access to electricity

Namibia's 1998 White Paper on Energy Policy promises 25% rural household access to electricity by 2010, but electrification rates since 2000 indicate that this target will not be reached by a substantial margin (if current rates can be sustained it is estimated that only about 17.4% of rural households will be grid-electrified by 2010, with off-grid systems making an insignificant contribution).

Impacts on rural communities

Rural communities have greatly benefited from rural electrification, through tangible improvements in the provision of social services, better telecommunications infrastructure, more reliable water supply services, an enhanced business environment, and better access to regional and local government services, most of which would not have been possible without access to electricity.

Impacts on rural households

Electrified rural households now enjoy a high quality energy service, with good lighting, in particular, being perceived as the most important benefit of access to electricity. There is, however, scope for improving the positive impact of rural electrification in terms of awareness about the risks and opportunities associated with access to electricity.

Most households perceive the electricity service to be worth the cost, a sentiment confirmed by the relatively high average household consumption and low non-payment rate.

Few households have made a complete switch to electricity, mainly because firewood is the preferred energy source for cooking, for cultural reasons. Electric appliances are widely used, however, and even unelectrified households already own electric appliances, in anticipation of being connected.

Impacts on businesses

The emergence of small businesses does not appear to be a typical consequence of rural electrification. But existing businesses benefit greatly from access to electricity through an improved business environment, better energy economy, greater convenience, and the possibility of offering a wider range of goods and services.

Access to electricity in isolation, however, is usually insufficient to promote business development, which also depends on factors such as access to finance, credits and markets, and training and development. Among small enterprises in Central-North, little diversification of goods and services was observed and productivity-related benefits on income and profits were found to be minimal. Larger retail establishments, on the other hand, make extensive use of electricity to increase business growth.

Access to electricity was found to lead to reductions in energy expenditure in businesses that had switched to electricity for their principal energy requirements.

The rural electricity industry has created some employment opportunities, and there is a general perception among rural folk that electrification is creating work opportunities in other sectors, but this is difficult to confirm.

Impacts on public institutions

In addition to the benefits that accrue due to avoided cost of alternative energy sources, access to electricity can lead to the creation of new facilities, improve the quality of public services, and entice staff to work in rural areas.

The rural health sector and secondary schools (including hostels) are benefiting greatly from the use of electrical equipment, but the impact of electrification on primary schools has been limited as electricity use in these schools is generally restricted to only a few appliances. Access to electricity largely improves telecommunication and water services (both supply and purification) in rural areas, and even agriculture and the police service are benefiting, albeit to a lesser extent.

Among institutional users there is a mistrust of electricity tariffs (particularly maximum demand charges), and supply interruptions are perceived to be detrimental to electrical equipment. Inefficient replacement of light bulbs in public institutions appears to be an issue.

Impacts on the local economy

There have been significant net economic gains from rural electrification in Central-North, with an estimated economic internal rate of return of about 33%. Given the social nature of the investments and other potential benefits (e.g. environmental benefits, gender related improvements, etc.) a relatively low discount rate can be justified. Accordingly, at a discount rate of 8%, the benefit-cost ratio is just over 2.

Total discounted capital and operating expenditures of some N$691 million between 1991 and 2006 will have resulted in discounted economic benefits estimated at some N$1.4 billion by 2016. Households, as well as large and small business reap a large portion of the benefits. These returns are significant and are thus robust to rather significant changes in either the discount rate or the assumption employed in the analysis.

Impacts on the environment

Access to electricity displaces CO_2 emissions associated with displaced fuels such as diesel, wood, paraffin and candles. On a household level, this environmental benefit is typically very small, but for large-scale users of diesel generators switching to grid electricity it would be substantial.

The impact of rural electrification on deforestation is minor, firstly because household firewood use is a relatively minor contributor to deforestation (fires and land clearing for agriculture are the principal proximate causes of deforestation in Namibia), and secondly because rural household firewood use has important cultural significance and will not easily be abandoned in favour of electricity for cooking. The

benefits of electrification on the health of rural dwellers (mainly respiratory diseases caused by air pollution, and fire risks) are limited for the same reasons.

Success factors

Three distinct factors have been instrumental in ensuring the success of Namibia's rural electrification programme.

1. The 100% capital subsidy enabled a rapid roll-out of the programme, providing essential services for previously disadvantaged communities, addressing poverty issues and stimulating the local economy, and improving the quality of life of many rural dwellers.
2. The introduction of a dedicated electricity service in rural areas, initially by way of a public-private partnership and later through Regional Electricity Distributors, provided the basis for sustainable service delivery and continued electrification in these areas.
3. Pro-active private sector involvement in planning and implementation of the NREP and in electricity service provision significantly contributed to an efficient and cost effective development programme that continues to this day, yielding high levels of customer satisfaction, rapid electrification and a viable yet affordable rural electricity service of good quality.

Key lessons

There are four key lessons to be learnt from the Namibian approach towards implementing a successful national rural electrification programme, namely:

a) Government commitment is a key factor in bringing about real change. The Namibian Government demonstrated its commitment through the capital subsidy for rural electrification and its determination to achieve long-term sustainable benefits for rural communities.

b) Donor assistance to such a structured initiative (like the NREP) is a most effective way of contributing to real development.

c) A rural electrification programme cannot expect to succeed without addressing the resulting infrastructure and management service needs. Ideally, the necessary structures and resources are already in place to assist with implementing a rural electrification programme.

d) The private sector can play a significant role in ensuring success of an electrification programme, particularly from an efficiency and innovation perspective. The Northern Electricity experience has also shown that private sector participation in rural electricity supply services does not necessarily lead to higher tariffs, it can be a profitable venture while still affordable by typically poor rural communities.

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GLOSSARY AND DEFINITIONS

Central-North	Descriptive name for the study area. This part of the country was formerly known as Owamboland and today roughly spans the Omusati, Oshana and Ohangwena administrative regions, as well as the northern parts of the Oshikoto Region, excluding the Guinas and Tsumeb constituencies.
Cuca Shop	Small informal retail business, mostly found in Central-North. These establishments play an important role in rural areas as they are often the only retail outlets in a locality, offering basic groceries (like canned food, cool drinks, sugar, coffee, maize meal, sweets/candy, etc) and essential household goods (like candles, matches, batteries, toilet paper, washing powder, body lotion, etc). They also double as entertainment center/bar at night, offering music and beer. Many cuca shops incorporate a backroom where a person or family (either the owner or an employee) lives.
ECB	Electricity Control Board
EMC	Evaluation and Monitoring Committee, a dedicated regulatory agency overseeing Northern Electricity's contractual compliance
ESI	Electricity Supply Industry
FGD	Focus Group Discussion
GEF	Global Environment Facility
GRN	Government of the Republic of Namibia
GTZ	Gesellschaft für Technische Zusammen Arbeit (German Agency for Technical Cooperation)
KI	Key Informant
Locality	Rural location consisting of a cluster of households and support infrastructure like shops, schools and a clinic. A locality may refer to a rural settlement, village or town, as defined in relevant legislation (Regional Councils Act and Local Authorities Act). The term 'locality' has specifically been coined for the 2000 baseline REDMP to avoid confusion with defined terms 'settlement', 'village' and 'town'.
MME	Ministry of Mines & Energy
MRLGH	Ministry of Regional & Local Government & Housing
NHIES	National Household Income & Expenditure Survey
NOK	Norwegian Kroner
NORAD	Norwegian Agency for International Development
NREP	National Rural Electrification Programme
N$	Namibian Dollar
RE	Rural electrification
RED	Regional Electricity Distributor
REDMP	Rural Electricity Distribution Master Plan
REIA	Rural Electrification Impact Assessment
UNDP	United Nations Development Programme
VAT	Value added tax

1 INTRODUCTION

NORAD has provided funding assistance for rural electrification in Namibia during the 1990s, and now wishes to have an assessment of the impacts of this intervention carried out. This forms part of an evaluation of the long-term effects of Norwegian assistance in the power sector, with similar rural electrification interventions in Mozambique and Nepal.

1.1 OBJECTIVES

The prime objective of the assessment is to draw conclusions from the experiences with this rural electrification intervention, and to compare these with conclusions drawn from rural electrification interventions in other countries, for the benefit of future such funding assistance initiatives.

The assessment shall clarify the short-term and medium-term effects of the rural electrification intervention on public institutions, businesses, the local population and the environment. It shall also describe the electrification programme itself ("volume, time pattern, content, quality of service, relations to policy and strategy of the energy suppliers, context, etc") and evaluate the intervention with reference to DAC's criteria ("relevance, effectiveness, efficiency, impact and sustainability").

A further objective is to identify other factors that have influenced development in the electrified areas and clarify cause-effect relationships.

1.2 SCOPE

Namibia's national rural electrification programme (NREP) was launched in 1991 and has benefited communities in all parts of the country. This assessment focuses on the central northern regions - **descriptively referred to as *Central-North* in this report** - where the majority of the country's population resides and where by far the most connections have been made to date. This part of the country was formerly known as Owamboland and today roughly spans the Omusati, Oshana and Ohangwena administrative regions, as well as the northern parts of the Oshikoto Region, excluding the Guinas and Tsumeb constituencies (this area is roughly demarkated by the yellow boundary in Figure 1).

Central-North is also where most of Norwegian donor funding for rural electrification has been invested during the 1990s.

1.3 REPORT STRUCTURE

This report deals concisely with the methodology (Section 2), the context (Section 3) and the impact assessment (Section 4), highlighting key lessons in Section 5 and evaluating NORAD's intervention in Section 6. The detailed analyses are included in

the appendices, together with a summary of Northern Electricity and the survey results at the end.

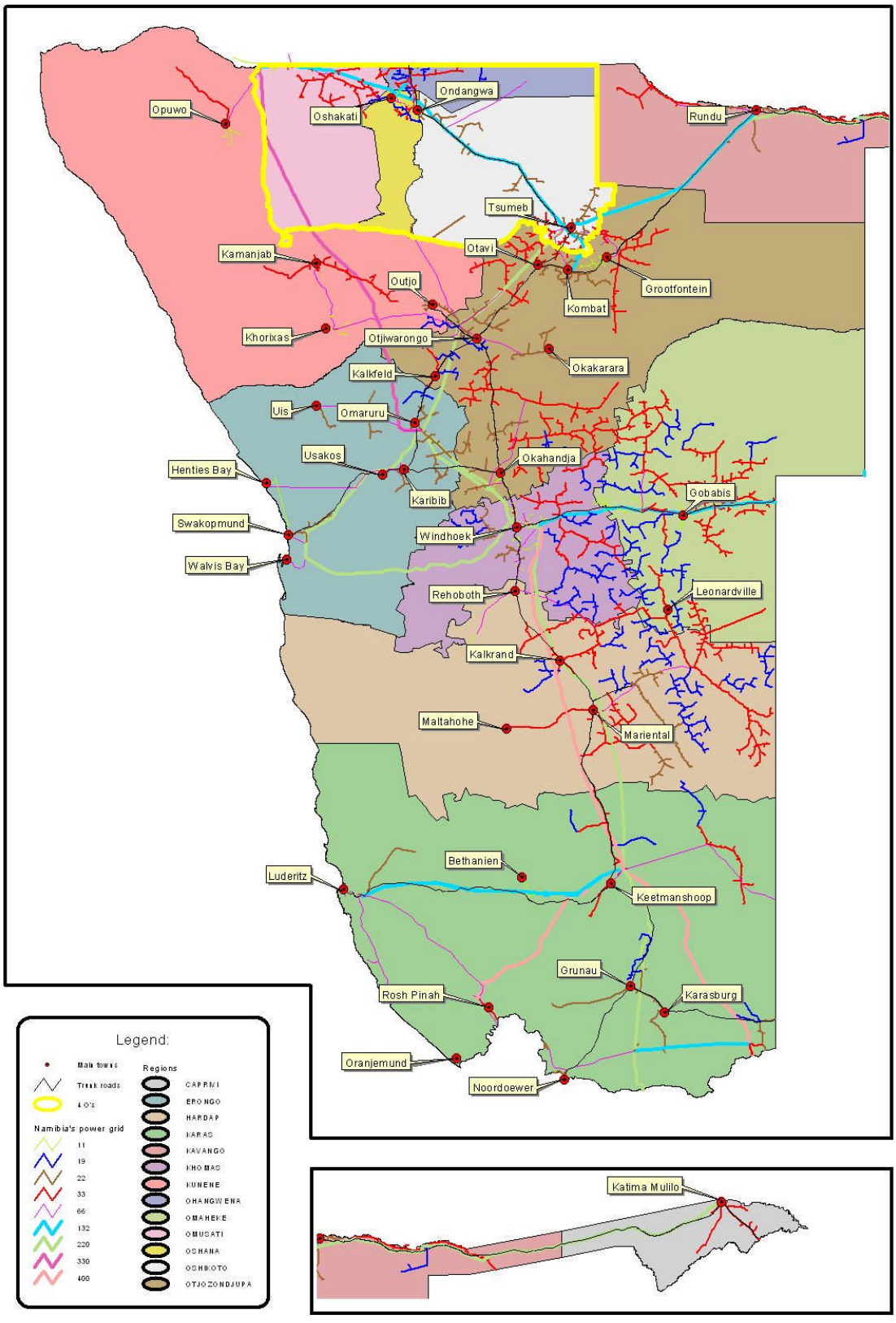

FIGURE 1: Overview Map

2 METHODOLOGY

A preliminary evaluation of the socio-economic impacts of the rural electrification programme was conducted in 1992 (Tapscott, 1992), only a year into the programme. It was too early then to see meaningful results, but the report is non-the-less useful in that it provides some baseline information for future studies such as this one. Another socio-economic evaluation was done in 1995 (Davis et al, 1995), providing insight into early impacts of the NREP. In 1999, a third socio-economic impact evaluation was conducted (Wamukonya et al, 1999), assessing the impact of electricity, both grid and off-grid, on energy consumption patterns in households and examining the impact of electrification on household welfare, health care provision, education and small business development.

This fourth study of the impacts of rural electrification is intended to provide a deeper understanding of how such a programme influences development. Statistics gathered in the survey differentiate between electrified and unelectrified study areas to be able to compare differences. The electrified localities studied are Onayena, Ontananga, Outapi, Oshikuku, Engela and Oshifo. Ompundja, Omakange and Tsumkwe are still not grid-electrified, but Tsumkwe is partially electrified with diesel-generated power. Unelectrified localities and households have been included in the survey to be able to determine differences in terms of livelihoods and living standards that can be directly or indirectly attributed to rural electrification.

216 households in nine rural localities were interviewed during the survey in May/June 2007. The number of households interviewed in each locality and their electrification status are presented in Table 1.

2.1 STUDY LOCALITIES

Six localities that have benefited from the NREP have been studied in detail to determine the impact that rural electrification has had on their development. These six localities - Oshifo, Outapi, Oshikuku, Engela, Onayena, and Ontananga - are spread out across the geographical area of Central-North and represent the full spectrum of socio-economic and geo-political characteristics of rural settlements in this region, thus offering a sound basis from which to draw general conclusions for the whole area. The group comprises a small rural settlement (Ontananga), a typical medium-sized settlement (Onayena), a large rural center that has by now acquired town status (Outapi), a formal residential township with village status (Oshifo), an emerging medium-sized rural center with village status (Oshikuku), and a settlement that developed around a mission station and hospital (Engela).

Detailed intermediate baseline information for the six localities exists from a 1995 review of the rural electrification programme in Central-North (Davis et al). In addition, descriptive and anecdotal information for these localities is available from the time around the commencement of the NREP (1991/2). Namibia's two population and housing censuses (1991 and 2001) and two national income and

expenditure surveys (1993/4 and 2003/4) to date provide further socio-demographic and economic insight into regional developments.

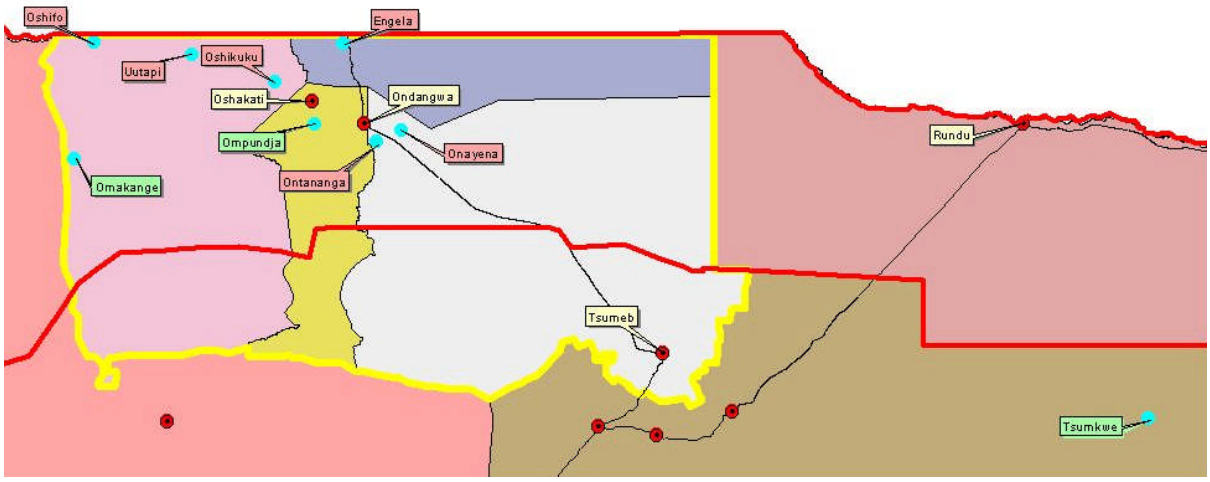

FIGURE 2: Study Locality Map

2.2 COMPARATIVE ANALYSIS

As one of the impact assessment tools, it was proposed to study patterns of socio-economic and demographic development in unelectrified localities and compare these with development patterns in electrified settlements. The following unelectrified localities have been identified as suitable for this purpose:

- Tsumkwe in the far eastern Otjozondjupa Region close to the Botswana border, an isolated rural centre that is not connected to the grid due to its remoteness. Tsumkwe is comparable in socio-demographic make-up to Oshikuku. Text Box 1 provides an anecdotal account of the energy supply situation in Tsumkwe, highlighting the challenges that have been faced by many formerly unelectrified localities of similar size and composition.
- Ompundja in Oshana Region south of Oshakati, a medium-sized locality with two schools, a clinic and an agricultural development centre, comparable to Onayena. Ompundja is already reticulated but has yet to be connected to the grid.
- Omakange in western Omusati Region, an informal settlement comprising of a combined school with hostel, a mobile clinic and a few cuca shops, comparable in size to Ontananga.

Ompundja and Omakange are highly compatible and comparable, culturally and socio-politically, with the assessment localities. Tsumkwe may be different, but unlike Ompundja and Omakenge it is a larger settlement that is not connected to the grid, with parts of it having access to electricity from a diesel generator as power source, similar to Oshikuku and Outapi before electrification.

Text Box 1: Energy Supply in Tsumkwe

The medium-sized settlement of Tsumkwe in north-eastern Namibia is a good example of how many rural centers were at the time just prior to the commencement of the rural electrification programme. Tsumkwe consists of a junior secondary school (grades 1-10) with hostel, a clinic, police station and post office, the settlement office, 2 formal supermarkets and 10 informal shops, a petrol station, a number of government offices (Environment & Tourism, Forestry, Agriculture, Veterinary Services, Rural Water Supply, Gender Equality & Child Welfare, Youth), a Namibian Broadcasting Corporation station, 4 NGO offices, a few guest houses, and about 165 houses.

The settlement is not connected to the national electricity grid, but is partially electrified and supplied from a diesel generator that is operated by the settlement office. All institutions are connected, as well as the 2 supermarkets, 2 informal businesses and about 30 houses. Power is only available at certain times of the day (weekdays from 06h00 to 15h00 and again from 17h00 to 23h00, and weekends from 08h00 to 13h00 and again from 17h00 to 23h00). Diesel consumption is about 15,000 litres per month, which costs the Regional Council approximately N$97,500. Electricity sales, however, only generate about N$55,000 per month.

The school hostel normally uses LPgas and diesel for cooking. The regional education office in Otjiwarongo provides these fuels, with gas cylinders being transported to Tsumkwe by the Department of Works while a supplier under contract delivers the diesel. However, both gas and diesel have not been delivered to the hostel in many months: the contract with the diesel supplier ended in March 2006 and has not been renewed, and the November 2006 order for eight 48kg gas cylinders is still outstanding. In the absence of both gas and diesel the school hostel now relies on firewood for cooking, which is being collected by students from a nearby forest under a special permit issued by the Department of Forestry.

2.3 FIELDWORK

Fieldwork was conducted in all nine localities between mid-May and mid-June 2007 by a team of five fieldworkers. Various survey instruments were used to gather relevant information for the impact assessment.

2.3.1 Survey Instruments

Information was gathered by way of structured household questionnaires, key informant (KI) interviews and focus group discussions (FGDs) (see Appendix D for details of the survey instruments).

The household survey captured information on household size and composition, dwelling type, household income, energy use and expenditure, household appliance ownership, perceptions of electricity, energy safety issues, and perceived community priorities. The questionnaire was designed in modular format such that it could be used for both electrified and unelectrified households. 136 grid-electrified, 2 non-grid-electrified and 78 unelectrified (a total of 216) households were surveyed in the nine localities.

Key informants from four focus groups (community representatives, institutional leaders, business owners, and the electricity supply authority) were interviewed, to capture perceptions and experiences from the respective perspectives. The primary aim of the KI interviews was to capture the perceived influence of rural electrification on local area/community development. A total of 55 interviews were conducted in the nine localities.

Nine focus group discussions were held, five of which with mixed groups, two with women groups and one with a group of shop owners. The FDGs were intended to capture collective views and perceptions on rural electrification and its impact on local development.

Table 1 provides an overview of the fieldwork activities that were undertaken.

TABLE 1: Fieldwork Summary

Locality	Constituency	Region	Unelec-trified HH	Electrified HH		Key Inform-ant Inter-views	Focus Group Discus-sions
			number of interviews		years electri-fied		
Oshifo	Ruacana	Omusati	4	18	8.9	4	1
Outapi	Outapi	Omusati	8	48	6.0	14	4
Oshikuku	Oshikuku	Omusati	4	20	6.5	6	1
Engela	Engela	Ohangwena	4	19	6.3	2	0
Onayena	Onayena	Oshikoto	3	15	4.4	9	1
Ontananga	Olukonda	Oshikoto	4	16	6.0	7	0
Ompundja	Oshakati East	Oshana	22	0	0.0	6	1
Omakange	Ruacana	Omusati	23	0	0.0	4	1
Tsumkwe	Tsumkwe	Otjozondjupa	6	2	10.0	4	0
	TOTALS/AVERAGE:		**78**	**138**	**8.0**	**56**	**9**

3 CONTEXT

3.1 A BRIEF HISTORY OF NAMIBIA'S ELECTRICITY INDUSTRY

The birth of the electricity supply industry in Namibia dates back to 1905 (some 20 years after German colonisation) when the first power plant was erected at Lüderitz to provide lighting for the main street, the prison and military installations. The main purpose of power generation and distribution at this time were security considerations in view of the Nama and Herero rebellion, and not the general electrification of Lüderitz!

As the country developed, individual towns established their own power stations and distribution networks (Swakopmund in 1907, Windhoek in 1918, Mariental and Omaruru in 1939, and others in later years). However, economic considerations of operating many isolated power plants, as well as the need for a cheaper source of electric energy that would fuel industrial development, necessitated the interconnection of the town networks and power generation from fewer stations. In 1964 the South West Africa Water and Electricity Corporation (SWAWEK) was founded to establish the national grid and construct a coal-fired power station in Windhoek and a hydroelectric power station at Ruacana on the Kunene River. In 1972, the new 90MW Van Eck power station in Windhoek, as well as the 220kV national grid (connecting Windhoek, Omaruru, Otjiwarongo, Tsumeb, Walvis Bay and Swakopmund), was inaugurated. The demand for power increased significantly, mainly as a result of the cheaper and more reliable electricity now available, and it was anticipated that the supply capacity of the existing power stations would not be able to meet the demand until the 240MW Ruacana plant could be commissioned in 1976. It was therefore decided in 1973 to have a further power station (diesel-powered) built at Walvis Bay.

By 1975, twelve towns, ten mines and a number of commercial farms were connected to the national grid. The winter peak demand in 1975 measured 85MW and the available capacity amounted to 100MW. It was then decided to have a 200MW capacity interconnector built between the South African and Namibian national grids, as a back-up in times when Ruacana was unable to meet the demand as a result of the periodic drought which would limit the water supply of the Kunene river. The interconnector was commissioned in 1982, ensuring sufficient reserve capacity for a number of years and enabling decommissioning of uneconomical power stations (the larger power stations, although uneconomical, were kept as standby generators for emergency situations). With the interconnector it also became possible to connect towns in the southern regions of the country. By 1984, a further six towns, several water pumping stations and three tourist resorts, were connected to the national grid. The 1984 winter peak (182MW) had more than doubled since 1975, representing a demand growth of 9% per year, which was high compared to the world average of 7% per year at that time.

The installed generation capacity in 1984 amounted to 610MW, which appears high in comparison with the peak demand. However, 240MW of the 610MW belonged to

the Ruacana hydroelectric power station, which is dependent on the water flow of the Kunene river and the output can easily drop to 10% of its full capacity during the dry season. The electricity generated at Ruacana is the cheapest. At a higher cost, a maximum of 200MW could be imported from South Africa. The remaining 170MW reserve capacity could not be expected to meet the country's maximum demand for long and was very expensive. Future electricity supply planning needed to take account of this situation to ensure that the demand could be met reliably and economically, and a new 400MW interconnector with the South African grid was constructed at around the turn of the century.

While all major urban centres had been electrified by Independence in 1990, rural areas – in particular communal areas where the majority of the population resides, but also commercial farming areas – remained without access to grid electricity. Ten years earlier SWAWEK had been confirmed, through new legislation, as bulk electricity supply authority, with the right to supply electricity, but without obligation to supply, as is customary in other countries. Such an electrification obligation would have encouraged rural development and provided a significant economic impulse for Namibia at an earlier stage.

3.2 NATIONAL POWER SYSTEM

3.2.1 Generation Capacity

Namibia's total power generation capacity of 384MW is made up of the 240MW Ruacana hydroelectric plant on the Kunene River, the 120MW Van Eck coal-fired power station at Windhoek and the Paratus 24MW diesel station at Walvis Bay.

Namibia is connected to the southern African power system via two interconnectors with ESKOM in South Africa, one with a transfer capacity of 200MW and operated at 220kV, and the other with a transfer capacity of 500MW and operated at 400kV. Namibia also imports electricity for two isolated power systems, one in the far north-eastern Caprivi Region (from Zambia) and the other in the extreme south-western corner of the country (from South Africa). Namibia supplies cross-border electricity to western Botswana and southern Angola.

3.2.2 National Grid

The national grid, which is characterised by a central backbone structure from which one-directional spur feeders emanate (except for one major ring in the central northern regions, and another ring to the central coast), connects all major centres and a multitude of small rural localities in the country (see Figure 3).

3.3 ELECTRICITY CONSUMPTION AND DEMAND GROWTH

Namibia's annual electricity consumption presently is in the region of 2.5TWh, with a peak load of approximately 410MW. In 1990, the country's peak demand was 225MW and annual electricity consumption amounted to 1.6TWh, indicating an average annual growth of about 5% in peak demand and 3.5% in consumption over the 16 years. The deteriorating load factor can at least partly be attributed to the

effects of electrification, as an increasing number of low-consumption rural households are connected to the grid. Newly electrified rural households tend to consume much less electricity than average urban households, given the typically low disposable rural household incomes and expenditures compared to urban households.

Net imports of electricity from ESKOM in South Africa currently account for over 50% of the requirements, with the remainder being supplied mainly by Namibia's Ruacana hydroelectric power station. Namibia is a member of the Southern Africa Power Pool (SAPP).

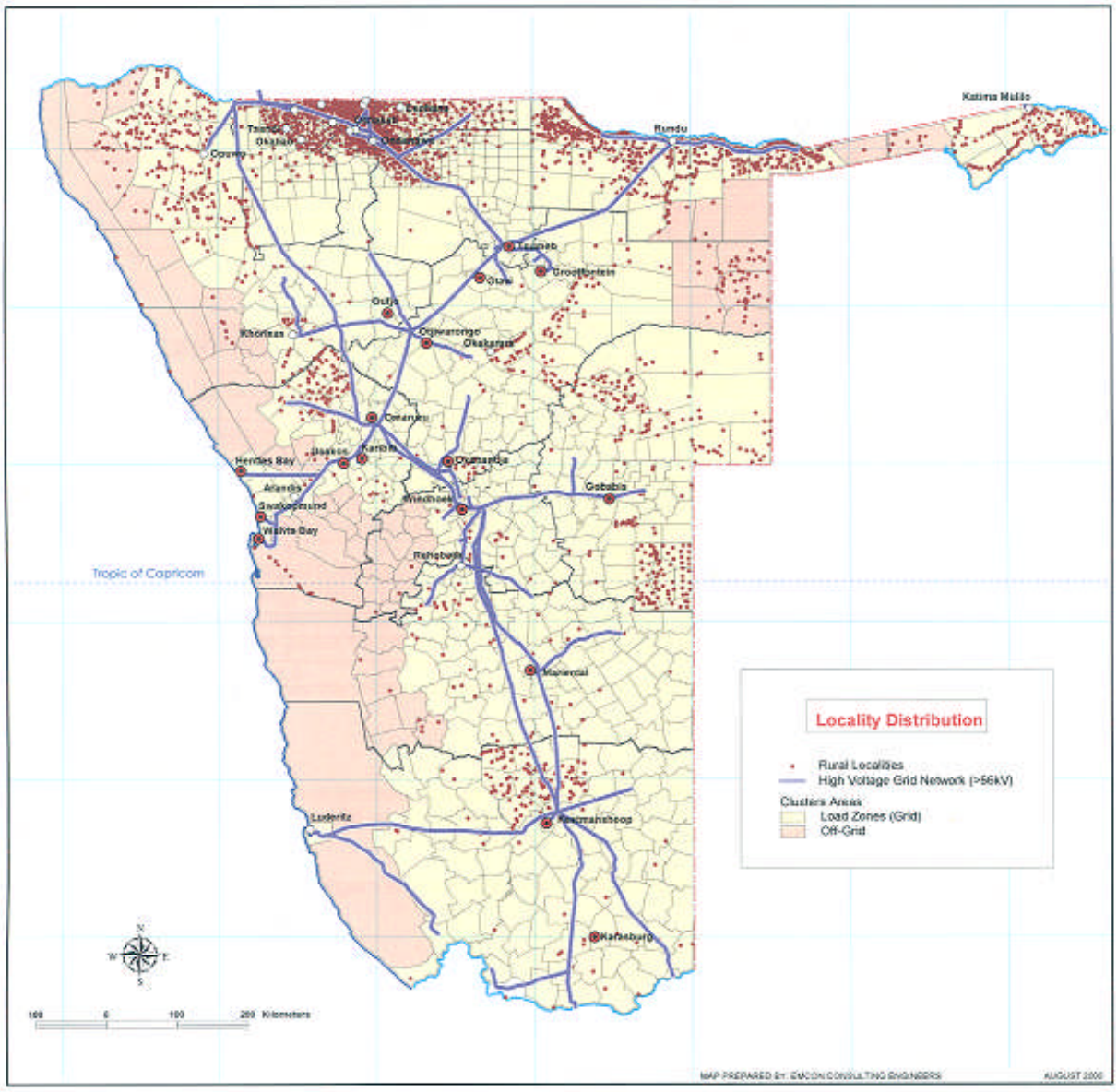

FIGURE 3: Rural Locality Distribution and National Electricity Grid

3.4 THE NATIONAL RURAL ELECTRIFICATION PROGRAMME (NREP)

Large-scale rural electrification commenced shortly after Namibia's independence from South Africa in 1990. With a vision of economic empowerment and social upliftment of rural communities, the new Government embarked on a national rural electrification programme to provide the infrastructure for grid electricity services.

The electrification programme, in its first phase, aimed to connect all main rural centres and larger settlements. The programme commenced in the most densely populated central northern regions of the country, covering the Omusati, Ohangwena, Oshana and Oshikoto regions (then referred to as Owamboland) between 1991 and 1993. In 1992 and 1993 the western Kavango Region was electrified for the first time, followed by the eastern Kavango Region in 1993 and 1994. Proceeding in a clockwise direction around the country, the electrification programme covered parts of the Otjozondjupa and Omusati regions in 1994 and 1995, and most main centres in the Hardap and Karas regions were electrified between 1995 and 1998. The first phase of rural electrification in the Caprivi Region took place in 1995 and 1996, with the central northern regions receiving a second phase during 1997. Larger settlements in the Erongo and Kunene regions were electrified in 1998 and 1999, during which period the third phase of rural electrification in the central northern regions was implemented.

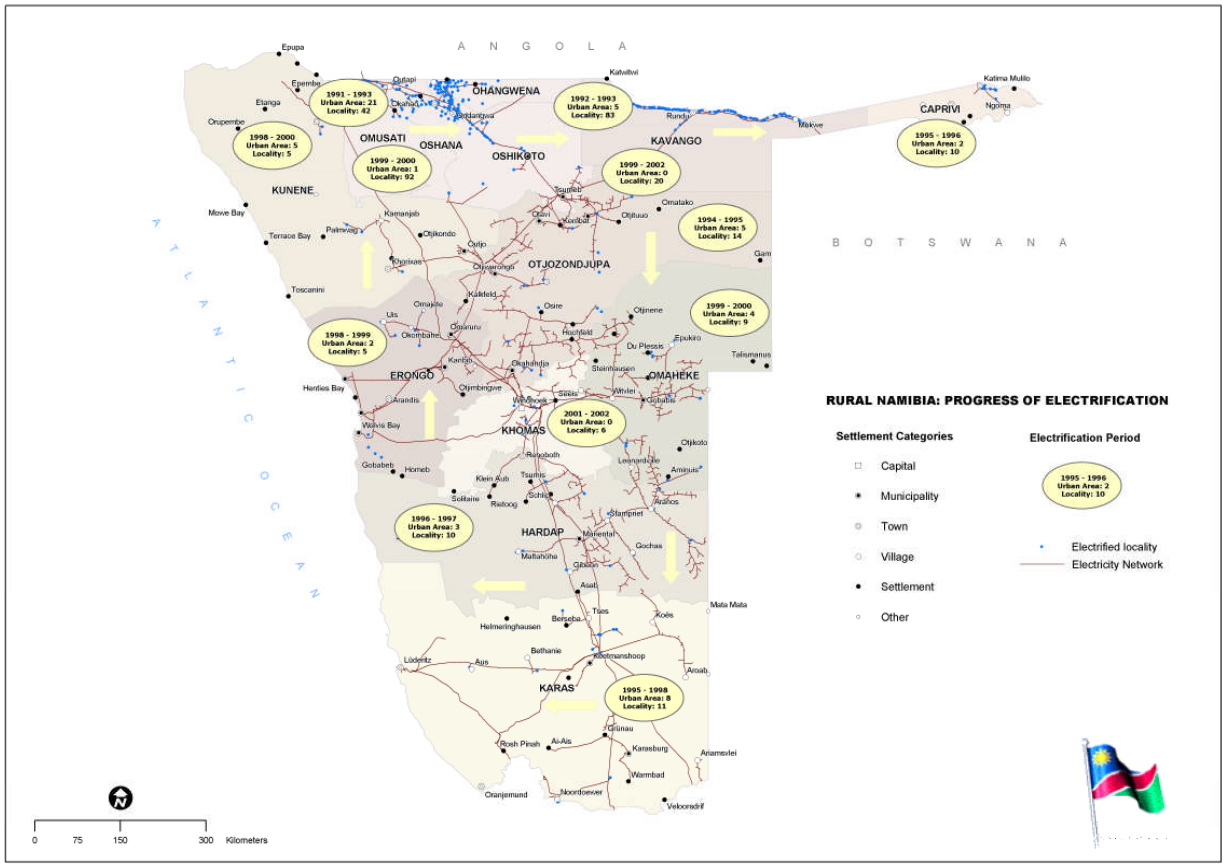

FIGURE 4: Namibia's National Rural Electrification Programme

While rural electrification in the initial phases was limited to grid extension, the Ministry of Mines and Energy in 1996 instituted a revolving fund for solar home systems (SHS), in an effort to afford remote rural households the opportunity to acquire basic electrification for their homes. Various approaches to large-scale off-grid energy provision have been investigated since 2001, but little progress has been made to date.

Grid extension into previously unelectrified rural areas initially focused on connecting public institutions and infrastructure (schools, hospitals/clinics/health centres, police stations, post offices, government offices, water supply and purification plants, agricultural development centres, telecommunications infrastructure, etc), missions and churches, as well as commercial establishments (super markets, cuca shops, bakeries, manufacturing workshops, fuel stations, etc). Households within localities being electrified also benefited, with the electrification programme pledging to connect all customers within a 500m radius of distribution transformers. The dispersed nature of many rural localities, however, implied high costs of electrifying and maintaining service in such localities.

3.4.1 Pre-Payment Metering

A key success factor of the electrification programme was the introduction of pre-payment metering. This new technology was motivated primarily as a means of making electricity accessible in areas where metering and billing infrastructure would be difficult and costly to maintain, but it soon found application too in urban and peri-urban centres around the country. The fact that the pre-payment system enabled greater perceived customer control over energy consumption proved to be a major driver of rural and urban electrification programmes, and the technology was widely embraced (quite contrary to experience in neighbouring South Africa). Many customers on a post-paid tariff even opted for pre-payment metering, particularly in rural towns like Oshakati, Ondangwa and Rundu.

With the majority of pre-payment customers being poor households, both in rural and urban areas, this tariff and payment mode is ideally suited to address the plight of the poor. Individual coding of pre-payment meters also allows for differentiation between poor and more affluent customers, although no differentiated tariffs have been introduced as yet.

3.4.2 Master Planning

Until 2000, electrification planning has always been ad hoc, based on perceived rather than measured priorities. The Rural Electricity Distribution Master Plan (REDMP) for Namibia was commissioned in late 1998, to determine the remaining electrification requirements (number of connections and costs) and to establish a prioritised annual electrification schedule. Since 2000, the grid electrification programme has been implemented in accordance with this systematic and objective method of prioritising projects, based on the social benefit and capital cost of a project in relation to other projects. Some of the high priority off-grid projects identified by the REDMP have also been executed. In 2005 the master plan has been updated to account for developments over the last five years and to generate new prioritised schedules for the following years.

3.5 RURAL ELECTRIFICATION FUNDING

Investment funding for rural grid electrification in Namibia has come from various sources. During the early stages, the NREP was heavily supported by donor funds, most importantly contributions from NORAD, with the balance being made up with Government subsidies. Nowadays the programme is almost entirely funded through annual budgetary allocations from Government, with NamPower having a limited rural electrification responsibility.

Namibia's expenditure on rural grid-electrification, since the start of the NREP to the present day, is summarized in Table 2, indicating the various funding sources.

3.5.1 Foreign Donor Funding

Since Independence, Namibia has received considerable financial resources from foreign donors for the purposes of rural electrification. **Norway, in particular, has been a major grant fund contributor to the national rural grid-electrification programme, with a total of about N$75 million between 1991 and 1998**. Another significant donor has been the German *Gesellschaft für Technische Zusammenarbeit* (GTZ) whose focus was on off-grid electrification.

3.5.2 Government Funding

The Namibian Government has identified rural electrification as one of the key means of achieving its social upliftment and rural development goals, and has an annual budgetary allocation for this purpose.

To date, a total of about N$310 million has been invested by the GRN in rural electrification through annual budgetary allocations. These are continuing into the future, albeit at lower levels than were recommended by the REDMP.

3.5.3 NamPower Funding

In terms of a 1996 performance agreement between Government and NamPower the utility undertook to invest N$10 million annually in rural electrification for the duration of the agreement (1996-1999). This was largely used for rural community electrification. The performance agreement was extended for another three years in 1999, providing for an annual capital commitment of N$12.5 million which has been increased again in 2002 to N$15 million for the year 2002/3.

Since the establishment of Regional Electricity Distributors (REDs), however, NamPower's RE investments have been limited to areas where the utility remained the asset-owning entity. Exact investment figures could not be obtained, but the utility estimates that not more than N$4 million per annum has been invested in the last four years.

In 1998, the rural electrification programme received a significant capital injection of around N$200 million over a period of 20 years through a loan subsidy from the European Investment Bank, the Swedish International Development Agency (SIDA) and the African Development Bank that has been negotiated as part of the financing arrangements for the 400kV interconnector with South Africa. The first utilisation of these concessional funds for actual infrastructure has occurred in 2002 under GRN's programmes, but these funding sources have not been tapped again until 2006/7.

NamPower's total contribution to date, including the concessional funding, is approximately N$116.5 million.

3.5.4 Northern Electricity Funding

Northern Electricity's 5-year contract required the company to invest N$2.7 million in rural electrification by way of new customer connections. Over and above this obligation, the company invested some N$14 million in network extensions and customer connections, adding a total of almost N$17 million to Namibia's RE expenditure to date.

3.5.5 Investments in Off-Grid Electrification

To date, nearly all (>98%) of the investment funds that have gone into rural electrification have been allocated to grid extension. However, in future off-grid electrification is expected to play an increasing role, as population densities decrease further, localities become ever smaller and more remote, and distances to the existing grid continue to increase.[1]

Despite Namibia's 3,300 hours of sunshine per year (one of the highest figures in the world), and insolation levels reaching 8kWh/m^2/day (even in the rainy season there are usually 4 to 5 hours of bright sunlight per day), the widespread use of solar energy (eg for photovoltaic systems and solar water heaters) is constrained by a lack of financing and awareness.

[1] While the energy policy document encourages the promotion and use of renewable energy technologies in meeting the ambitious access targets, the differing levels of subsidisation allocated to grid and off-grid electrification indicate a strong preference for grid electrification. However, due to Namibia's geographical vastness and low population density, off-grid energy solutions are bound to rise in importance.

TABLE 2: Investments in Rural Grid-Electrification in Namibia (1991/92 – 2006/07)

YEAR	NORAD		MME	NamPower		Northern Electricity	TOTAL	CPI	TOTAL
	nominal NOK	nominal N$	nominal N$	Performance Agreement (nominal N$)	Concessional Funding (nominal N$)	nominal N$	nominal N$	%	real N$ (2007)
1991	32,022,000	13,184,123	11,000,000	-	-	-	24,184,123	11.90	5,562,348
1992	16,592,302	7,641,023	9,000,000	-	-	-	16,641,023	17.70	4,326,666
1993	24,763,000	11,200,000	9,000,000	-	-	-	20,200,000	8.50	6,464,000
1994	11,605,000	6,000,000	7,716,000	-	-	-	13,716,000	10.80	4,800,600
1995	23,180,500	13,157,895	10,000,000	-	-	-	23,157,895	10.00	9,031,579
1996	9,000,000	6,207,041	3,776,724	10,000,000	-	700,000	20,683,765	8.00	8,894,019
1997	18,000,000	12,540,000	18,240,000	10,000,000	-	1,500,000	42,280,000	8.80	19,871,600
1998	7,500,000	5,426,575	29,902,452	10,000,000	-	3,500,000	48,829,027	6.20	25,391,094
1999	-	-	25,000,000	12,500,000	-	4,500,000	42,000,000	8.60	23,100,000
2000	-	-	25,000,000	12,500,000	-	6,500,000	44,000,000	9.30	26,400,000
2001	-	-	25,145,000	12,500,000	-	-	37,645,000	9.30	24,845,700
2002	-	-	26,646,000	15,000,000	10,000,000	-	51,646,000	11.30	37,701,580
2003	-	-	29,088,000	4,000,000	-	-	33,088,000	7.20	27,463,040
2004	-	-	30,855,000	4,000,000	-	-	34,855,000	4.10	31,020,950
2005	-	-	30,000,000	4,000,000	-	-	34,000,000	2.30	31,620,000
2006	-	-	20,000,000	4,000,000	8,000,000	-	32,000,000	5.10	30,400,000
2007	-	-	20,000,000	4,000,000	-	-	24,000,000	5.90	24,000,000
TOTAL	**142,662,802**	**75,356,657**	**330,369,176**	**102,500,000**	**18,000,000**	**16,700,000**	**542,925,833**		**340,893,176**

NOTES:

a) GRN's financial year commences on 1 April and ends on 31 March of the following calendar year.

b) The figures in this table have been compiled from various sources, including NORAD's, MME's and Northern Electricity's records, personal communication with MME and NamPower officials, as well as the following literature: (Krugmann et al, 2004), (EMCON, 2003), (Davis et al, 1995). Many of the figures are judged to be no more than best estimates as it was not possible to confirm them.

c) Where figures differ from those quoted in Davis et al (1995), these have been sourced from investment records that are considered more accurate.

d) NORAD's NOK value of investments for the years 1996/7 to 1998/9 is approximate as no records of applicable exchange rates could be found.

e) NamPower's investments until 2001/2 are budgetary commitments that the company maintains have been met, while those since 2002/3 are estimates only.

f) The distribution over the five years of Northern Electricity's total investment is approximate only.

g) Investments for wiring of government buildings (which were included in Davis et al, 1995) have been omitted as it has not been possible to source such figures for subsequent years.

h) The annual CPI values have been obtained from the International Monetary Fund.

4 IMPACT ASSESSMENT

Impact, in terms of the OECD's DAC Criteria, is assessed by the positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended. This involves the main impacts and effects resulting from the activity on the local social, economic, environmental and other development indicators. Both intended and unintended results, as well as the positive and negative impact of external factors, are examined in the effort to assess the real difference that NORAD's grant funding contribution to rural electrification has made in rural communities of Namibia's Central-North.

In particular, this assessment aims to clarify the short-term and medium-term effects of the intervention on rural dwellers and community life, businesses, public institutions, and the environment.

The detailed analyses that have resulted in this assessment are included in appendices A to E.

4.1 IMPACTS ON RURAL COMMUNITIES

Various studies have shown that rural electrification has had significant positive social and economic impacts in Namibia, indicating that strong policy and public financial support significantly promotes rural development and poverty alleviation.

However, despite living standards having steadily improved for rural communities in Namibia, in part as a result of electrification, there are also some apparent negative trends: unemployment is increasing, and life expectancy at birth is dramatically dropping (due to AIDS), while the number of orphans is increasing (also due to AIDS). Overall, it is therefore difficult to judge in how far rural communities are better off now than 15 years ago.

4.1.1 Growth and Development

Access to electricity creates an enabling environment for rural growth and development. Since implementation of the rural electrification programme, communities in Central-North have experienced

- tangible improvements in social service provision (better health services and education opportunities, improved social security and police services),
- a vastly enhanced telecommunications infrastructure,
- more reliable water supply services,
- an enhanced business environment with expanding markets and better employment opportunities, and
- better access to regional and local government services (through the Government's decentralization drive),

most of which would not have been possible without access to electricity. Many former rural settlements have developed into urban centers with modern

infrastructure and services, offering convenient lifestyles for its residents and changing population migration patterns.

4.1.2 Improved Service Delivery

As customers of businesses and institutions, community members are the receivers of improved service delivery due to electrification, benefiting from previously unavailable services (eg electronic banking, evening classes), as well as from expanding shops and businesses that are able to offer a wider range of services (eg better entertainment, electronic processes) and goods (eg perishable groceries and cold drinks) as a direct result of access to electricity.

Night-time activity has increased considerably in electrified localities, with cuca shops entertaining customers until late, churches holding evening services, schools offering night classes, and community groups holding evening meetings. Street and area lighting has improved security, allowing people to move about more freely and without concern for their safety. Access to electricity has also improved police service delivery, and it is enabling clinics to offer improved nighttime emergency services.

4.1.3 High Quality and Affordable Electricity Service

Distinct improvements in the quality of electricity supply have been achieved through the rural electrification programme. These improvements have manifested themselves in the form of enhanced access to electricity, better power supply infrastructure than existed in some areas, better system maintenance, and fewer and shorter power failures.

The Namibian rural electrification experience also shows that innovative commercialization and private sector participation can lead to tangible improvements in customer service quality, without increased cost to the customer. Where electricity supply operations have been ring-fenced, and where private sector companies (Northern Electricity) and dedicated public sector electricity service providers (REDs) have been involved, this has tended to result in greater attention to customer needs, including carefully structured tariffs that take account of the poorer sections of the community. The results of this customer focus are most evident in the Northern Electricity experience, where high electricity consumption, few tamper cases, high payment levels, and a rapid rate of connection demonstrated a high level of customer satisfaction. It must be emphasized, however, that this positive aspect was not an automatic consequence of the rural electrification programme: before commercialization, service quality was extremely poor due to severe capacity constraints, and the widespread benefits that rural electrification was expected to bring about did not materialize (or only for a short while), threatening to discredit this important development initiative. The lesson to be learned from this is that the provision of physical infrastructure alone is not guaranteed to result in sustainable improvements in the quality of life of rural communities. It needs to be coupled with simultaneous - or even precursory - deployment of the support infrastructure necessary to effectively manage, maintain and develop the physical assets.

4.2 IMPACTS ON RURAL HOUSEHOLDS

4.2.1 Perceived Benefits and Dislikes of Electricity

First and foremost, rural households experience the benefits of electrification through the convenience of flicking a switch for high-quality energy services. Good lighting, in particular, is perceived as the most important benefit of access to electricity. Other highly ranked advantages include flexibility and reliability of grid-electricity, and that it is a clean source of energy. The most common dislike, on the other hand, is the potential danger associated with incorrect electricity use that may result in short circuits and electric shock. Another perceived dislike is that electricity supply is prone to outages due to lighting strikes.

Furthermore, electrified households observed improved health of household members (by not being as exposed to toxic fumes from wood fires and kerosene lamps), a better home learning environment for students, and better access to information through TV and the internet as positive impacts of electrification.

Overall, rural households experience access to electricity as an improvement in their quality of life. Whether or not they utilize the full potential of electricity and actively explore opportunities for income generation and changes in livelihoods is not apparent though.

These findings indicate that there is scope for improving the positive impact of rural electrification on households - through public awareness campaigns, customer education and targeted initiatives - in terms of awareness about the risks and opportunities associated with access to electricity.

4.2.2 Affordability and Willingness to Pay

In some areas people perceive electricity service to be expensive and electric appliances unaffordable, but most households indicated that the cost of electricity is worth it because of all the benefits. This sentiment is confirmed by the relatively high average household consumption (compared to rural consumers in South Africa) and the low non-payment rate. Electrified households generally spend less on energy than unelectrified households, although in some areas the experience is the opposite.

4.2.3 Fuel Switching

As could be expected, access to electricity has reduced consumption of and demand for other energy sources, but very few households have made a complete switch to electricity. For the majority of electrified households firewood is still the preferred energy source for cooking (mostly for cultural reasons), and most still use at least some candles, batteries, paraffin and/or gas.

4.2.4 Rural Household Electricity Use

Electrified rural household's use of electricity has gradually increased over the years, with most households initially using little more than electric lighting and a radio/HiFi system. Today, electrified households in Central-North own a wide variety of electric appliances, including common household items like kettles, refrigerators, irons, TVs,

stoves/hotplates, washing machines, microwave ovens, hair dryers and shavers, but also more luxurious appliances like DVD players and gaming consoles. In 1999 60% of electrified households in Central North owned an electric refrigerator and 30% owned an electric stove, and by 2007 these figure had risen to 88% and 40% respectively. Also, 30% of electrified households and 37% of unelectrified households use gas stoves today, indicating a tendency towards modern cooking methods. However, it was found that traditional cooking methods using firewood are still widely preferred in rural areas, even among electrified households.

Interestingly, many unelectrified households already own electric appliances like TVs (22%), HiFi systems (56%), refrigerators (14%), kettles (10%), hotplates (8%) and stoves (7%), in anticipation of grid electricity.

4.2.5 Potential Gender Benefits

Although this impact assessment did not find any direct evidence of gender benefits of rural electrification, the potential benefits are nonetheless worth mentioning.

Providing rural households with access to electricity has potentially a major impact on reducing women's burden, in terms both of time saved not collecting firewood and of improved health due to a reduction in pollution from burning wood and not having to carry heavy loads, often over large distances.

Freeing up time for women creates opportunities to engage in income generating activities and to become economically empowered, resulting in an improvement in status within the household. Some of these benefits will only be realized if there is a demand for labour which the extra time of women can fill or if women are provided with the opportunity and are supported to start up their own business.

Statistics show that women more often have a higher illiteracy level than men and tend to be more inclined to attend literacy classes. A higher level of literacy will further improve women's empowerment in that they can take a more active part in decisions, political discussions, assist and encourage their children with homework, understand medical prescriptions and handle money with more confidence.

Women suffer disproportionately more from health problems related to gathering and burning wood for cooking. Cooking with firewood causes air pollution that can have serious negative effects on the respiratory system and the eyes, particularly if done indoors. Firewood collection also poses the threat of being bitten by snakes and of being sexually assaulted.

4.3 IMPACTS ON BUSINESSES

4.3.1 Small Business Development

Although there has been some limited evidence in Central-North of the emergence of new businesses as a direct result of access to electricity, this does not appear to be a typical consequence of electrification. More prominent benefits are associated with utilization of electricity, such as the possibility for businesses to offer a wider range of goods and services (eg longer business hours, perishable foods, cold drinks), and better energy economy and convenience.

Increased access to electricity helps to improve the business environment for enterprises, potentially raising productivity, creating employment opportunities and generating more income. However, access to electricity in isolation is usually insufficient to promote business development, which also depends on factors such as access to finance and credits, access to markets, training and information. This implies that electrification should be an integral part of broader strategies for the promotion of small business development.

4.3.2 Small Business Productivity and Income

In assessing the impact of electrification on productivity and income in Central-North, electricity was found to be contributing to the quality of services offered by small businesses and playing a role in attracting and keeping a client base. But the ability to attract customers also depended on other factors, including location, range of goods and services, condition of the building, and quality of the service. Electrified cuca shops tended to stay open longer than unelectrified ones. Generally, very little diversification of goods and services was observed, and the impact of any productivity-related benefits on income and profits was found to be minimal.

While electrified small businesses tended to have higher earnings, on average, than unelectrified ones, this could not be attributed to access to electricity as no previously unelectrified businesses reported an increase in daily income after electrification. Even where some shops had managed to diversify their services, this was not necessarily reflected in higher incomes. It was clear that other factors, such as access to finance and business location, were important determinants of the income earned.

4.3.3 Employment Opportunities

The general perception in Central-North today is that electrification has created employment opportunities, and that more people have work, either as employees or through different types of self-employment. The direct impact of electrification on employment is hard to measure, however, except in the case of the electricity industry itself where people are employed as technicians and pre-paid electricity vendors, in electric appliance sales and service, and by the electricity supply authority. These jobs did not exist prior to the electrification programme.

Employment opportunities are an important facet of an improved business environment, which may mitigate urbanization pressures and improve the overall living conditions in rural areas.

4.3.4 Business Electricity Use

The prime benefit of access to electricity for enterprises has been the utilization of electric appliances to enhance business services. The indication from small enterprises, however, was that electricity-enhanced service does not necessarily improve business. Larger retail establishments, on the other hand, were found to engage in more extensive electricity use, contributing to business growth by increasing production/sales and creating more employment opportunities.

4.3.5 Small Business Energy Expenditure

Access to electricity was found to lead to reductions in energy expenditure in small businesses that had switched to electricity for their principal energy requirements. Furthermore, where small businesses had shifted to electricity for a number of thermal energy services, greater reductions in energy expenditure had resulted than for small businesses with fewer energy requirements. It also transpired that unelectrified small businesses paid up to three times more for the same energy services than electrified ones.

4.4 IMPACTS ON PUBLIC INSTITUTIONS

In addition to the benefits that accrue due to avoided cost of alternative energy sources (including diesel generators), access to electricity can lead to the creation of new facilities (such as an X-Ray unit at a rural hospital), improve the quality of public services, and entice staff to work in rural areas.

4.4.1 Health Care

Rural health care has improved as a direct result of access to electricity. All electrified clinics and health centres are now equipped with electric refrigerators for more reliable storage of vaccines and medication, and electric lighting has enabled nurses to better attend to emergencies after dark. Electricity has also benefited radio communication systems in remote areas for enhanced service delivery.

For hospitals, which generally depend on modern medical and office equipment, electricity is critical to their effective functioning. All rural hospitals had diesel-generated electricity before rural electrification, which was expensive and prone to maintenance problems. Access to grid electricity has meant a more reliable and less costly power source for hospitals, thereby improving service delivery of these institutions. This in turn has enabled technology improvements and in some cases even expansion of facilities.

Access to electricity is also thought to be an important factor in attracting qualified staff to work in rural areas, although the extent to which this occurs is not clear as there are many factors influencing nurses' and doctors' choices of where to work.

4.4.2 Education

The impact of electrification on primary schools has been limited, as electricity use in these schools is generally restricted to very few appliances. Lights are rarely used, given that the schools are seldom used at night. Educational equipment may include an overhead projector, computers, a TV with DVD/VCR player, and there may be a photocopier and fax machine in the office.

Secondary schools, on the other hand, generally make extensive use of electricity, in classrooms as well as offices and hostels. Many electrified secondary schools previously had access to diesel-generated electricity, with benefits of electrification accruing from savings in operational and maintenance costs as well as greater reliability of electricity supply and improved service quality, both associated with the replacement of diesel generators by grid electricity. These schools typically own a wide range of appliances, including lights, fans and heaters, photocopiers, overhead

projectors, typewriters, computers and printers, fax machines and lab equipment. School kitchens use electricity for large boilers, extractor fans and larger refrigerator rooms, but also for cooking in some instances.

Perceived problems and difficulties associated with electrification included the lack of a workable system for replacing light bulbs, mistrust of tariffs (in particular in relation to maximum demand charges), and the effect of supply interruptions (mainly in terms of damage to equipment, rather than adverse effects on teaching activities).

4.4.3 Telecommunication

Extension of telecommunications infrastructure into rural areas has previously largely relied on de-centralised photovoltaic (PV) systems as power source. With the expanding electricity grid, many PV systems have now been replaced with a grid connection, eliminating the risk of PV panels being stolen (which was widely experienced) and offering greater supply reliability.

More recently, Namibia's two cell phone operators have extended their networks into the densely populated rural areas of Central-North, primarily using grid electricity as power source on their repeater stations.

4.4.4 Water Supply

Access to electricity has greatly benefited water supply and purification in Central-North, providing an uninterrupted supply of clean water to rural communities. Expensive and maintenance-intensive diesel systems have been replaced with electric pumps and automatic control equipment, enhancing water pollution management and improving water quality standards.

4.4.5 Agriculture

Rural electrification has had a reasonable impact in the agricultural sector of Central-North. The main benefits have been substitution of diesel generators by grid connections to power electric pumps for irrigation schemes, and electrification of Agricultural Development Centres and training colleges. While the former achieved savings in operational costs, the latter provides better living and working conditions for agricultural extension officers and improved service delivery.

4.4.6 Police

Police stations generally make limited use of electricity, but electric lighting and electronic radio communication systems have significantly improved their capacity to handle emergencies after dark. In terms of safety and security, street and area lighting has had a positive impact on the crime rate, and is rated as a high priority by residents in rural localities. Better telecommunication services in rural areas, enabled by access to electricity, have improved rural residents' access to police services when needed.

4.5 IMPACTS ON THE LOCAL ECONOMY

Infrastructure development programmes - like rural electrification - have far-reaching impacts on the economy, with the large investment costs being intended to lead to a range of benefits that accrue over the lifetime of the assets. A cost-benefit analysis systematically compares these up-front costs with the resulting benefits.

The cost of the programme in Central-North includes

a) all capital expenditures on rural electrification for the period 1991/92 until 2005/06, and
b) operating costs which include costs of sales, operation and maintenance costs and cost of customer service during the life of the program (25 years).

The types of benefits of rural electrification will partially depend on the user group:

- For households and small businesses, electrification leads to the displacement of most expenditures on other energy sources, as well as improved well-being from a reduction in the price per kWh allowing for an increase in consumption.
- Some institutions provide critical services. In many cases, these institutions rely on a diesel generator to provide these services. It is thus (conservatively) assumed that the same services will have to be provided whether consuming expensive diesel generated electricity, or grid electricity. In these cases, the benefits associated with electrification will be limited to the displacement of the associated diesel generation costs.
- For those institutions not previously using a generator, on the other hand, the type of benefits will be similar to those observed for households and small businesses, described above.

For each consumer group, the benefits of the program have been estimated and aggregated to account for all connections.

The analysis demonstrates significant net economic gains from the program in the former Owamboland, with an estimated economic internal rate of return of about 33%. Given the social nature of the investments and other potential benefits (e.g. environmental benefits, gender related improvements, etc.) a relatively low discount rate can be justified. Accordingly, at a discount rate of 8%, the benefit-cost ratio is just over 2.

In other words, total discounted capital and operating expenditures of some N$691 million between 1991 and 2006 will have resulted in discounted economic benefits estimated at some N$1.4 billion by 2016. Households, as well as large and small business reap a large portion of the benefits. These returns are significant and are thus robust to rather significant changes in either the discount rate or the assumption employed in the analysis.

4.6 IMPACTS ON THE ENVIRONMENT

Environmental considerations form part of the objectives of the rural electrification programme, with assumptions that electrification reduces biomass fuel use and that

fuel switching (from wood to electricity) would impact CO_2 emissions and reduce health hazards for rural dwellers.

4.6.1 Electric Infrastructure Impacts

Two adverse environmental impacts of rural electrification are a) the environmental footprint of electricity supply infrastructure, and b) the indirect environmental effects of electricity generation for distribution in rural areas. The former impact can be minimized through careful infrastructure and land use planning, based on sound economic and environmental criteria. The latter depends on the particular mix of primary energy sources, which in the case of Namibia is made up, on average, of about 50% hydro-electric power from Ruacana and 50% mostly coal-based power generation from South Africa. While hydropower is relatively clean, it carries significant environmental opportunity costs, and coal-based generation tends to be highly polluting.

4.6.2 Reduction of CO_2 Emissions

Each electricity connection displaces wood, paraffin and candle consumption, thus also displacing the associated CO_2 emissions. This provides a global benefit that is generally estimated by the market value of each ton of CO_2 emission displaced, and the value of this depends on the type of project, the buyer and the price at the date of contract signing.

On a household level, this environmental benefit is typically very small, but for large-scale users of diesel generators switching to grid electricity (hospitals, secondary schools, water pumping stations, agricultural colleges and irrigation schemes) it would be substantial.

4.6.3 Deforestation

Widespread household use of wood fuel for cooking and heating contributes to deforestation. In an area with the ecological setting as Central-North, where trees and wood fuel are scarce resources, deforestation is a threat to the environment as it might be one factor[2] leading to the increased spread of sandy and loose soil. The principal proximate causes of deforestation in Namibia, however, are fires and clearing of land for agriculture, and collection of fuelwood generally has only been a minor contributor to deforestation. Nevertheless, deforestation has been causing growing fuelwood scarcity, particularly in Central-North, where evidence exists that in unelectrified localities household expenditures on fuelwood can be a substantial proportion (up to 50%) of overall household expenditures and income. In electrified localities, by contrast, levels of household expenditures on fuelwood are small (less than 8%) relative to overall household expenditures. It must be emphasised, however, that the vast majority of electrified households still prefers to use firewood for cooking, for cultural reasons. The main lesson in this is that rural electrification cannot be assumed to significantly reduce reliance on firewood in the short term.

[2] Other factors affecting deforestation are agricultural practices and population densities.

In terms of the increasing fuelwood scarcity, an electrification programme can achieve environmental benefits if it links up and works in parallel with re-forestation programmes.

4.6.4 Respiratory Diseases and Poisoning

Cooking with wood, particularly indoors, causes air pollution that contributes to respiratory diseases and it poses a fire risk. Using paraffin and candles for lighting also carry potential risks in terms of fire and poisoning[3]. While rural electrification contributes to fuel switching (from wood/paraffin/candles to electricity), the extent of this is limited, particularly in the case of fuelwood, which is still widely used, even by electrified households. Hence, these health and environmental threats continue to be present.

[3] Distribution and trade with paraffin in rural areas often uses a variety of containers, including drinking bottles. This could present a potential risk of poisoning since people, often children, might mistake it for a drink. Also, if not cleaned properly, traces of paraffin will be left in the container.

5 LESSONS LEARNT

Namibia's rural electrification programme was initiated 17 years ago and has already reached the more densely populated regions of the country, connecting all rural growth centers and more than 26,000 customers to the grid. This section highlights the key lessons that have emerged from this impact assessment.

5.1 SUCCESS FACTORS

There are three distinct factors that have been instrumental in ensuring the success of Namibia's rural electrification programme: the 100% capital subsidy, a dedicated electricity service, and pro-active private sector involvement in implementation and service provision.

5.1.1 Capital Subsidy

Without the capital subsidy, rural electrification would have been a sluggish development effort, with low connection rates due to the high capital costs that mostly poor customers would have had to bear. Many corners of the country would not yet have had access to electricity and development would almost certainly have charted a different path that would probably have been most apparent in the lack of decentralization of services and consequent population migration patterns. Subsidizing rural electrification (with funding assistance from Norway) signaled a huge development commitment and was one of the most important infrastructure investments the Namibian Government could have made. It enabled rural development on a grand scale, providing essential services for previously disadvantaged communities, addressing poverty issues and stimulating the local economy, and improving the quality of life of many rural dwellers.

5.1.2 Dedicated Electricity Service

The introduction of dedicated electricity supply services in newly electrified areas ensured both sustainability of the service and continued electrification in these areas. However, the realization of this essential facet only emerged gradually after the first phases of rural electrification had been completed. Network maintenance and service needs had increased beyond the capacity of the under-resourced regional Government departments responsible for this service, and the backlog of new connections to be provided was rising rapidly. The resulting community dissatisfaction put the rural electrification programme under threat, with indications that the expected benefits could not be achieved nor sustained. Government then took swift action in awarding a management contract to a dedicated electricity service provider (Northern Electricity), while committing to restructure the industry to address the issue of long-term sustainability. This action yielded the desired results within a short period of time and rescued the development initiative, with the electrification programme continuing to this day and into the future. Dedicated

permanent electricity service structures are now in place in three out of Namibia's five envisaged electricity supply regions.

5.1.3 Private Sector Participation

The Namibian experience suggests that the role of the private sector in promoting the success of a rural electrification programme should not be underestimated. With Government providing policy direction and funding for the programme, and exercising overall regulatory control, the Namibian private sector actively participated in the implementation of the rural electrification programme on three levels:

a) ***Planning***: Private consultants were responsible for conceptualizing and planning of the development initiative.
b) ***Implementation***: Private contractors constructed the physical infrastructure.
c) ***Service provision***: Electricity service provision was outsourced to a private company on a management contract basis for an interim period of five years, yielding high levels of customer satisfaction, rapid electrification and a viable, yet affordable, rural electricity service of good quality.

5.2 KEY LESSONS

There are four key lessons to be learnt from the Namibian approach towards implementing a successful national rural electrification programme, namely:

a) Government commitment is a key factor in bringing about real change. The Namibian Government demonstrated its commitment through the capital subsidy for rural electrification and its determination to achieve long-term sustainable benefits for rural communities.
b) Donor assistance to such a structured initiative (like the NREP) is a most effective way of contributing to real development.
c) A rural electrification programme cannot expect to succeed without addressing the resulting infrastructure and management service needs. Ideally, the necessary structures and resources are already in place to assist with implementing a rural electrification programme.
d) The private sector can play a significant role in ensuring success of an electrification programme, particularly from an efficiency and innovation perspective. The Northern Electricity experience has also shown that private sector participation in rural electricity supply services does not necessarily lead to higher tariffs, it can be a profitable venture while still affordable by typically poor rural communities.

5.3 SPECIFIC LESSONS

5.3.1 Small Business Development

Evidence from Central-North indicates that access to electricity alone does not sufficiently stimulate small business development. Nor does electricity-enhanced service improve income generation for small businesses. Targeted initiatives - like access to finance and credits, access to markets and information, awareness creation and skills training - could be offered in conjunction with a rural electrification programme in an effort to promote the emergence of new small enterprises and improved business for existing enterprises.

5.3.2 Electricity Usage

There is no doubt that access to reliable grid electricity holds enormous advantages for users, and significantly improves the quality of life of beneficiaries that previously had to rely on more basic energy sources. First and foremost, electricity is a very convenient form of energy that is available at the flick of a switch, offering a wide spectrum of applications. The huge variety of electrical appliances, tools and equipment available today opens a multitude of cost-saving and income-generating opportunities for electricity users. However, such opportunities may be out of reach for the poorer sections of society without targeted incentives.

Electricity in the Household

Evidence from Namibia's Central-North suggests that rural communities do value having access to electricity in the household. Electrified households, over time, acquire a broad range of electrical appliances, and even unelectrified households start accumulating such appliances in anticipation of being connected to the grid. Further evidence of rural households' appreciation of electricity is the relatively high level of consumption, which in turn contributes to ensuring a viable electricity service.

Productive Uses of Electricity

Income-generating applications of electricity are far less prevalent in Central-North. While the reasons for this are not clearly evident and are probably influenced by a range of factors, there may be great merit in actively promoting productive uses of electricity as part of an electrification programme, for example through awareness campaigns, skills training and incentive schemes. The sooner rural communities engage in productive activities that are made possible through access to electricity, the sooner the local economy is stimulated with far-reaching developmental consequences.

Public Awareness

This impact assessment found that many perceive electricity as a dangerous source of energy. Accidents have happened and people have been injured, often as a result of sheer ignorance about the inherent dangers and risks associated with access to

electricity. A simple awareness campaign, as part of the electrification programme, could have gone a long way in preventing such accidents that are potentially fatal.

5.3.3 Fuel Switching

Market Development

The Namibian experience has shown that the switch from traditional and other sources of energy to electricity happens gradually rather than instantly. Reasons for this include cultural preferences, resistance to change, and appliance affordability and availability. Leaving the development of a local market (for electric appliances, equipment and tools, as well as for installation and maintenance services) to market forces alone, however, affects the viability of the electricity supply service and hampers market development. In many areas, customers still have to travel to the larger towns to purchase even light bulbs. The electrification programme could have included an element of market development to stimulate the local economy, for example a publicity campaign coupled with incentives (eg credits) for local shops to carry a basic range of electric appliances.

Deforestation

Rural electrification in Namibia has had a negligible impact on deforestation as many electrified households continue to use firewood, mostly for cultural reasons. In many parts of Central-North households today purchase firewood as local collection is not possible anymore.

6 EVALUATION OF NORAD'S INTERVENTION

In this section NORAD's development assistance intervention in the Namibian rural electrification programme, with particular reference to Central-North, is evaluated using the OECD's DAC Criteria[4] of relevance, effectiveness, efficiency and sustainability. The fifth criteria, impact, was already dealt with in detail in a previous section.

Norway's offer of technical and financial assistance to Namibia's energy sector came at the time of the birth of the new nation in 1990, and may have even been a significant trigger for the rural electrification programme. NORAD's assistance consisted primarily of capital grants towards NamPower's responsibility for constructing bulk electricity supply infrastructure, with complementary government subsidies funding reticulation of rural localities and connection of customers. In retrospect, it can also be argued that NORAD's assistance was one of a number of funding sources towards the capital subsidy element (also referred to as *'basket funding'*) of the national rural electrification programme.

6.1 RELEVANCE

The relevance of NORAD's intervention hinges upon the extent to which the aid activity was suited to the priorities and policies of the new Namibian Government and the development needs of rural communities in Central-North.

Central-North was largely marginalised before independence despite the high population concentration, and the new government had placed the development of the region as a top priority on the agenda at independence. It was therefore a political priority to improve service and infrastructure to this area. In that setting, the rural electrification programme has supported the political ambition, and has contributed positively to meeting equity goals and improving socio-economic circumstances for the target group. The long-term effect of improved public services and infrastructure, typically, is a better-educated and healthier population that can take a more active part in the work force, the political arena and contribute to economic growth and development of the region.

NORAD's intervention was highly relevant in the context of rural electrification in Central-North.

6.2 EFFECTIVENESS

Effectiveness is a measure of the extent to which an aid activity attains its objectives. NORAD's grant funding contribution towards Namibia's rural electrification programme served to fulfill a part of Norway's commitment to development aid for the new nation. The primary objective of this specific contribution was upliftment of the living standards and improvement of the quality of life of Namibia's rural population.

[4] The DAC Criteria are described in the OECD's "DAC Principles for Evaluation of Development Assistance" (1991)

Rural electrification has substantially contributed to rural development and has certainly transformed life in those areas that the programme has reached, as explained throughout this report. Most of the NORAD funds have been invested in the bulk electricity supply infrastructure for Central-North where Namibia's rural population density is at its highest, thereby maximising the extent to which the primary objective could be achieved. Funding was applied in a manner to ensure near-100% electrification of localities (including transmission infrastructure, substations, supply feeders, distribution networks and customer connections). Poor customers were even provided with an instant distribution board that provides lighting and the use of electrical appliances without house wiring.

However, one of the key lessons from Namibia's rural electrification programme (see previous section) has been the realization that physical infrastructure development should not happen in isolation and cannot be expected to succeed without developing a supporting service infrastructure that ensures sustainability of the benefits of the initiative. In this sense, NORAD's intervention could have provided for a more holistic approach to the NREP, specifically targeting electricity supply service systems and management.

6.3 EFFICIENCY

Efficiency measures the outputs -- qualitative and quantitative -- in relation to the inputs. It is an economic term, which signifies that the aid uses the least costly resources possible in order to achieve the desired results.

NORAD's intervention was specifically in grid-electrification, and primarily focused on the bulk supply infrastructure. NamPower's technical specifications for high and medium voltage networks have been optimized over many years to Namibian conditions. This is supported by the fact that reliability of supply is high and very few, if any, changes or upgrades needed to be made to the bulk supply infrastructure in Central-North over the last 15 years. NamPower has always been held in high regard in southern Africa as a profitable utility with a high degree of technical competence.

One case in point is the very first phase of the rural electrification programme in 1991, during which NamPower had a saving of some N$6million that was subsequently used to fund the distribution networks for the rural localities that had been grid-connected. This contributed to accelerated progress with the programme, which otherwise would have had to wait for the next government budget cycle.

Another example is the supply of high voltage conductor from Norway during the early phases of the programme, which ensured that progress didn't have to be delayed as a result of capacity constraints at South African conductor factories that were also supplying to the much larger South African rural electrification programme.

However, while the physical infrastructure of the NREP was swiftly put in place, simultaneous development of a supporting service infrastructure was initially neglected, which soon put the anticipated benefits of the NREP in the balance. Fortunately, the situation could be rescued through the appointment of a management contractor. A more holistic approach towards implementation of the NREP could have averted such a situation from arising in the first place.

6.4 SUSTAINABILITY

Sustainability is concerned with measuring whether the benefits of an activity are likely to continue after donor funding has been withdrawn. Both financial and environment sustainability are assessed.

Judging by the changes that have occurred since the onset of the rural electrification programme more than 15 years ago, there is now overwhelming evidence that this initiative has substantially contributed to development in Central-North, transforming life for affected communities and benefiting the region in a macro-economic sense. Together with other development interventions, it has put in place infrastructure and processes that drive socio-economic progress, which is a key condition for sustainable development.

The outlook has not always been that positive, however. Conception of the programme and the early implementation stages were very focused on the physical infrastructure, with little thought given to operational competence, both in terms of systems/processes and technical/managerial capacity. A precarious situation developed from resource constraints (human, physical and financial), weak accounting and administrative systems, and limited understanding of the financial implications of the programme, resulting in rising operational subsidies, an increasing backlog of connections to be provided and poor service delivery. At that stage, sustainability of rural electricity distribution was very much in doubt, which held serious implications for the broader development effort. Fortunately, government showed leadership by engaging the private sector to help rectify the situation, which turned out to be a resounding success from an operational perspective. Northern Electricity improved service delivery, implemented cost-reflective yet affordable tariffs and connected more than 10,000 new customers during its 5-year term, far in excess of its contractual obligation. The greatest lesson in this was that, contrary to popular belief and previous experience, rural electricity supply can be a profitable venture while still affordable by typically poor rural communities. The industry has not looked back since, and rural electrification had graduated to its rightful role as a major driver of development.

Another aspect of sustainability is that of continued funding of the rural electrification programme. Up to now, the programme has covered all the larger and a significant proportion of smaller rural localities that could cost-effectively be connected to the grid. What remains to be achieved is electrification of a multitude of increasingly smaller and more remote localities, at higher cost and smaller benefit. At a constant annual electrification budget, the number of connections that can be provided per year will thus be decreasing. What is worrying, however, is the decline in rural electrification expenditure in recent years, which may signify an emerging lack of government commitment to the programme.

Another cause for concern, in terms of sustainability, is the impact that electrification of the smaller, more remote localities will have on operational expenses and therefore tariffs. Customers in these localities are typically poorer than in larger centers where there are employment opportunities and economic growth. These customers are therefore less likely to make full use of electricity as they can often not afford the appliances nor their consumption costs, which increases the burden of cross-subsidies. Solar home systems may be a more appropriate option in this regard, although this approach has its own challenges.

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APPENDIX A: SOCIO-DEMOGRAPHIC ANALYSIS

In comparison to regional and national figures, there was an overrepresentation of women in the survey. 134 of the 216 household respondents were women. Although there is a shift towards more gender equality, the gender roles are still fairly traditional and men carry the main responsibility for providing cash income for the household. Men might therefore have been unavailable for interviews during working hours, while the women were at home.

A.1 DEMOGRAPHIC OVERVIEW OF CENTRAL-NORTH

Demographic information for the four regions of Central-North is summarized in Table 3. Eight of the nine surveyed localities are situated within these regions. The ninth village, Tsumkwe, is in Otjozondjupa Region, which can in many ways provide a contrast when comparing it to the regions of Central-North. In the statistics presented in this section, Otjozondjupa region, as well as national figures for Namibia, are used as comparison to regional figures for Central-North. Data from the surveyed villages and towns is included where available.

TABLE 3: Demographic Summary of Central-North

Region	Area (km2)	Population size	Growth rate	Urban population (%)	Rural population (%)	Number of HHs	Average HH size	Main source of income
Ohangwena	10,703	228,384	2.4	1	99	35,958	6.3	Farming
Omusati	26,573	228,842	1.9	1	99	38,202	5.9	Farming
Oshana	86,53	161,916	1.8	31	69	29,557	5.4	Farming
Oshikoto	38,653	161,007	2.2	9	91	28,419	5.6	Farming
Otjozondjupa	105,185	135,384	2.8	41	59	25,338	4.6	Wages/ salaries
Namibia	**824,116**	**1,830,330**	**2.6**	**33**	**67**	**346,455**	**5.1**	**Wages/ salaries**

(Source: Namibia 's Population and Housing Census, 2001)

A.2 POPULATION AGE AND GENDER COMPOSITION IN CENTRAL-NORTH

Namibia has a young population, and in 2001 39% of the population was younger than 15 years. 52% of the Namibian population is between 15-59 years old, and 7% is 60 years or older.

The national gender ratio from 2001 is 94 males per 100 females. It has dropped slightly from the figures in 1991 (95 males per 100 females). In regions with a large industrial sector there tend to be more men than women, while in regions dominated by subsistence farming and rural communities there is often an overweight of women.

Since 1991, the gender ratio has evened out slightly in Ohangwena and Omusati. It is perhaps not a coincidence that it has remained unchanged over the ten-year period in Oshana that has well established urban centers and industry. A more even gender ratio is partly an indication that decentralization and urbanization of growth points in the different regions do in fact influence migration patterns in the Central-North.

TABLE 4: Age and Gender Composition in Central-North

Region	No.of males per 100 females	Age composition (%)			
		under 5 years	5-14 years	15-59 years	60+ years
Ohangwena	83	15	33	41	9
Omusati	81	13	31	45	9
Oshana	84	12	28	53	7
Oshikoto	90	14	29	47	8
Otjozondjupa	107	14	24	55	5
Namibia	**94**	**13**	**26**	**52**	**7**

(Source: Namibia 's Population and Housing Census, 2001)

Table 4 indicates that the labour force (the population between the ages of 15 and 59) in Omusati, Ohangwena and Oshikoto is lower than that in Oshana and Otjozondjupa, and lower than the Namibian average. This is consistent with the rural-urban profiles of the regions, where Oshana is by far the most urbanized and industrialized region in Central-North, explaining why fewer people in work-active age leave the region in search of employment. In Otjozondjupa 55% of the population is in work-active age, which is higher than the national average, indicating that people move to the region in search of employment (mining and agriculture). In Ohangwena, by contrast, only 41% of the total population is in work active age, while 48% of the population is younger than 15 years, and 9% have reached pension age of 60 years, indicating that many people leave the region in search of employment.

Of the 216 survey respondents more than 75% were between 20 and 50 years old (see Table 5), indicating that there is an overrepresentation of respondents in work-active age compared to the average regional age composition.

TABLE 5: Age Composition of Survey Respondents

Region	Age composition				Total
	<20	20-30	31-50	>50	
Onayena	1	4	7	6	18
Ontananga	0	4	8	8	20
Outapi	2	16	31	7	56
Oshikuku	0	6	17	1	24
Engela	1	8	5	9	23
Oshifo	1	8	14	0	23
Ompundja	1	4	7	10	22
Omakange	1	5	12	6	24
Tsumkwe	0	1	5	0	6
Total	**7**	**56**	**106**	**47**	**216**
Percentage	**3.2**	**25.9**	**49.1**	**21.8**	**100**

(Source: 2007 REIA survey)

A.3 EMPLOYMENT

There are limited employment opportunities in subsistence agriculture, which is the main livelihood for many households in Central-North. The farming activities do require the labour force of several household members, but few people are employed with a salary in subsistence agriculture. Employment opportunities in the Central-North are to a large extent concentrated in the urban areas.

TABLE 6: Employment in Central-North

Region	% of total population		% of total labour force (15-59 years)			
	Labour force		Employed		Unemployed	
	1991	2001	1991	2001	1991	2001
Ohangwena	49	43	83	64	17	36
Omusati	55	38	89	65	11	35
Oshana	49	51	79	60	21	40
Oshikoto	48	40	79	55	21	45
Otjozondjupa	n/a	52	n/a	68	n/a	32
Namibia	**58**	**54**	**81**	**69**	**19**	**31**

(Source: Namibia 's Population and Housing Census, 2001)

There are considerable variations in the employment rates in the different regions considered in this study. Oshikoto is the region with the lowest employment rate (55% of the labour force), while Omusati has the highest employment rate (65%). The national employment rate was 69% in 2001, which means that all the regions considered in this study had lower employment rates than Namibia at large.

The type of employment people have provides an indication of whether the employed labour force is generating an income to support themselves and their dependents. In Ohangwena more than 50% of the total employed work force are unpaid family workers of different kinds. In Omusati more than 40% of the work force has unpaid employment. In Oshikoto and Otjozondjupa unpaid family employment is less common, and more people are employed in the private sector or in government institutions and parastatals. Unpaid family workers do not generate an income to support themselves or their dependants. They are integrated into the household where they work and receive accommodation and food in return. A large percentage of the total labour force in rural regions like Ohangwena and Omusati fall in this category. They are generally very poor people without any security, resources or assets. Underemployment, where a person has some regular paid employment, but is actively looking for more employment because the employment does not generate sufficient income, is also a serious problem in Namibia. The high rates of unpaid family employment and underemployment are partly due to lack of education and skills, but there are also limited employment opportunities in the regions. Census data from 1991 and 2001, as well as NHIES information from 1994, suggests that there is a growing problem with unemployment in Namibia, and that the regions in Central-North have even higher unemployment rates than the national average of 31%. It is possible that further development of identified growth points and urban areas in the region will change employment status over time.

There are no comparable employment figures available from earlier REIA studies and it is thus not possible to determine how the employment situation has changed.

TABLE 7: Employment Statistics from the Survey

Locality	No. of HH surveyed	Average HH size	HH members with employment	Average no. employed HH members	No. of HHs without employment	Max no. of employed HH members/HH
Onayena	18	6.8	33	1.8	0	4
Ontananga	20	9.5	35	1.8	1	4
Outapi	56	5.3	124	2.2	0	5
Oshikuku	24	5.8	47	2.0	0	4
Engela	23	6.4	59	2.6	1	13
Oshifo	23	5.1	37	1.6	1	4
Ompundja	22	8.0	39	1.8	2	5
Omakange	24	7.8	35	1.5	3	5
Tsumkwe	6	7.7	n/a	n/a	n/a	n/a

(Source: 2007 REIA survey)

The 2007 survey respondents listed employment opportunities as the most important developmental issue for local communities, followed by electrification, water supply, access to education and good roads. Electrification by itself is not guaranteed to bring about development, but in conjunction with the simultaneous implementation of other infrastructural and social services it becomes a powerful driver of development.

A.4 HOUSEHOLD COMPOSITION

Namibia's average household size has slightly declined since 1991. Although extended family households are still common, particularly in rural areas, there appears to be a tendency towards smaller core-family households consisting of a couple and their immediate children. Urbanization and migration patterns are partly responsible for the reduction in household sizes, while declining fertility is another contributing factor.

TABLE 8: Household Numbers and Sizes in Central-North

Region	Number of households		Average HH size		Avg HH size (2001)	
	1991	2001	1991	2001	Urban	Rural
Ohangwena	17,831	35,958	6.2	6.3	3.8	6.3
Omusati	30,882	38,202	5.9	5.9	3.9	6
Oshana	22,190	29,557	5.7	5.4	4.2	6.1
Oshikoto	21,426	28,419	5.8	5.6	4.2	5.8
Otjozondjupa	n/a	25,338	n/a	4.6	n/a	n/a
Namibia	**254,389**	**346,455**	**5.2**	**5.1**	**4.2**	**5.7**

(Source: Namibia 's Population and Housing Census, 2001)

In Central-North, households are still larger than the Namibian average. Ohangwena is the only region where the average household size has increased since 1991, and it is also the region with the highest average household size of 6.3 persons. Urban households are generally much smaller than rural households, which is consistent with the prevalence of subsistence agriculture in Central-North's rural areas. In urban areas households depend mainly on cash income and smaller family units are therefore more common.

Interestingly, average household sizes in the surveyed localities (see Table 7 above) are generally larger than the regional average. Electrified households were found to be smaller on average than unelectrified households, which is consistent with findings of the 1999 REIA study (Wamukonya et al). The average sizes of both electrified and unelectrified households in the 1999 study were found to be larger than in the 2007 study (8 vs 6 for electrified households, and 10 vs 8 for unelectrified households), confirming the national trend of declining household sizes.

A.5 POPULATION GROWTH

Namibia's national average annual population growth rate of 2.6% between 1991 and 2001 indicates that the population will double in approximately 27 years. There are, however, regional variations in population growth rate. Ohangwena is the region with the highest average growth rate of 2.4% per annum, while Oshana's average population growth is the lowest with 1.8%. Population growth rates for Namibia and the regions in north-central Namibia are presented in Table 4. The relatively low population growth rates in Central-North' regions are partly attributed to migration patterns, and partly to the HIV/AIDS pandemic. They are not due to lower fertility rates, since women in Central-North give birth to more children on average than women in Namibia as a whole.

Population growth is not evenly distributed throughout Central-North, but tends to concentrate around urban areas or growth points. Electrification has certainly played a significant role, along with other services and initiatives, in development of these growth points as it has enabled improved service delivery for institutions and businesses, and has opened up new entrepreneurial and employment generating opportunities. This in turn impacts on migration patterns, which are reflected in the population growth figures. People are less likely to move out of the region if they have employment opportunities and services nearby, a fact that has been confirmed by the surveys conducted in the 9 localities.

A.6 URBANIZATION

Urbanization and migration patterns are closely related. People normally move from rural areas towards urban centres in search of employment and improved living standards with more opportunities and choices. There is an ongoing process of urbanization taking place at different levels all over Namibia. At regional level there is a tendency of people moving from typically rural regions like Central-North (perhaps with the exception of Oshana which has significant urban centres), towards more urban regions like Khomas and Erongo, with established industrial and commercial centers (like Windhoek and Walvis Bay) having to deal with a large influx of people in search of employment.

The migratory tendencies in Central-North are shown in Table 9, which appear to indicate that rural electrification may not have had a significant influence in preventing people to move from rural areas to urban centers in search of work and lifestyle opportunities. It must be considered, however, that Omusati and Ohangwena did not have any urban centers in 1991, and that a number of growth points that had benefited from rural electrification have by 2001 been classified as

urban. This is also the case with some localities in Oshana and Oshikoto. Of the surveyed localities included in this study, Outapi has become a town in 1997, while village status was bestowed upon Oshifo in 2004 and Oshikuku in 2005. These localities now increasingly offer the services and facilities of a modern urban center, and have thus become attractive migration targets for opportunity seekers from rural areas. Interestingly, urbanization in Oshikoto Region has declined, which is primarily attributable to declining development in urban centers like Tsumeb than increasing rural migration.

TABLE 9: Urban/Rural Split in Central-North

Region	People living in urban areas (%)		People living in rural areas (%)	
	1991	2001	1991	2001
Ohangwena	0	1	100	99
Omusati	0	1	100	99
Oshana	26	31	74	69
Oshikoto	13	9	87	91
Otjozondjupa	n/a	41	n/a	59
Namibia	**28**	**33**	**72**	**67**

(Source: Namibia 's Population and Housing Census, 2001)

The 1999 REIA study (Wamukonya et al) concluded that rural electrification does not seem to have a noticeable impact on migration in Namibia. The study stressed that the time period of less than 10 years might be too short to see a visible change in migration patterns. Since 1996, there have been more people migrating out of the regions of Central-North than the influx of people moving to those regions. On average 85% of the population currently residing in Central-North is still living in the regions they were born in. As a comparison, only 43% of Khomas Region's population was born in Khomas, and the majority of the people that have moved to Khomas came from Central-North. In Namibia as a whole, less than 60% of the urban population was born in urban areas, compared to 91% of the rural population that is still residing in rural areas (2001 Housing and Population Census). The respondents in the 2007 survey believe search for employment and studies are the main reasons why people leave the rural areas.

A.7 GENDER ISSUES

In Namibia there is a gradual shift towards gender equality, with traditional gender roles breaking up and more room for women to pursue a professional or business career than was previously possible. There are regional differences, as well as urban and rural variations, and there are variations amongst the different ethnic groups in country, but the general trend appears to be that rural households adhere more to traditional gender roles than urban households.

A steady increase in female-headed households in Central-North raises the need for including women's views and opinions in decision-making processes. While female-headed households tend to be poorer than male-headed households, women often have more basic-need-oriented priorities in managing the household than men would have. Traditionally, the woman is responsible for raising children and looking

after the household, while the man is responsible for providing an income. Women are often in control of the household budget, after the man has taken a share for his own spending. Women are usually also responsible for attending to the energy needs of the household (eg gathering or buying firewood, purchasing prepaid electricity), with the money coming from the household budget.

A.8 HOME OWNERSHIP

76% of all the households in Namibia own their dwelling. 65% of them have no mortgage and 12% are in the process of paying down their mortgage. Nearly 10% are provided with housing by their employer and less than 9% live in rented accommodation (in rural areas as few as 2% rent). In rural areas 81% of households live in owned dwellings with no mortgage, compared to only 41% in urban areas. In Central-North, as many as 92% of the households in Omusati live in owned dwellings without mortgage, while only 0.2 % live in dwellings with mortgage. In more urban regions, like Oshana 81.9% of the households own their dwellings without mortgage, while 3.5% are paying down their mortgage. In urban areas, rented housing is more common, with nearly 10% of all the households in Oshana living in rented accommodation, compared to 1.4% of the households in Ohangwena (Source: 2001 Population and Housing Census).

Households that live in owned dwellings are more likely to be willing to bear the cost of grid connection than households that either rent or temporarily occupy someone else's house. Homeowners have a more secure and permanent tenure, and installed electricity is adding value to the house, both on the market and for the people living in the house. The 2007 survey respondents said it was very important to have grid electricity when living in a formal brick house in town.

A.9 HOUSING CONDITIONS

According to the 2003/04 Namibia Household Income and Expenditure Survey (NHIES), the majority of houses in Central-North are traditional dwellings made of wood, grass and/or cow dung. The floors are mainly made of sand or mud/clay, and the roof is made from either wood and grass or corrugated iron.

In Otjozondjupa, by contrast, most of the dwellings (63%) are made from cement bricks with corrugated iron roof and concrete floor.

The rural electrification programme only required houses to be relatively permanent and waterproof, as housewiring was not a prerequisite due to the extensive use of Readyboards (an instant distribution board with one light and three power outlets – see Figure 5). However, the majority of household dwellings that have been electrified are brick structures with corrugated iron roofs.

A.10 ACCESS TO SOCIAL SERVICES

The provision of social services usually plays a most significant role in rural development. Social services typically include health care and education, shops and public transport, as well as police and fire brigade.

There are considerable regional differences in access to social services. Ohangwena is generally worst off in terms of service delivery in the regions of Central-North, while Oshana is best off.

FIGURE 5: Prepayment Meter and Readyboard in a Cuca Shop

The 1993/94 NHIES measured distances to social services in how many minutes it took to walk from home to the service point, while the 2003/04 NHIES measured the distance in kilometers, thus making it somewhat difficult to compare the two datasets.

Rural electrification has encouraged construction of service delivery points (like mobile telephone transmitters) in rural areas, and the service delivery from already existing service points have improved as a result of electrification. There are policies in place that dictate the decentralization process in Namibia and that provide national standards for access to services. These policies, together with infrastructure like electrification and water supply has improved access to services in Central-North. This is not to say that the service delivery is adequate or sufficient, but that there is a positive trend that hopefully will continue in the right direction in the coming years.

A.10.1 Health Care

In 1994, Omusati already had a fairly good clinic and hospital coverage, with 32% of the population living less than half an hour's walk away from the nearest health care

facility. By 2004 more than 57% of the population lived less than 5km away from the nearest clinic.

In Ohangwena more than 60% of the population lived more than one hour's walk away from the nearest health care facility in 1994. In 2004, 68% of the population lived less than 10km away from the nearest clinic.

Rural health care has improved as a direct result of electrification. The health centers and the clinics are now equipped with refrigerators that ensure appropriate storage of medicines, and electric lighting makes it easier for nurses to attend to emergencies after dark. Previously, candles and torches were used for lighting during after-hours treatment and consultations. Telecommunication has also improved considerably, and it is easier now for clinic staff to consult a doctor or call an ambulance if the patient needs to go to hospital.

Infant and under-five mortality are dropping in all regions of Central-North, indicating a positive trend in rural health care services between 1991 and 2001. Interestingly, these indicators are generally lower in the rural areas of Central-North than in urban areas. This is a somewhat surprising finding, since one would expect that access to medical services is better in urban centres. Causes of deaths are not provided in the census data.

Life expectancy at birth, however, has been dropping dramatically over the same period. This trend is mainly caused by the HIV/AIDS pandemic, and regional variations can be explained by varying access to health care and medical aid benefits, lifestyle and living standards. According to the Regional Development Plans for Oshikoto and Oshana life expectancy rates are projected to reach an all time low in 2011 before they will start to improve. People living in urban areas can expect to live longer than people in rural areas.

TABLE 10 Health Care Indicators

Region	Infant mortality		Under-five mortality		Life expectancy at birth			
	Both sexes		Both sexes		1991		2001	
	1991	2001	1991	2001	Females	Males	Females	Males
Ohangwena	59	56	109	78	64.6	60.9	44.8	43.2
Omusati	49	39	64	61	66.9	63.0	50.3	46.4
Oshana	62	44	80	64	64.0	60.3	47.7	46.2
Oshikoto	66	60	86	74	63.0	59.3	49.8	50.0
Otjozondjupa	67	48	87	70	62.6	59.0	61.2	54.9
Namibia	**67**	**52**	**87**	**71**	**62.8**	**59.1**	**50.2**	**47.6**

(Source: Namibia 's Population and Housing Census, 2001)

A.10.2 Education

In 1994, 50% of the learners in primary schools in Ohangwena lived more than 30 minutes walk away from school. In 2004, more than 60% of the learners walked less than 3km to get to school. Oshana provides a stark contrast to the more rural Ohangwena Region: In 1994, more than 65% of the learners in primary schools lived less than 30 minutes walk away from school, while in 2004 more than 80% of all learners lived within a 3km radius to the nearest school. There is a clear correlation between urbanization rates and access to services.

Rural electrification has clearly had a positive impact on education in rural areas. Secondary schools nowadays make extensive use of study aids (like projectors, copiers and computers) and offer evening classes and night study periods. Hostels mainly use electricity for lighting, cooking and water heating. All senior secondary schools with hostels used diesel generated power before grid electrification, but this was limited to specific uses and was only available at certain times during the day. Primary schools are using fewer electric appliances, and most primary schools are closed during the afternoon and evening and thus are not as dependent on lighting.

An improvement in the quality of education as a result of access to grid electricity was confirmed by the surveys conducted in the nine localities, citing lighting and the opportunity to use electric appliances as the main benefits.

A.10.3 Police Services

Police stations generally make limited use of electricity, with lighting and electronic radio communication systems having significantly improved their capacity to handle emergencies after dark. Better telecommunication services in rural areas have improved rural residents' access to police services when needed. Street lighting has had a positive impact on the crime rate, and is rated as a high priority by residents in rural localities.

A.10.4 Shops

In 1994, 55% of the population in Central-North lived more than one hour's walk away from the nearest shop, and in 2004 more than 75% of the population lived less than 10km away from the nearest shop.

A.11 ACCESS TO INFRASTRUCTURAL SERVICES

Improved household access to infrastructural services like electricity and potable water is an important aspect of rural development. Between 1994 and 2004 access to electricity for cooking and lighting improved only slightly in the regions in Central-North (refer to Table 11, while access to potable water improved hugely over the same period. In 1994 only 20% of Ohangwena's population had access to potable water within a 5-minute walk from their home, but this increased to more than 80% by 2004. Similar significant improvements in access to potable water have occurred in all the regions of Central-North during the same period.

A.12 SAFETY AND SECURITY

Lighting in general is one of the most important benefits of electrification. A house with lights on is much less likely to be broken into, than a dark house, said the respondents in the 2007 survey.

Installation of streetlights has also contributed to a reduction in break-ins, but perhaps even more important is the perceived reduction in street crimes such as robbery, attacks and rapes as a direct result of street and area lighting. There are no independent statistics available that can support the respondents' perception of reduction in crimes.

TABLE 11 Usage of Modern Fuels in Central-North

Region	Number of households		% HH cooking with electricity or gas		% HH lighting with electricity	
	1994	2004	1994	2004	1994	2004
Ohangwena	25,574	37,854	0	4.8	1	5
Omusati	21,822	39,248	1	6.0	2	8
Oshana	24,198	31,759	12	24.3	10	25
Oshikoto	18,795	31,871	13	13.2	15	16.6
Otjozondjupa	22,827	28,707	22	44.6	37	55.8
Namibia	**244,827**	**371,678**	**27**	**34.7**	**27**	**37.1**
Urban	*82,864*	*150,533*	*72*	*71.9*	*71*	*71.2*
Rural	*161,962*	*221,145*	*5*	*9.4*	*5*	*13.8*

(Source: NHIES, 1994 and 2006)

Electrification has also contributed positively to the service delivery of the police in Central-North, through improved radio communication and lighting.

Survey respondents also felt that electrification has had a positive impact on reduction in fires. They felt that electricity is a safer source of energy than paraffin, candles and firewood, and there are less accidents and injuries caused by electricity.

A.13 HOUSEHOLD APPLIANCE OWNERSHIP

All the previous socio-economic impact assessments of the rural electrification programme have concluded that, although households are getting more and more electric appliances, the acquisition rate is fairly low. It was not common to own a TV, and electricity was used mainly for lighting in many households. The survey in 2007 showed that more and more households acquire electric appliances for household purposes. 143 of the 216 households, or 66%, own a Hi-Fi system, and 118 (55%) own a TV. 60% own a refrigerator and more than 100 of the interviewed households (46%) either have an electric hotplate or an electric stove. In addition to already owned appliances most households also indicated that they were planning to buy additional electric appliances in the near future. The majority of the electrified households in the survey owned an electric iron, and almost all households used electricity for lighting. The majority of the electrified households had TVs and Hi-Fi systems or radios. There is a clear trend that more and more electrified households own a TV, and more luxurious electric appliances like DVD players, VCRs and game machines (eg play station) are becoming more common.

In previous REIA studies the three stone fireplace was the most commonly owned appliance overall, and also amongst electrified households. By 2007 this had changed, and the most common appliance owned by electrified households nowadays is electric lights, followed by refrigerator, electric iron, Hi-Fi system and TV.

Households in Outapi, Engela and Oshikuku own, on average, more appliances than households in the other surveyed localities. While an average household in Engela on owns 8-9 appliances, a household in Ontananga owns around 6.

TABLE 12 Appliance Ownership in Electrified Households

Locality	Onayena		Ontananga		Outapi		Oshikuku		Engela		Oshifo		TOTAL	
No. of electrified HH	15		16		48		20		19		19		137	
APPLICANCE	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Electric lights	11	73%	9	56%	48	100%	20	100%	18	95%	19	100%	**125**	**91%**
Electric refrigerator	13	87%	12	75%	45	94%	19	95%	17	89%	14	74%	**120**	**88%**
Electric iron	11	73%	12	75%	37	77%	18	90%	15	79%	12	63%	**105**	**77%**
Radio/HiFi	11	73%	10	63%	37	77%	18	90%	14	74%	12	63%	**102**	**74%**
TV	14	93%	5	31%	39	81%	18	90%	16	84%	10	53%	**102**	**74%**
3-stone fire place	6	40%	15	94%	24	50%	10	50%	15	79%	12	63%	**82**	**60%**
Electric hotplate	8	53%	9	56%	21	44%	11	55%	11	58%	14	74%	**74**	**54%**
Electric fan	6	40%	3	19%	27	56%	14	70%	10	53%	8	42%	**68**	**50%**
Electric stove	8	53%	1	6%	27	56%	8	40%	7	37%	3	16%	**54**	**39%**
Gas stove	8	53%	6	38%	8	17%	11	55%	7	37%	2	11%	**42**	**31%**
Electric kettle	1	7%	0	0%	12	25%	7	35%	4	21%	5	26%	**29**	**21%**
Cell phone	0	0%	0	0%	10	21%	6	30%	5	26%	5	26%	**26**	**19%**
Microwave oven	0	0%	0	0%	7	15%	5	25%	3	16%	2	11%	**17**	**12%**
Non-electric iron	3	20%	5	31%	4	8%	1	5%	1	5%	0	0%	**14**	**10%**
Paraffin lamp	1	7%	8	50%	1	2%	0	0%	3	16%	0	0%	**13**	**9%**
DVD player	0	0%	2	13%	5	10%	2	10%	0	0%	0	0%	**9**	**7%**
Computer	0	0%	0	0%	4	8%	0	0%	1	5%	1	5%	**6**	**4%**
Paraffin stove	0	0%	2	13%	1	2%	1	5%	0	0%	1	5%	**5**	**4%**
Washing machine	2	13%	0	0%	2	4%	0	0%	1	5%	0	0%	**5**	**4%**
VCR	0	0%	0	0%	2	4%	1	5%	1	5%	1	5%	**5**	**4%**
Gas refrigerator	0	0%	2	13%	2	4%	0	0%	0	0%	0	0%	**4**	**3%**
Electric oven	0	0%	0	0%	1	2%	0	0%	2	11%	0	0%	**3**	**2%**
Solar oven	1	7%	0	0%	0	0%	1	5%	0	0%	0	0%	**2**	**1%**
Electric griller	0	0%	0	0%	1	2%	0	0%	1	5%	0	0%	**2**	**1%**
Electric hairdryer	0	0%	0	0%	1	2%	1	5%	0	0%	0	0%	**2**	**1%**
Paraffin refrigerator	0	0%	0	0%	1	2%	0	0%	0	0%	0	0%	**1**	**1%**
TV game machine	0	0%	0	0%	0	0%	1	5%	0	0%	0	0%	**1**	**1%**
Electric hair cutter	0	0%	0	0%	0	0%	1	5%	0	0%	0	0%	**1**	**1%**
Electric sewing machine	0	0%	0	0%	0	0%	0	0%	0	0%	1	5%	**1**	**1%**
Electric shaver	0	0%	0	0%	0	0%	0	0%	0	0%	1	5%	**1**	**1%**
Wood/coal stove	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	**0**	**0%**
TOTAL	**104**		**101**		**367**		**174**		**152**		**123**		**1,021**	
AVERAGE	**6.9**		**6.3**		**7.6**		**8.7**		**8.0**		**6.5**		**7.5**	

(Source: 2007 REIA survey)

In 1999 60% of the electrified households owned an electric refrigerator, and by 2007 refrigerators have become even more common, with 88% owning one. Today, 30% of electrified households own a gas stove and 40% own an electric stove, while in 1999 only 30% of the households owned an electric stove. There is thus an observed tendency of increasing use of electric stoves among electrified households, although this is slow process. The ownership of gas stoves in electrified households has remained more or less unchanged since 1999, but it has increased considerably in unelectrified households: in 2007, 37% of the unelectrified households own a gas stove, compared to merely 6% in 1999.

Appliance ownership is much lower amongst unelectrified households. The highest average number of appliances (5 per household) is found in households in Omakange, while the lowest average number of appliances (3 per household) is found in households in Onayena. The three-stone fireplace and paraffin lamps are the most commonly owned appliances in unelectrified households, but it is interesting to see that electric appliances like TVs and Hi-Fi systems are fairly common also in unelectrified households.

TABLE 13 Appliance Ownership in Unelectrified Households

LOCALITY	Onayena		Ontananga		Outapi		Oshikuku		Engela		Oshifo		Ompundja		Omakange		TOTAL	
No.of Unelectrified HH	3		4		8		4		4		4		22		24		73	
APPLIANCE	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
3-stone fire place	2	67%	4	100%	5	63%	3	75%	4	100%	4	100%	22	100%	19	79%	**63**	**86%**
Paraffin lamp	2	67%	1	25%	5	63%	2	50%	2	50%	3	75%	14	64%	19	79%	**48**	**66%**
Radio/HiFi	1	33%	3	75%	5	63%	1	25%	3	75%	3	75%	12	55%	13	54%	**41**	**56%**
Non-electric iron	3	100%	2	50%	4	50%	0	0%	1	25%	2	50%	9	41%	8	33%	**29**	**40%**
Gas stove	1	33%	2	50%	1	13%	2	50%	0	0%	1	25%	10	45%	10	42%	**27**	**37%**
TV	0	0%	0	0%	0	0%	1	25%	1	25%	1	25%	7	32%	6	25%	**16**	**22%**
Paraffin stove	0	0%	0	0%	5	63%	2	50%	0	0%	1	25%	3	14%	2	8%	**13**	**18%**
Cell phone	0	0%	0	0%	1	13%	0	0%	0	0%	1	25%	5	23%	6	25%	**13**	**18%**
Electric refrigerator	0	0%	0	0%	0	0%	2	50%	0	0%	1	25%	3	14%	4	17%	**10**	**14%**
Gas refrigerator	0	0%	1	25%	2	25%	0	0%	0	0%	1	25%	2	9%	4	17%	**10**	**14%**
Electric kettle	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	7	29%	**7**	**10%**
Electric hotplate	0	0%	0	0%	0	0%	1	25%	1	25%	1	25%	0	0%	3	13%	**6**	**8%**
Electric stove	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	2	9%	3	13%	**5**	**7%**
Microwave oven	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	5	21%	**5**	**7%**
Electric iron	0	0%	0	0%	0	0%	0	0%	1	25%	0	0%	1	5%	2	8%	**4**	**5%**
Welding machine	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	5%	2	8%	**3**	**4%**
DVD player	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	2	8%	**2**	**3%**
Electric hair cutter	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	2	8%	**2**	**3%**
Electric fan	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	4%	**1**	**1%**
Solar oven	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	4%	**1**	**1%**
Computer	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	4%	**1**	**1%**
VCR	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	4%	**1**	**1%**
Electric hairdryer	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	4%	**1**	**1%**
TV game machine	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	4%	**1**	**1%**
TOTAL	**9**		**13**		**28**		**14**		**13**		**19**		**91**		**123**		**310**	
AVERAGE	**3.0**		**3.3**		**3.5**		**3.5**		**3.3**		**4.8**		**4.1**		**5.1**		**4.2**	

(Source: 2007 REIA survey)

The 1999 REIA study (Wamukonya et al) found that 50% of unelectrified households owned a TV, while in the 2007 study this figure was down to 22%. In 1999 there was no significant difference in TV ownership between electrified and unelectrified households, but in 2007 close to 75% of the electrified households said that they owned a TV.

TABLE 14 Appliance Ownership in 1999

Non-electrical Appliances	Unelectrified Households %	Electrified Households %	Electric Appliances	Unelectrified Households %	Electrified Households %
Gas stove	6	29	Electric stove	1	31
Non-elec fridge	6	6	Electric fridge	1	60
Radio	79	27	Radio	1	61
TV	7	1.8	TV	50	53
Wood iron	77	70	Electric iron	6	73

(Table from Wamukonya et al, 1999)

Most households obtain their appliances as brand new from shops, either through cash or hire purchases. The hire purchase option is beneficial in that it does not impact on household cash flow, but the interest makes the appliance more expensive in the end. Very few households purchase second-hand electric appliances, presumably because this market is hardly developed at this stage.

A.14 STANDARD OF LIVING AND POVERTY

The livelihood and well-being of households is depending on a wide range of factors that are interconnected and impact on each other. Access to social services such as health care and education, as well as basic infrastructure provision, are indicators that can easily be measured. From the statistics it is apparent that there has been a steady improvement in living standards in terms of service provision over the past 15 years. However, unemployment is increasing and life expectancy at birth is dramatically dropping, while the number of orphans is increasing. So even though there are obviously positive signs, there are also visible negative trends. Certain parts of the regions might experience fantastic economic growth and progress, while other areas are at a stand still. Identified growth points where support and service delivery is focused develop more and faster than the surrounding rural area.

The majority of the households in Central-North rely on subsistence farming as their main source of income. Almost all the households that were interviewed in the survey in 2007 had at least one household member with employment. However, when looking at the statistics showing employment status, a large number of the employed work force in Central-North are unpaid family workers that generate limited income. Also, no information exists on whether the employed household members have sufficient work or if they are under-employed.

Rural electrification has had a significant impact on people's livelihoods. Survey respondents highly rate access to grid electricity and see it as having improved their living standard. In all the REIA surveys, access to good lighting is seen as the most important benefit of grid-electrification. Other highly ranked benefits are the

flexibility and reliability of electricity, as well as the fact that it is a clean source of energy compared to other household fuels like firewood and paraffin.

People's perceived dislikes of electricity as an energy source focus primarily on the danger associated with its use (electric shocks and short circuits). During the rainy season, users in some parts of Central-North experience power cuts, mainly as a result of lightning strikes. Another prominent 'dislike' among households is that it is expensive and that electric appliances are unaffordable. The 2007 survey, however, found that electrified households generally feel that the cost of electricity is worth it because of all the benefits, and that unelectrified households are envious and rate electrification as a high priority. In 1999, Wamukonya et al found that less than half of the interviewed unelectrified households had applied for grid-electricity, with the main reason being lack of money to pay for the service and for the connection.

Respondents said that electrification has had a positive impact on health in the household, but were vague in explaining how electricity had improved their health. Electrification had also made it easier for the learners in the household to do homework after dark. Access to electricity also enabled the use of modern technology like computers, and having access to information through TV, radio and the internet would give learners a better foundation for tertiary studies and future employment.

In terms of household chores like cooking and cleaning, access to electricity has had limited impact up to now. Only a few households use electricity as their main source of energy for cooking with the majority still using firewood. Survey respondents believe that electricity use for cooking will be more common in future and that there is a gradual shift towards more electrical appliances, but that traditions, culture and habits make the shift from firewood to electric stoves particularly slow. Scarcity of firewood in the area might speed up the process.

People that have received electricity through the rural electrification programme see it as improvement in living standard and as development. Whether or not they utilize the full potential of electricity and actively explore opportunities for income generation and changes in livelihoods is not clear though. There is no doubt that most households enjoy the convenience of electric lighting and to watch TV and listen to radio, but there is limited evidence that electrification has contributed to employment creation. According to survey respondents, expenses related to electricity use have not negatively impacted the household budget, indicating that energy expenses prior to electrification have been of a similar magnitude.

It is difficult to determine the extent to which electrification is driving or initiating development in rural areas, but there is no doubt that electrification plays an important role in the rural development process. Electrification can be an effective tool for creating new opportunities for local communities. As a driver for change and development, electrification becomes more effective when it is part of a 'service and infrastructure package'. A part of the national decentralization policy is to focus the attention on certain identified growth points and supply infrastructure and improve service delivery for the communities living in and around these localities. There are definite signs that this effort is paying off. The question is whether it is local development, or whether it over time will have spin-off effects and benefit a larger surrounding rural area. Likewise, electrification has an impact where it is being supplied, but limited impact in the large, still unelectrified, rural area.

APPENDIX B: ACCESS TO ELECTRICITY

Access to modern energy services is a high development priority for Namibia. The White Paper on Energy Policy (MME, 1998) states Government's intention to grid-electrify at least 25% of rural households and 95% of urban households by 2010 (as opposed to an estimated 8-9% and 75% respectively in 1997), at an estimated cost of "N$30 million or more". These targets are ambitious when considering the extent and scope of the future electrification programme as defined by the Rural Electricity Distribution Master Plan for Namibia (baseline REDMP implemented in 2000 and updated in 2005), as described below.

A major constraint to attaining the rural household electrification target is the dispersed settlement pattern in the northern regions of Namibia where more than half of the country's population resides, mostly in rural areas. Traditionally, the people of northern Namibia are subsistence farmers who live in traditional homesteads on allocated land parcels where they plant crops and graze their animals (mostly cattle, goats and donkeys). As these land parcels generally cover an area of several hectares, the settlement density is low which makes it unattractive for grid-electrification (see Figure 6). Rural localities usually do not feature many households, as the primary purpose for their existence is their support infrastructure (churches, schools, health care facilities, agricultural development centers and other institutions, and commercial outlets like cuca shops) for the surrounding areas. The emergence of new rural households over time is declining, both in subsistence farming areas and in the smaller rural localities, as young people tend to prefer settling in larger urban centres and the country's cities in response to the promise of employment and educational opportunities and a more convenient life style.

Another significant factor affecting the measurement of rural household access-to-electricity levels is Namibia's high urbanization rate, which the 2001 census put at 5% per year, one of the highest in Africa and the world. This rate of urbanization can be expected to have a considerable negative influence on the growth of rural households.

While exact figures indicating accurate household access-to-electricity levels for Namibia do not exist, this section explores various estimates and analyses electrification approaches in relation to set targets.

B.1 ESTIMATING PRESENT ACCESS LEVELS

The application of different (and mostly incompatible) estimation methods, definitions and assumptions by various studies and initiatives makes it difficult to accurately determine access-to-electricity levels in Namibia. One specific factor that hampers the assessment of access levels is the changing status of what is classified as 'rural': in 1991 all localities in Central-North, except for Oshakati, Ongwediva and Ondangwa, were categorized as rural, while the 2001 census included many previously rural centers (like Outapi and Eenhana) in the 'urban' category. Similarly, the 2005 REDMP update included Government farms in the count of rural localities but excluded proclaimed towns and villages, while the 2000 baseline REDMP did not

count Government farms and included some rural centers that attained town or village status in subsequent years. The consequence of changing classifications is that historical measures of access to electricity are not directly comparable with present and future measures and should therefore be treated with caution.

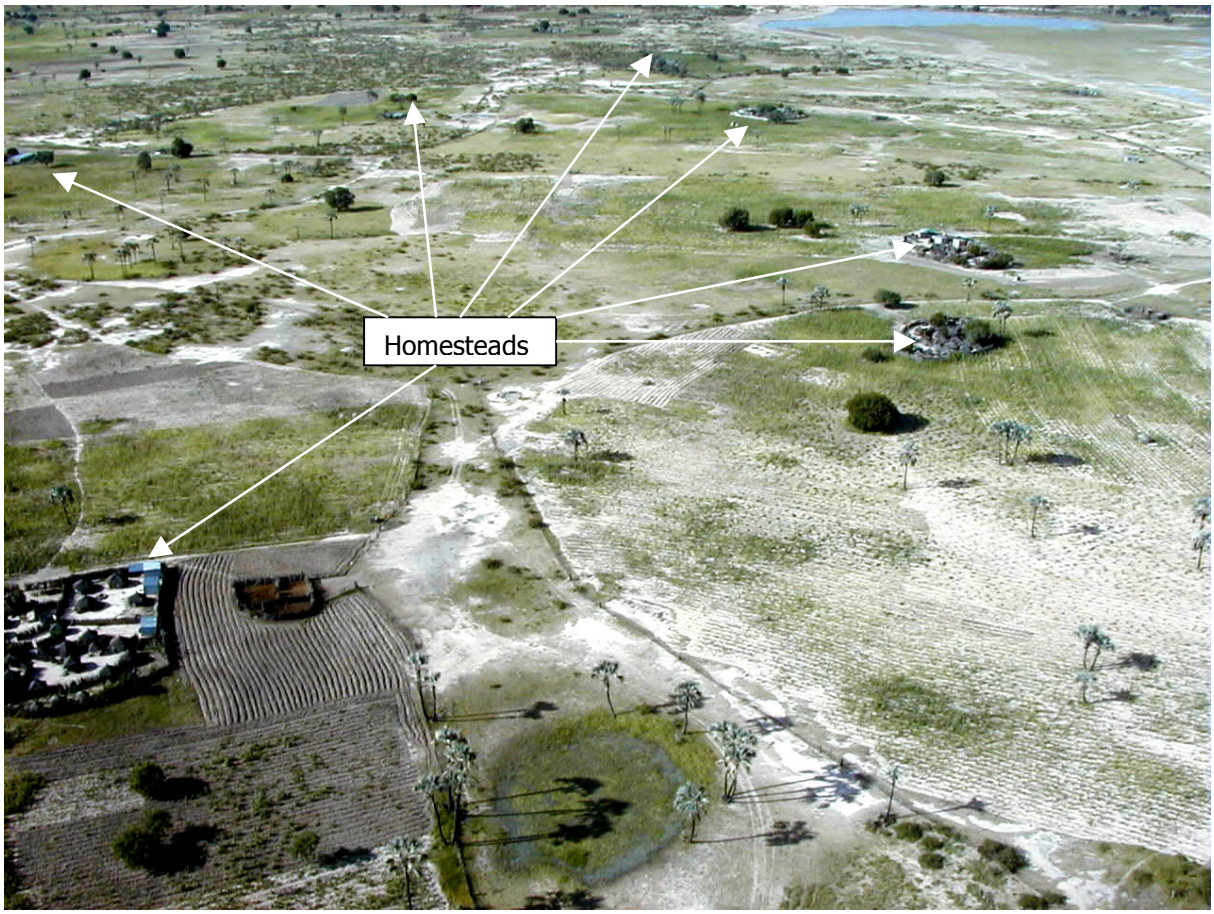

FIGURE 6: Dispersed rural Settlement Pattern in Central-North

The most trustworthy sources of information appear to be the two master plan studies which provide actual numbers of rural household connections made between 1991 and 2000, and between 2001 and 2005, respectively. At Namibia's Independence in 1990, an estimated 9,700 rural households[5] were connected to grid electricity (MME, 2000), representing a 5% rural access-to-electricity level according to the 1991 census. Over the next 10 years the National Rural Electrification Programme (NREP) grid-electrified some 400 rural localities across the country and connected 15,852 households, which brought the access figure up to an estimated 12% by 2000 (MME, 2000). 5,678 (36%) of these households were connected in Central-North alone, reflecting the high priority that these regions enjoyed on the Government's development agenda.

Between 2001 and 2005, a further 10,452[6] rural household connections were made across the country (4,676 = 45% in Central-North), yielding a total of 26,304 rural

[5] It should be noted that these households were mostly found in rural towns and villages that are today classified as urban areas.

[6] Source: 2005 REDMP update

household connections (10,354 = 39% in Central-North) having been provided under the NREP since 1991 (MME et al, 2005).

While the arithmetic sum of grid-connected rural households in 2005 would yield a total of 36,004 (=9,700+15,852+10,452), it must be kept in mind that some formerly rural centers have been reclassified as urban in the meantime. According to the 2001 census, only 19,884 (9.5%) - instead of 25,552 (12%) - of all 210,140 rural households in Namibia used electricity for lighting. Adding to this the number of rural household connections made between 2001 and 2005 (10,452) yields a total of 30,336 in 2005, which translates to an access level of about 14%[7].

In Central-North, approximately 4,800 (4.1%) of all 116,884 rural households used electricity for lighting in 2001. Adding to this the number of rural household connections that were made between 2001 and 2005 (4,676) yields a total of almost 9,500 in 2005. This translates to an access level of at best 7% in 2005 when assuming the national annual growth rate of 2.6%[8] for rural households in these regions. This low level (compared to the national average) is primarily due to the dispersed settlement pattern described above.

TABLE 15: Access-to-Electricity Levels

NAMIBIA

YEAR/ PERIOD	NREP Connections	Total Rural HHs	Electrified Rural HHs	Access Level
1991		194,000	9,700	5%
1991-2000	15,852			
2001		210,140	19,884	9.5%
2001-2005	10,452			
2005		216,686	30,336	14%
	26,304			

CENTRAL-NORTH

YEAR/ PERIOD	NREP Connections	Total Rural HHs	Electrified Rural HHs	Access Level
1991		?	?	?
1991-2000	5,678			
2001		116,884	4,800	4.1%
2001-2005	4,676			
2005		135,371	9,476	7%
	10,354			

B.2 DIRECT AND PROXIMITY ACCESS

While the above analysis only counted actual connections, there are many potential customers within reach of the electricity grid that are not (yet) connected. To account for these potential customers, the 2005 REDMP update made a distinction between 'direct access' and 'proximity access'. A radius of 500m around existing

[7] assuming that rural household numbers grow by only 50% of the 2001 population growth figure of 2.6% per annum.

[8] Growth in the number of rural households in Central-North is expected to be far lower than this national average, because of the high rate of urbanisation (at 5% per annum, Namibia has one of the highest urbanisation rates in the world).

distribution transformers defines direct access, with grid-connection of individual customers only requiring low voltage infrastructure. This applies primarily to potential customers in already electrified localities. Proximity access, on the other hand, is defined by a 10km distance from existing medium voltage distribution lines, and applies to unelectrified localities (and potential individual customers) requiring medium voltage as well as low voltage infrastructure, including distribution transformers.

Using these measures to approximate the rate at which access to electricity can be expected to grow, the 2005 REDMP update calculated that 32.0% (12.7% in Central-North) of rural households had direct access and 13.8% (23.7% in Central-North) had proximity access in 2005. By 2010, these access figures were expected to be 32.3% and 12.4% respectively (15.6% and 16.9% in Central-North) if the master plan roll-out was implemented as proposed. The mere marginal increase in direct access of rural households is ascribed to the population growth rate, which is nearly as high as the electrification rate, and the high rate of urbanisation. The decrease in proximity access results from the increasing remoteness of unelectrified rural localities as the electrification programme progresses.

B.3 ELECTRIFICATION TARGETS

The overall electrification target of 25% rural household access to electricity by 2010 has been defined in Namibia's 1998 White Paper on Energy Policy. Assuming that the average growth in rural households is only 50% of the 2001 population growth rate (due to the high urbanization rate), i.e. 1.3% per annum, there will be about 236,000 rural households in Namibia by 2010. The electrification target will therefore be reached if 59,000 of these households have access to modern energy services in 2010, either by being connected to the electricity grid or a diesel mini-grid, or by having a solar home system installed.

The baseline REDMP (MME et al, 2000) identified 2,486 still unelectrified localities in the country, of which 131 were classified as too remote for grid electrification. This master plan expected the grid-electrification programme to provide some 34,000 new connections (23,000 of which are households) in 1,350 rural localities over the next 10 years (2000-2009), on annual budgets of between N$40 million and N$46 million (total N$422 million). In addition, almost 7,000 solar home systems were to be installed over a five-year period as part of a UNDP-GEF funded initiative, and N$17.5 million were budgeted for off-grid electrification of about 500 clinics and schools in remote rural localities. These proposed investments were within the envisaged (at the time) available rural electrification funds (about N$50 million per annum) and would raise rural household connection levels to some 21% by 2010, which still falls short of the 25% electrification target. Even if additional funding was available it is doubtful whether the local industry had adequate capacity to manage a larger electrification programme.

Five years later, the REDMP update (MME et al, 2005) found that only 53% (5,874[9]) of the planned 11,042 household connections proposed by the 2000 REDMP were actually provided between 2000 and 2004. The reasons for this are not discussed in

[9] This figure only accounts for connections in newly electrified localities, and not for additional connections in previously electrified localities.

the master plan report, but the lower connection rate significantly impacts on the challenge of meeting the White Paper target. By 2005, a total of just over 30,000 rural households was grid-connected and the national rural household access level was estimated at 14% (see above), excluding off-grid households provided with solar home systems. Between 2001 and 2005, an average of 2,090 rural households were grid-connected per year, which is almost double the annual connection rate achieved between 1991 and 2001 (1,174). If this rate can be sustained, there will be about 41,000 grid-connected rural households by 2010 (equivalent to 17.4%), which falls far short of the envisaged target. Whether the difference can be made up by off-grid connections is doubtful.

APPENDIX C: INSTITUTIONAL ARRANGEMENTS

After Independence, electricity distribution became the responsibility of three main agencies:

- Local Authorities within their service territories,
- the Ministry of Regional and Local Government and Housing (MRLGH) in rural areas; and
- NamPower in commercial farming areas, some smallholding and village areas, and bulk supply to the other distributors.

Larger local authorities (eg. Windhoek, Walvis Bay and Swakopmund) have operated successful electricity distribution businesses and electricity revenue was used to subsidise other services. Many smaller local authorities, however, have struggled to maintain viable distribution systems, primarily due to deteriorating networks that required large refurbishment investments. Many of these networks were built in the 1960s and 1970s and have not been maintained to the required standards for their continued safe and reliable operation.

C.1 INITIAL OPERATIONAL CONSTRAINTS

The NREP hugely increased operational responsibility over a rapidly expanding service territory, a challenge for which existing MRLGH electricity distribution structures were not prepared, and for which little provision was made during the conception and planning phases of the NREP.

A general lack of funds for operation, maintenance and extension of the infrastructure, as well as a lack of suitably qualified and experienced personnel, threatened to diminish the developmental benefits that rural electrification offered. What compounded this serious problem was the rapidly increasing demand for new connections after the initial phases of rural electrification were completed.

Despite recruiting a team of trained electricians to augment the existing maintenance crew, the technical capacity of the MRLGH in Central-North remained limited. The electricians were largely inexperienced and lacked organizational skills. Having just recently returned from exile, many of them experienced re-integration difficulties, a situation that was hardly conducive to meeting the demands of an expanding electricity distribution system.

Organizational systems were virtually non-existent. Response to power outages and other technical problems was slow and measures taken to rectify the fault often inadequate. The lack of financial control and poor meter reading and billing habits saw rapidly increasing customer debt, without appropriate remedial action (eg disconnection) being taken. The result was rising electricity consumption subsidies by the MRLGH who had to foot NamPower's bulk supply bill.

C.2 NORTHERN ELECTRICITY[10]: A PUBLIC-PRIVATE PARTNERSHIP IN ELECTRICITY DISTRIBUTION

This untenable situation led GRN to seek assistance from the private sector, while more long-term power sector reform initiatives -- a new Energy Policy and Electricity Act, establishment of a regulator for the electricity industry, and consolidation of the fragmented distribution sector -- were initiated.

Northern Electricity, a private Namibian company and the first of its kind in sub-saharan Africa, was contracted for a period of five years to manage, operate and maintain the new distribution networks in Namibia's central northern regions (Central-North plus Kavango, a service territory of some 120,000km² with approximately 200 electrified rural localities and four towns). The contract also provided for a limited electrification obligation.

Within little more than a year, the company was able to turn the precarious situation around and run a profitable operation. The implementation of suitable management systems (including a 24-hour fault reporting centre, strategically located service centres, planned maintenance routines, and sound financial management systems) paved the way for providing an effective and efficient electricity supply service. Detailed customer surveys and a meter audit (including meter repairs/replacements where necessary, as well as sealing) consolidated the company's revenue base. Network weaknesses were rectified, thereby improving system stability. A new tariff structure was introduced, which saw an effective tariff reduction for domestic customers. Customer willingness to pay for the service increased to more than 99%.

Northern Electricity not only met its electrification obligation (N$2.7 million over five years), but exceeded it by almost N$14 million (more than 300%!), connecting some 4,000 additional customers out of its revenue. The company was even keen and operationally able to speed up the electrification process with loan funding from the Development Bank of Southern Africa, which unfortunately did not materialise due to a) MRLGH's unwillingness (as asset owner) to provide appropriate guarantees, and b) the limited contract period.

Northern Electricity has demonstrated that private sector involvement in electricity distribution can be successful and affordable, and this in spite of a lack of appropriate legislation and a suitable industry structure.

C.3 ELECTRICITY DISTRIBUTION INDUSTRY RESTRUCTURING

In 1998 GRN published its energy policy framework for industry development as a White Paper. Emanating from this policy:

- the Electricity Act was promulgated in 2000;
- the Electricity Control Board (ECB) was established; and
- the Electricity Supply Industry (ESI) restructuring process was launched.

One work stream of the ESI restructuring process is the rationalisation of the distribution industry with a view to improving its viability and sustainability. The accepted structure features a number of asset-based Regional Electricity Distributors (REDs).

[10] A more detailed account of the Northern Electricity experience can be found in Appendix G.

Four possible RED areas were identified, one covering the entire northern regions, one covering the coastal Erongo Region, one in the central regions of the country, and one for the southern regions (see Figure 7). The establishment of REDs was initiated in all four proposed regions early in 2001, and technical committees were established in April/May 2002 to expedite the processes. The REDs policy encourages the commercialisation of electricity supply utilities, but it is deemed appropriate within the present political framework that these new entities are composed of public sector owners (like NamPower, local authorities and regional councils) rather than the private sector. Liberalisation in this sense assumes that the private sector is invited to participate in sector activities through its expert skills and business orientation, rather than through equity capital. While Northern Electricity has set a fine example of how such a public-private partnership could work, both for the benefit of the distribution industry and the end users, the company's ultimate demise is an indication that political aspirations still overshadow sector policy implementation.

The first RED -- NORED Electricity -- was established as a joint venture company by NamPower, Regional Councils and Local Authorities (except Oshakati Town Council) in northern Namibia, taking over the electricity supply responsibilities from Northern Electricity in March 2002 when the management contract expired. Its service territory spans the entire northern parts of Namibia, including Central-North, but excluding the Oshakati local authority service territory. Oshakati is presently being integrated into NORED Electricity, which is expected to significantly improve the financial viability of the RED.

Two further REDs - CENORED and Erongo RED - have been established in 2005 and are fully operational. CENORED's service territory comprises many commercial farms and a few significant towns, but far less rural localities than are found in NORED's service territory. Erongo RED is centred upon the coastal towns of Swakopmund and Walvis Bay, with a largely unpopulated hinterland that only includes a few commercial farms and a small number of rural localities in the north-east of the service territory.

The remaining two REDs - Central RED and Southern RED - are yet to be established. The City of Windhoek is resisting being incorporated into a RED because of a feared loss of a very lucrative revenue stream (from electricity sales) for the municipality (this same revenue stream is essential for the viability of the RED and would greatly enhance electricity supply in the surrounding rural areas), while stakeholder disagreements in southern Namibia have so far prevented the creation of a RED in this most sparsely-populated part of the country.

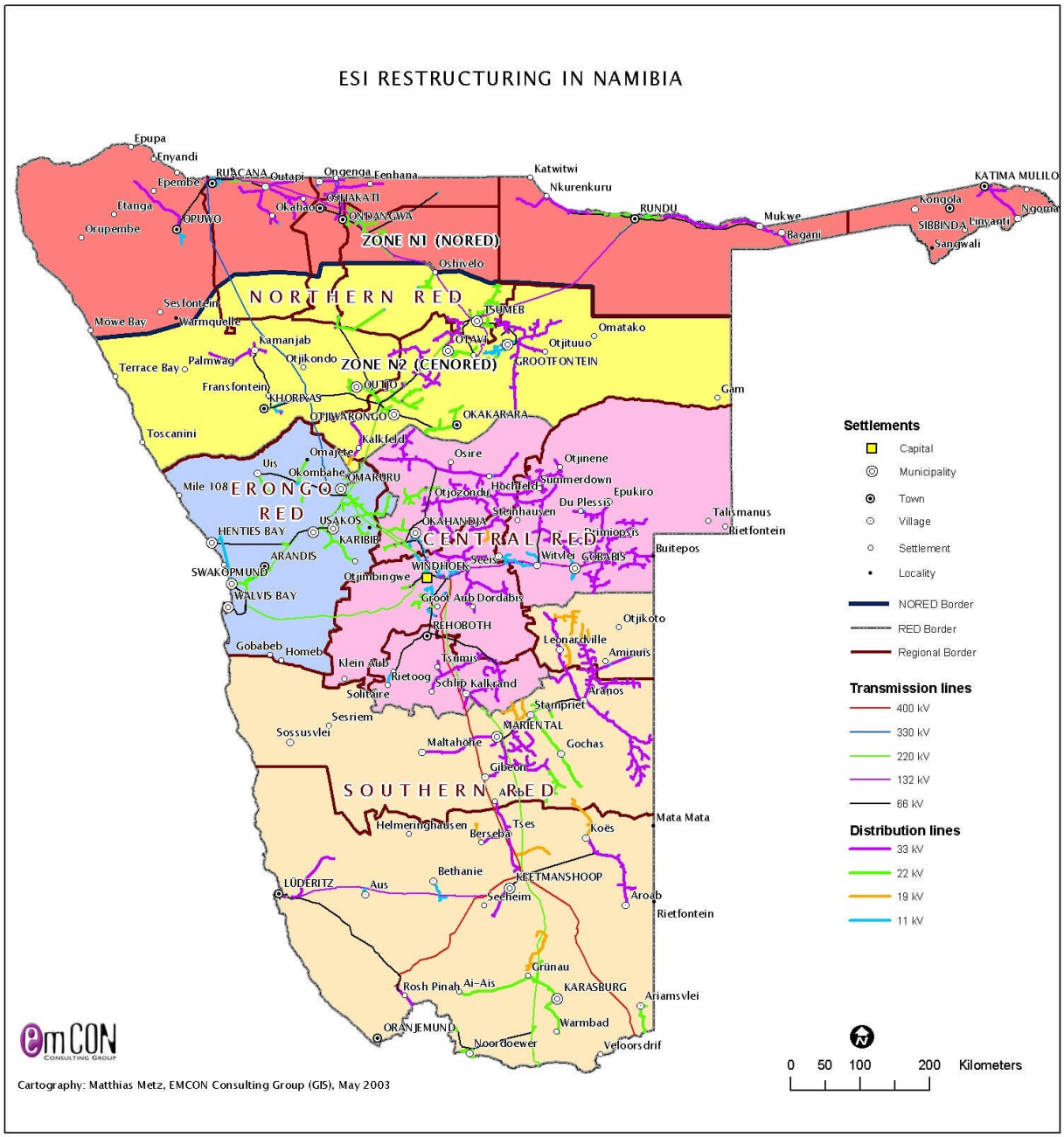

FIGURE 7: ESI Restructuring in Namibia

C.4 ELECTRICITY SUPPLY SERVICE EFFICIENCY ASSESSMENT

The initial institutional arrangements, under MRLGH, were clearly inadequate and therefore inefficient in the provision of electricity supply services to a growing customer base spread over a huge service territory. The lack of skills and proper management systems was further hampered by poor means of communication (only a party line telephone system existed at the time) and limited transport. The maintenance crews operated from Oshakati and Rundu, and could usually only attend to two or three call-outs at a time, often covering considerable distances to firstly determine the cause of a fault and then having to come back with appropriate equipment and spares to repair it. This was a slow and costly exercise that fuelled

rising budgetary needs, adding to the already loss-making operation as a result of poor revenue collection. At the same time the backlog of new connections was growing because of similar resource constraints on the construction crew's side. The 1995 impact assessment study (Davis et al, 1995) confirmed the MRLGH's inadequate electricity service quality, citing the following constraints:

- Human resource cpnstraints
- Physical and financial resource constraints
- Weak accounting and administrative systems
- Inadequate analysis of the financial implications of the RE programme.

Lack of transport was still seen as the single biggest problem faced by the electricity supply authority, affecting both maintenance and the distribution of prepaid electricity cards.

When Northern Electricity took over the electricity supply responsibilities in densely populated northern Namibia, operational efficiency rapidly increased. The company introduced efficient management systems, reduced tariffs in real terms, upgraded and extended existing power supply infrastructure and improved customer services to unprecedented levels. The result of this was a high level of customer satisfaction, which manifested itself through high payment levels (about 99%), insignificant tampering by customers with their supplies, a rapidly expanding customer base, and high levels of consumption (in excess of 200kWh customer per month for domestic customers). Northern Electricity adapted their service approach to local condition, for example by making use of community agents for marketing and the sale of pre-paid electricity. The company was very careful not to antagonise customers by unreasonable actions and always sought to understand their customers' circumstances (for example, by investigating reasons for non-payment and devising mutually acceptable solutions with defaulters), which earned them a lot of credit.

The commendable operational performance of Northern Electricity is not only ascribed to its profit motive, but also to other incentives like continuous monitoring by the Evaluation and Monitoring Committee (EMC - a dedicated regulatory agency that was set up to ensure contractual compliance by the company), and to professional advice from a group of technical consultants that the company had appointed to assist with electrification planning and more complex technical matters. The 1999 impact assessment study (Wamukonya et al) found that fewer households experienced technical problems with their electricity supply in northern Namibia than in the eastern parts of the country, indicating superior service quality by Northern Electricity.

NORED Electricity inherited a well-organized and smoothly functioning electricity distribution system from Northern Electricity, with efficient management systems in place. The extent of the service territory was increased to include the whole Caprivi Region as well as the northern parts of Kunene Region, increasing the customer base by some 40% to 20,786. Dedicated performance monitoring by the EMC gave way to broader regulatory control by the Electricity Control Board (ECB) in terms of the new Electricity Act (of 2000), which does not directly address operational performance issues, like the perceived decline in technical skills and inadequate forward planning. Anecdotal information from the 2007 survey suggests that service levels have somewhat dropped under NORED Electricity, with some respondents citing unacceptably long power outages (this could not be verified from NORED

Electricity's records) and poor distribution of prepaid electricity cards in some areas. Also, it appears that the maintenance of the company's management systems has been somewhat neglected, with the company not being able to readily provide indicators such as accurate customer numbers or average consumption figures for the various tariff categories. However, efforts are currently underway to implement a new customer management system. To this effect, the company has recently replaced all 6,780 group coded prepayment meters with keypad meters to enable individual customer control.

In contrast with Northern Electricity, which by its private sector nature was a staunchly non-political profit-driven service provider, NORED Electricity's decision-making is often influenced by political motives and priorities that are not necessarily in the best interest of customers.

C.5 FINANCIAL AND ECONOMIC SUSTAINABILITY ASSESSMENT

Namibia's rural electrification programme was made possible by continuing Government capital subsidies, as well as foreign donor funding during the initial 10-year period. The operational costs of managing the rural networks and connecting new customers, however, were intended to be funded from revenue.

Unfortunately, the operational challenges that a large-scale rural electrification programme poses have not been properly taken into account during the conception of the NREP, with the consequence that service provision during the early years (by the MRLGH) was poor and clearly not sustainable, heading for a disaster of major financial and economic proportions. A collapse of the programme could be averted, however, by outsourcing service provision to the private sector, while the industry was restructured and regulatory controls put in place to effectively deal with operational matters on a sustainable basis.

Northern Electricity (the private service provider that managed rural electricity supply in northern Namibia between 1996 and 2002) has demonstrated that a rural electricity distribution system can be operated sustainably and expanded, even without capital[11] and operational[12] subsidies, if managed appropriately in the long-term interest of both customers and the service provider. The new REDs continue to confirm this, although tariff levels have substantially increased in some parts of the country in response to the regulatory requirement of cost-reflectivity. In the case of NORED Electricity, tariffs fully reflect the operational costs (inclusive of depreciation), but they do not include a return on the infrastructure because this has largely been funded by Government and donor grants.

[11] Northern Electricity had a limited contractual obligation for electrification, which consisted primarily of extending existing reticulation networks and connecting additional customers. In its service territory, the company was responsible for facilitating the NREP. However, these two initiatives could hardly satisfy the huge demand for electrification, and therefore in 1998 Northern Electricity applied for loan funding from the Development Bank of Southern Africa (DBSA). Although approved in principle by the DBSA, this initiative failed due to the company's lack of collateral (they did not own the networks) and Government's refusal to provide guarantees. As an alternative, the company then implemented a rural electrification levy (N$0.015/kWh sold and paid for) that increased the connection rate. In addition, the company spent almost N$14 million out of revenue (over and above its contractual obligation!) on rural electrification over its 5-year term, achieving electrification levels far in excess of expectations and almost tripling the customer base to about 15,000 users.

[12] Northern Electricity's contract provided for an operational subsidy of N$3 million per year, being the NamPower extension charges that Government continued to pay because the issue of extension charges was under dispute (between Government and NamPower) at the time. This subsidy roughly balances Northern Electricity's electrification investments out of revenue.

Experience from electrified rural areas around the country indicates that customers can afford and will pay for electricity at present subsidy levels[13] and tariffs. In more remote and less densely populated areas, consumption levels are expected to be significantly lower though, both for reasons of affordability and lack of appliances[14], which negatively impacts on the financial viability of delivering energy services in such areas. However, uniform RED tariff regimes aim to provide the necessary cross-subsidies to counteract this effect.

While management and operation of existing rural electricity distribution systems appear to be financially sustainable, there are indications that capital investments in the NREP are declining. Donor funding has provided a huge financial boost to the initial phases of the programme, but this source is not available anymore. Government's annual budget allocations for rural electrification have not been maintained at the levels recommended by the REDMP, and NamPower's rural electrification contributions have not been fully utilized in recent years, casting doubt over the achievability of the envisaged electrification target (25% of rural households electrified by 2010).

RED ownership of the electricity supply infrastructure could be a matter of concern, however. During the ESI restructuring consultations it was proposed that asset ownership be separated from service provision and leased to the REDs. The reasoning behind this argument was that REDs are granted service provision rights through a license that carries obligations, and if these obligations are not met, then the regulator (ECB) may revoke (or not renew) the license of that particular RED and give it to another service provider. With the REDs owning the assets, however, changing supply rights from an existing licensee to another is a complex and costly matter.

[13] Households connected as part of the NREP do not pay a connection fee, while those connecting at a later stage do pay for at least a portion of their connection costs. NORED Electricity subsidises about 50% of these connection costs.

[14] However, even if appliances were to be made available free of charge as part of the NREP (eg hotplate and kettle), it is questionable whether electricity consumption would increase as rural households may not be able to afford the higher consumption.

APPENDIX D: ENVIRONMENTAL IMPACT ANALYSIS

This section focuses on the impact of rural electrification on the bio-physical environment. Relevant environmental impact issues are highlighted and discussed on the basis of available literature[15] and with reference to the results of the survey conducted in the six target communities and three comparison communities.

D.1 BIOMASS-BASED RURAL ENERGY ECONOMY

In Namibia, most of the total energy consumed by industry, transportation, households, businesses and public institutions and places is derived from "modern" fuels -- liquid petroleum-based fuels (approximately 60%) and electricity (about 15%). While the contribution of traditional biomass fuels to total energy consumption is largely unknown, it is estimated that wood-based fuels account for an estimated 15 – 20% of all energy consumed. There are great differences in energy use patterns between urban and rural areas, however.

While use of modern petroleum-based fuels and electricity predominates in urban areas, the majority of people and many small businesses in rural areas to a great extent still rely on biomass fuels, most importantly wood. An estimated 90% of rural households use biomass energy to meet their daily energy needs. By far the largest use of biomass energy is for cooking – mostly done by women. Throughout the rural areas, wood is also used in the construction of houses, compounds and fences. With respect to cooking, some 90% of rural households use firewood, 34% LPG, 9% paraffin, 8% electricity, 7% cow dung – and about 30% a combination of these fuels.[16]

Figures 8 and 9 provide a graphical representation of the proportion and number, respectively, of households using wood, electricity, and other fuels (gas and kerosene) for cooking in rural and urban areas, respectively – for Namibia as a whole and broken down by Region. The Figures illustrate the importance of wood for cooking throughout Namibia, especially in rural areas but also in urban areas (except for urban areas in the Khomas and Erongo Regions) where similar percentages of households use wood energy and electrical energy for cooking, respectively.

How do the survey results compare with these national fuel use patterns for cooking, as far as rural areas are concerned? It appears that both the three unelectrified and the six electrified localities surveyed show considerable deviations from this national picture of cooking fuel use, although the broad picture that the survey provides seems not inconsistent. In the unelectrified localities, 69% of all surveyed households use firewood as first choice fuel and another 27% use firewood as second choice (back-up) fuel. The percentages of surveyed households in unelectrified localities using cooking fuels other than firewood as first (second) choice are: 19% (23%) gas (LPG); 10% (10%) cow dung; 2% (0%) electricity; and

[15] This section draws heavily on (Cecelski, 2001) and (CSA, 2004).

[16] These figures are based on (Wamukonya, 1997) who studied the energy consumption patterns of eight rural villages located in seven different Regions.

0% (2%) paraffin. The corresponding percentages of surveyed households using different first (second) choice cooking fuels in the six electrified localities are: 48% (9%) electricity; 41% (29%) wood; 8% (18%) LPG; 2% (4%) paraffin; and<1% (10%) cow dung.

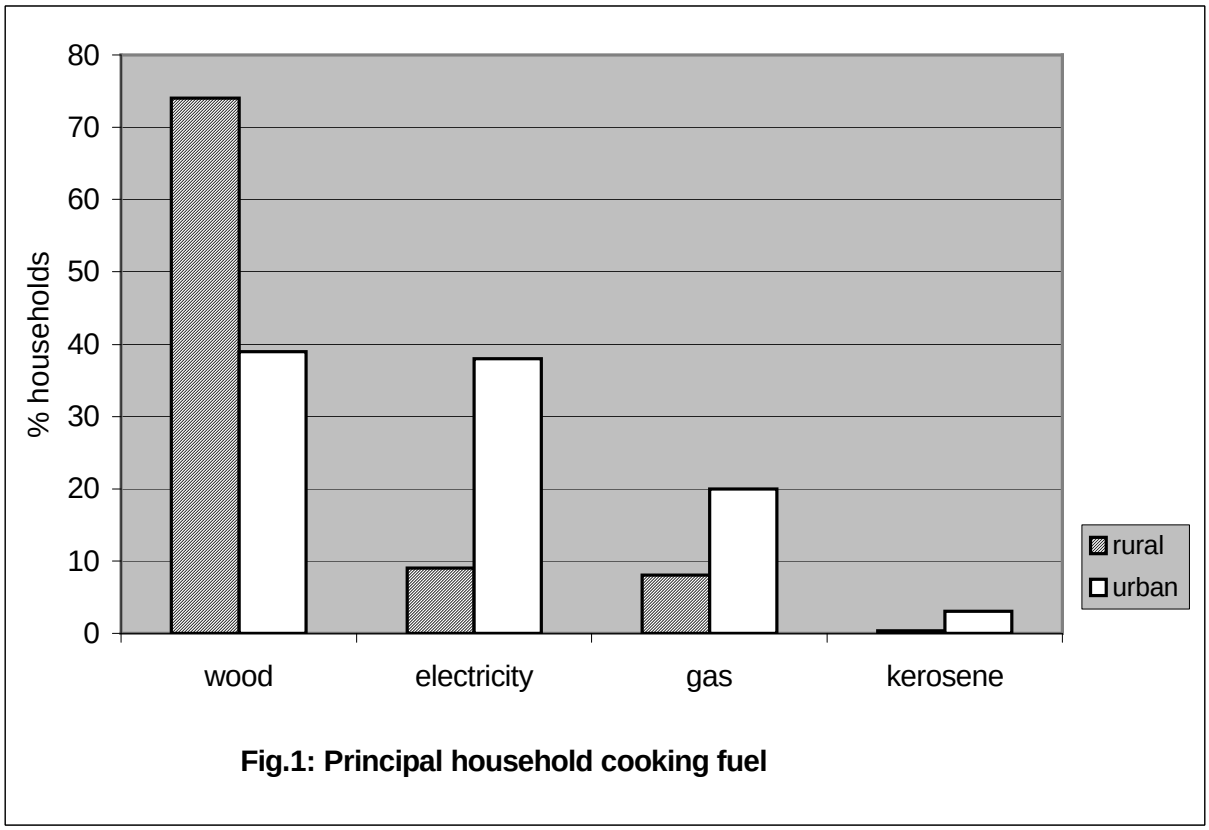

FIGURE 8: Fuels Used for Cooking in Rural and Urban Areas, Namibia, 1996

(Source: Hamutwe & Wamukonya, 1998 in Wamukonya, 1999)

It is possible that a combination of electrified and unelectrified localities, in proportion to the extent to which the rural areas are electrified, would have cooking fuel use patterns closer to the national average shown in Figure 8. It is, however, to be expected that the use of electricity for cooking generally has gone up with increasing electrification in rural areas since 1996 (the year to which Figure 8 refers).

D.2 ENVIRONMENTAL PROBLEMS AFFECTING THE AVAILABILITY OF BIOMASS RESOURCES

Namibia has been suffering from widespread deforestation, particularly in the Central-North and around major urban centres (in the vicinity of informal settlements). A variety of factors and processes – fires, land clearing for agricultural purposes, overgrazing, harvesting of wood for building purposes, and collection of wood for use as a fuel – have contributed to deforestation, but the principal proximate causes of deforestation have been fires and clearing of land for agriculture (Atlas of Namibia, 2002).

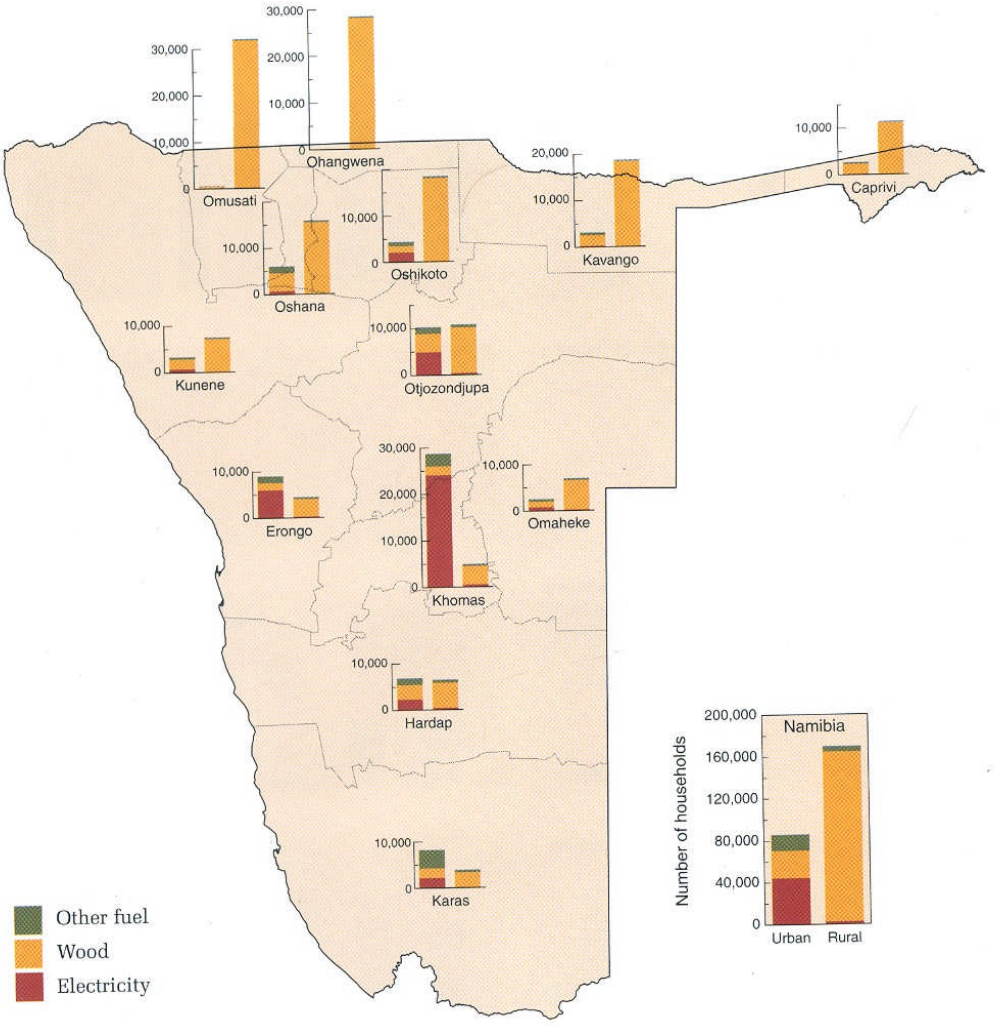

FIGURE 9: Use of Wood and Electricity for Cooking (Source: Atlas of Namibia, 2002)

While collection of fuelwood generally has only been a minor contributor to deforestation in the country, the ongoing process of deforestation has been causing growing fuelwood scarcity, particularly in Central-North and in peri-urban areas around informal settlements. At least two (out of nine) focus group discussions – one with a mixed group (FGD1), the other one involving women only (FGD8), and both groups assembled from people living in Outapi (the largest urban area surveyed) – highlighted perceptions that firewood has become scarcer and more expensive (in price when purchased or in time when collected). As a result of greater fuelwood scarcity, increasing amounts of wood are being purchased rather than collected. The household survey indicates that in larger localities (Outapi, Oshikuku and Engela) approximately half of the households purchase (at least some of their) wood, while the proportion households purchasing wood is smaller in the smaller localities. Key informant interviews also revealed perceptions that access to wood has become a greater challenge due to deforestation (see Appendix B).

Another environmental issue that has been affecting the availability of biomass resources and land use is bush encroachment. This phenomenon appears to have begun in Namibia as early as during the 1940s and has come to affect large areas of

commercial farmland. However, communal areas have been largely left untouched by bush encroachment so far. Bush removal by chemical or mechanical means is economically unattractive, but the production of charcoal from invader bush has been shown to be a financially and economically more attractive option (Bester, 1996).

An inventory of greenhouse gases in Namibia (Du Plessis, 1999) has shown that Namibia is a net carbon sink, mainly as a result of the growth of invader bush. Carbon emissions from fossil fuel use and the burning of biomass are estimated to have been more than offset by carbon capture through invader bush growth.

D.3 IMPACTS OF GROWING FUELWOOD SCARCITY ON RURAL LIVELIHOODS AND THE USE OF OTHER BIOMASS FUELS

As a result of growing fuelwood scarcity, particularly in the Central-North and around (peri)urban areas, rural women (and children) have been spending ever longer times and traversed ever greater distances in search of fuelwood, and increasingly men contribute to fuelwood collection efforts by going to more distant areas using donkey carts. Fuelwood is also increasingly being commercialised (bought and sold, rather than collected free of charge from the wild). Therefore, time, and increasingly, money spent on securing necessary fuelwood supplies has become a greater burden for rural women and men.

The survey provided some indication of the growing commercialisation of fuelwood and of rural household expenditures on fuelwood (as well as other fuels) relative to overall household expenditures and income. During a women's focus group discussion, local women in Outapi (FGD8) voiced concerns that "fewer people depend on wood because it is scarcer and more expensive now … and a fuelwood industry has emerged because people no longer fetch but buy fuelwood" (see Appendix C). The household survey shows that in unelectrified localities household expenditures on fuelwood can be a significant or even large proportion of overall household expenditures. Indeed, in one comparison village (Ompundja) it was revealed that nearly half of average overall household expenditures are on fuelwood. By contrast, in electrified localities levels of household expenditures on fuelwood are small relative to overall household expenditures (they range between <1% and 8% of average overall household expenditures) and are generally exceeded by household expenditures on electricity (which range between 5% and 30% of average overall household expenditures).

On the other hand, the survey yields less evidence on increasing fuelwood collection time burdens (mostly on women). A cross-sectional comparison, based on survey results, does not reveal any significant differences in fuel collection time burdens between electrified localities (average duration of fuelwood collection trips ranges between 0.4 and 1.0 hours) and unelectrified localities (fuelwood collection trips take between 0.6 and 1.6 hours). A time-longitudinal comparison of fuelwood collection times within the target localities now and 12 years ago might be more revealing, but unfortunately the baseline study (Davis et al, 1995) did not examine fuelwood related environmental issues.

Due to the increasing scarcity of fuelwood, a variety of biomass fuels are commonly used in rural areas. A baseline survey in the northern region listed the following

biomass fuels: fuelwood, bitter bush, marula husks, makalani husks, palm seeds, animal dung, and crop residues (Cecelski, 2001). The rural electrification impact assessment survey confirmed this for the case of animal dung. It was revealed that a significant proportion of rural households in both electrified target localities and unelectrified comparison localities rely on animal dung for cooking, water heating and space heating. In the unelectrified localities, animal dung is used by approximately 10% of all households as main fuel (and by an equal percentage of households as back-up/complementary fuel) for each of these three end uses. The difference to the situation in the electrified localities is that in the latter animal dung is used for these three applications only as a back-up fuel, also by about 10% of the households.

Agricultural residues and biomass wastes are invariably smokier than wood, creating or enhancing indoor air pollution and eye and respiratory illnesses. Although there have been no studies or measures of exposures to and health effects from (indoor) air pollution caused by the burning of biomass fuels in Namibia, in other African countries smoke from cooking has been shown to cause serious illnesses. Women are the main victims of this exposure to smoke due to their predominant role in cooking, although this may be less of a problem in Namibia due to the fact that cooking is normally done outside or in open shelters. Focus group discussions conducted as part of this study acknowledged the issue of adverse health effects from the inhalation of wood smoke in indoor or closed outdoor spaces, although views were expressed in some of the nine FGDs that the issue was not always sufficiently recognized, let alone well understood, by the rural people.

Household members, particularly women, operate a variety of fuel-intensive small-scale industries in the informal food and beverage processing sector in Namibia. These include processing of marula nut oil, fish smoking, bakeries, omalodu beer brewing, and pottery (where taboos exist for men). Men participate in sale of fuelwood and sometimes roast meat for sale. Fuelwood is the primary source of fuel for these small businesses, so the scarcity and high cost of fuelwood is a constraint and burden on their profitability.

D.4 ENVIRONMENTAL BENEFITS OF RURAL ELECTRIFICATION

It has sometimes been argued that rural electrification should be promoted in Namibia, *inter alia*, for environmental reasons. This argument is based on two major assumptions, namely 1) that electrification of rural homes and businesses reduces their wood and biomass fuel use, and 2) that this translates into less deforestation than would otherwise be the case. Both assumptions appear to stand on shaky ground. There is evidence that many newly electrified rural homes and businesses retain their wood stoves or charcoal stoves and at best may use a combination of fuels (biomass, electricity and other fuels) for cooking (see above). For instance, the rural electrification impact assessment survey indicates that only about 60% of households enjoying access to electricity in electrified localities actually use the electricity as the principal fuel for cooking, while as many as 40% of all households in these localities (of which some 15% don't have access to electricity yet) continue to use firewood for cooking. Moreover, another 30% of the households in the electrified localities use firewood as a back-up or complementary fuel for cooking.

This suggests that the extent of fuel switching (from wood/biomass fuels to electricity) for cooking in response to electrification is actually rather low. Not surprisingly, wood use for cooking on average remains high in urban areas (see Figures 8 and 9). The second assumption appears not to hold either, given that in most communal rural areas fuelwood collection is not a major cause of deforestation, as mentioned above.

The limited extent of fuel switching from fuelwood to electricity for cooking and the weak causal link between fuelwood use and deforestation also suggests that electrification is unlikely to slow, let alone reverse, accelerating fuelwood scarcity, and hence is unlikely to ameliorate its above-indicated adverse effects on rural livelihoods or the bio-physical environment (in terms of the use of other biomass fuels).

D.5 ENVIRONMENTAL DRAWBACKS OF RURAL ELECTRIFICATION

There are at least two (actual or potential) negative environmental impacts from rural electrification that should be mentioned here. One is the direct land use and environmental impact associated with extending the power distribution lines into previously unelectrified rural areas. The precise nature and extent of this impact will vary from case to case. It can be minimised through careful infrastructure and land use planning, based on sound economic and environmental criteria.

The other adverse environmental impact arises from the environmental effects of generating the electricity to be distributed to the rural areas. This indirect environmental impact depends on the particular mix of primary energy sources used to generate the electricity and the locations of the power generation plants. Electricity used in Namibia comes from two principal sources: the Ruacana Hydro Station (contributing much of the country's power during the rainy season) and South Africa's mostly coal-based power generation system (complementing Ruacana particularly during the dry season). While coal-based power generation tends to be highly polluting (sulphur, NOx, CO2, etc), hydro power is relatively clean, although it carries significant environmental opportunity costs in terms of the land foreclosed for other uses, aside from the costs associated with the displacement of local residents.

D.6 ASSESSMENT OF THE EXTENT OF ENERGY SUBSTITUTION

Tables 16 and 17 provide an overview of household fuel use by end use category in both electrified and unelectrified localities. Table 16 shows proportions of households using particular fuels for particular end uses, averaged over the six electrified target localities and the three unelectrified comparison localities, respectively. Table 17 shows the ranges of proportions of households in each locality using particular fuels for particular uses across the different electrified target localities and unelectrified comparison localities.

Table 16 suggests the following average fuel switching patterns resulting from electrification. To be sure, fuel switching characteristics indicated below are expressed merely in terms of numbers (or proportions) of households using particular fuels for particular end uses, without shedding light on the actual aggregate quantities of fuels used by households:

- Fuel switching from fuelwood to electricity for cooking (the principal fuel use in rural areas): Only about half of all electrified households (or households in electrified localities) switch to electricity for cooking. Nearly as many electrified households retain fuelwood as the principal cooking fuel (presumably for costs reasons) and more than half of all households using electricity for cooking retain fuelwood as a back-up or complementary fuel option. This picture is consistent with the evidence adduced and argument made earlier that electrification does not cut down much on fuelwood consumption or deforestation.
- Fuel switching from fuelwood to electricity for water heating and space heating: The pattern of fuel switching for water and space heating that results from electrification of localities and households appears to be quite similar to that for cooking, more so for water heating (where, however, the extent of fuel switching -- from fuelwood to electricity -- is somewhat greater than for cooking) and to a lesser extent for space heating (where the extent of fuel switching from fuelwood to electricity is significantly lower compared to cooking).
- Fuel switching from animal dung to other fuels (electricity and fuelwood) for cooking, water heating and space hearting: A significant proportion (about 10%) of households in the unelectrified localities use animal dung as the principal fuel for cooking, water heating and space heating and an approximately equal proportion of households (about 10%) use animal dung as a back-up or complementary fuel for these three end uses. Electrification results in animal dung being dropped as a principal fuel but retained as a back-up/ complementary fuel by an unchanged proportion of households (about 10%). Thus electrification appears to bring about some (potential if not actual) environmental benefits (in terms of more animal dung becoming available, and possibly being used, for use as fertilizer, but the extent of fuel switching away from animal dung is much more limited than it could be, given the adherence to animal dung as a back-up fuel).
- Fuel switching from LPG to electricity for refrigeration: The principal fuel substitution effect for refrigeration from electrification is from LPG to electricity, although small percentages of households retain LPG as a back-up and to a lesser extent principal fuel. The environmental implications of this fuel substitution effect are relatively insignificant.
- Fuel switching from paraffin to electricity for lighting: Electrification results in fuel switching mainly from paraffin to electricity, although small percentages of households retain paraffin as a principal or back-up fuel. While the use of candles as the principal means of lighting also drops, their use as a back-up fuel actually increases somewhat. Again, the environmental implications of this fuel substitution appear to be relatively insignificant.

Table 16: Fuel Switching resulting from the Electrification of Rural Localities (averages for electrified and unelectrified localities, respectively -- based on REIA survey)

End Use	Fuel	Electrified Localities (average for six target localities)		Unelectrified Localities (average for three comparison localities)	
		Proportion of households (%) using fuel as 1st choice	Proportion of households (%) using fuel as 2nd choice	Proportion of households (%) using fuel as 1st choice	Proportion of households (%) using fuel as 2nd choice
Cooking	Electricity	48	9	2	0
	Fuelwood	41	29	69	27
	LP Gas	8	18	19	23
	Paraffin	2	4	0	2
	Animal Dung	<1	10	10	10
Water Heating	Electricity	57	7	2	0
	Fuelwood	36	27	73	25
	LP Gas	3	17	17	15
	Paraffin	2	4	0	2
	Animal Dung	<1	9	8	12
Space Heating	Electricity	17	0	0	0
	Fuelwood	32	2	63	0
	LP Gas	0	0	0	2
	Paraffin	0	0	2	0
	Animal Dung	<1	9	8	8
Refrigeration	Electricity	73	0	2	0
	Fuelwood	0	0	0	0
	LP Gas	2	5	23	0
	Paraffin	0	<1	0	0
	Animal Dung	0	0	0	0
Lighting	Electricity	82	0	2	0
	Fuelwood	0	2	6	0
	LP Gas	0	<1	2	0
	Paraffin	7	5	52	8
	Animal Dung	<1	2	2	0
	Candles	9	59	37	52

Table 17 suggests that the aggregate picture provided above masks considerable variations across electrified and unelectrified localities in the extent to which fuel switching actually takes place, due to differences in demographic, socio-economic, cultural and environmental characteristics between localities. The variations across localities are particularly strong regarding the extent to which households switch from to fuelwood to electricity and from animal dung into other fuels (electricity and fuelwood) for cooking, water heating and space heating, as a result of electrification. Fuel switching processes from LPG to electricity for refrigeration and from paraffin to

electricity for lighting as a result of electrification are much less variable across localities.

Table 17: Fuel Switching resulting from the Electrification of Rural Localities (ranges for electrified and unelectrified localities respectively -- based on REIA survey)

End Use	Fuel	Electrified Localities (ranges for six target localities)		Unelectrified Localities (ranges for three comparison localities)	
		Proportion of households (%) using fuel as 1st choice	Proportion of households (%) using fuel as 2nd choice	Proportion of households (%) using fuel as 1st choice	Proportion of households (%) using fuel as 2nd choice
Cooking	Electricity	5 - 66	0 – 13	9 - 17	0
	Fuelwood	23 - 85	15 – 43	63 - 83	0 - 38
	LP Gas	0 - 25	9 – 28	0 - 38	4 - 67
	Paraffin	0 - 5	0 – 13	0	0 - 4
	Animal Dung	0 - 5	0 – 55	0 - 23	0 - 23
Water Heating	Electricity	5 - 73	0 – 13	0 - 17	0
	Fuelwood	21 - 85	15 – 48	63 - 83	0 - 38
	LP Gas	0 - 8	9 – 25	0 - 38	0 - 27
	Paraffin	0 - 4	0 –13	0	0 - 4
	Animal Dung	0 - 5	0 – 55	0 - 18	0 - 27
Space Heating	Electricity	0 - 25	0	0	0
	Fuelwood	8 - 85	0 – 6	33 - 71	0
	LP Gas	0	0	0	0 - 4
	Paraffin	0	0	0 - 4	0
	Animal Dung	0 - 5	0 – 50	0 - 18	0 - 18
Refrigeration	Electricity	61 - 83	0	0 - 17	0
	Fuelwood	0	0	0	0
	LP Gas	0 - 5	0 – 20	0 - 29	0
	Paraffin	0	0 – 5	0	0
	Animal Dung	0	0	0	0
Lighting	Electricity	78 - 83	0	0 -17	0
	Fuelwood	0	0 –15	0 - 13	0
	LP Gas	0	0 –4	0 - 5	0
	Paraffin	4 - 13	0 – 15	0 -67	0 - 9
	Animal Dung	0 - 4	0 – 5	0 -5	0
	Candles	4 - 15	48 – 70	21 - 83	17 - 71

APPENDIX E: MICRO-ECONOMIC ANALYSIS

This section focuses on perceptions of and experiences with rural electrification on household level, drawing on the findings of the May/June 2007 survey, as well as those of previous socio-economic impact assessments of rural electrification in Central-North (Tapscott, 1992, Davis et al, 1995 and Wamukonja et al, 1999).

E.1 SOCIO-POLITICAL PERCEPTIONS

Rural electrification has significant socio-political importance for affected communities. In previous REIA studies the communities have expressed gratitude towards the government for providing them with grid electricity. In Oshifo, for instance, the community strongly felt that electrification had brought back hope and optimism (Tapscott, 1992), providing a sense of initiative in dealing with daily challenges.

E.2 HOUSEHOLD INCOME

The majority of the households in Central-North rely on subsistence farming as their main source of income. It is, however, common that households have more than one source of income. A household normally mainly consists of family members, and occasionally includes unrelated boarders. Extended family households are still very common in Central-North, but average household sizes are declining. The income is often pooled together to cover household expenses, and women are normally in charge of the household budget (CBS, 2006). It is common that men keep a share of the income for themselves as personal spending money, while women cover their personal expenses through the household budget. Traditionally, women are responsible for gathering or buying firewood, and among electrified households women also purchase prepaid electricity.

TABLE 18: Average Household Income in Central-North

Region	Population (%)		Total income (%)		Average HH size		Average monthly HH income (N$)	
	1994	2004	1994	2004	1994	2004	1994	2004
Ohangwena	13.7	12.9	3.9	5.2	7.5	6.3	537	1,851
Omusati	11.0	12.3	4.4	6.4	7.0	5.7	703	2,197
Oshana	11.6	9.3	6.1	9.0	6.7	5.4	877	3,809
Oshikoto	8.4	9.4	3.9	5.3	6.2	5.4	724	2,232
Otjozondjupa	7.2	6.8	7.5	6.2	4.4	4.3	1,146	2,908
Namibia	**100**	**100**	**100**	**100**	**5.7**	**4.9**	**1,433**	**3,627**
Urban	*28.9*	*34.7*	*63.6*	*62*	*4.8*	*4.2*	*2,695*	*5,552*
Rural	*71.1*	*65.3*	*36.4*	*38*	*6.1*	*5.4*	*788*	*2,317*

(Source: Namibia Household Income and Expenditure Survey 2004)

Almost half of the Namibian population lives in the regions of Central-North, but they only generate just over 25% of the country's total annual income. Per capita income is therefore low compared to many other regions in Namibia.

Generally, more people are employed in electrified households. The lowest level of employment was found in unelectrified households in Onayena, Ontananga and Engela, with an average of 1.3 employed persons per household. In contrast, electrified households in Outapi, Oshikuku and Engela have more than two employed people on average. Also, the number of employed household members tends to be larger in electrified localities than in unelectrified localities, and there are more households with no employment at all in unelectrified localities than in electrified localities. Anecdotal remarks by survey respondents support these observations, with claims that electrification has had a positive impact on employment creation and that it has directly contributed to an increased income in many households. There is no statistical information on changes in employment over time in the surveyed localities.

Among the surveyed households the monthly average income varied between N$1,160 among unelectrified households in Engela and N$5,780 among electrified households, also in Engela (see Table 19). In Oshifo the community felt that electrification had positively impacted on people's livelihoods and had contributed to economic growth, but the average monthly income among electrified households is still low at only N$2,290. The unelectrified locality Omakange, in contrast, has a relatively high average monthly income (almost double that of electrified households in Oshifo), but is perceived by survey respondents as undeveloped and stagnated.

TABLE 19: Household Income & Expenditure Statistics from the Survey

	Unelectrified Households				Electrified Households			
	Average no. employed	Average monthly income (N$)	Average monthly expendi-ture (N$)	Disposable monthly income (N$)	Average no. employed	Average monthly income (N$)	Average monthly expendi-ture (N$)	Disposable monthly income (N$)
Onayena	1.3	3,970	2,200	1,770	1.9	2,710	1,400	1,310
Ontananga	1.3	2,090	970	1,120	1.9	2,650	935	1,715
Outapi	2.8	5,760	1,100	4,660	2.2	4,730	2,050	2,680
Oshikuku	1.5	2,770	650	2,120	2.0	4,980	2,210	2,770
Engela	1.3	1,160	600	560	2.4	5,780	1,750	4,030
Oshifo	2.0	2,025	510	1,515	1.5	2,290	1,390	900
Ompundja	1.8	2,890	1,020	1,870				
Omakange	1.5	4,400	2,050	2,350				
Average	**1.7**	**3,133**	**1,138**	**1,996**	**2.0**	**3,857**	**1,623**	**2,234**

(Source: 2007 REIA survey)

E.3 HOUSEHOLD EXPENDITURE

The 2007 survey did not analyse types of household expenditure, but the 2003/4 Household Income & Expenditure Survey lists water payments, school fees, groceries and food as the main household expenditures (CBS, 2006). Prepaid electricity and firewood are most probably considerable household expenses too. In addition to the

regular expenditures, unforeseen events tend to put a serious strain on the household budget.

In most regions there is positive trend in household consumption, with less of the total household expenditure covering basic needs like food and shelter and more funds being available for other expenses. The 1994 NHIES included education, health and transport in the 'Other' column, but the 2004 NHIES provides more detailed information and has divided the overall consumption into more types of expenses.

TABLE 20: Household Consumption in Central-North, 1994 and 2004

Region	Private household consumption (% of total HH expenditure)											Average HH consumption(N$)	
	Food		Housing		Clothing		Other		Health	Edu-cation	Trans-port		
	1994	2004	1994	2004	1994	2004	1994	2004	2004	2004	2004	1994	2004
Ohangwena	51	42	16	23	10	7	23	16	1	2	9	6,111	21,685
Omusati	50	46	13	17	10	5	27	19	1	2	10	7,746	25,325
Oshana	45	28	15	16	8	7	32	26	2	3	18	8,928	43,965
Oshikoto	48	39	19	13	7	6	26	26	1	6	9	7,407	25,662
Otjozondjupa	36	25	17	23	8	7	39	29	2	2	12	10,374	33,251
Namibia	**33**	**24**	**25**	**21**	**5**	**6**	**37**	**28**	**2**	**3**	**16**	**12,783**	**42,078**
Urban	23	16	32	24	5	6	40	31	2	3	18	22,912	64,863
Rural	47	39	15	17	7	5	32	23	2	2	12	7,601	26,568

(Source: Namibia Household Income and Expenditure Survey, 1994 and 2004)

Household expenditure on electricity was found to vary considerably, which may be an indicator of the extent to which households have switched to electric appliances. While some households are using electricity sparingly and for a limited number of household activities and appliances, others are obviously utilizing a wide range of appliances and perhaps without much attention to energy conservation. The 2007 survey found that communities with relatively low monthly electricity expenditure (like Onayena and Ontananga) tend to believe that grid electricity is saving households money, while communities with higher average household electricity expenditures (like Outapi, Oshikuku, Engela and Oshifo) tend to think that electricity is more expensive than other sources of energy. Both small and large household consumers have been surveyed, with the monthly expenditure ranging between N$15 and N$1200.

TABLE 21: Monthly Electricity Expenditure in Electrified Households

	Number of electrified HH	Monthly expenditure on electricity consumption (N$)			Has electricity saved the HH money?		Has electricity made life easier?	
		Avg	Min	Max	YES	NO	YES	NO
Onayena	15	115	15	250	9	6	15	0
Ontananga	16	82	25	275	12	4	16	0
Outapi	48	192	38	600	22	26	48	0
Oshikuku	20	204	35	750	8	12	18	2
Engela	19	274	20	1,000	7	12	19	0
Oshifo	19	192	20	1,200	4	15	19	0

(Source: 2007 REIA survey)

Almost all households use firewood, but unelectrified households use more wood than electrified households. Wood collection is widespread in smaller localities (like Onayena and Ontananga), while households in larger urban centres (like Outapi and Oshikuku) tend to buy firewood. Unelectrified households spend more of their monthly household budget on firewood than electrified households.

TABLE 22: Energy Use and Expenditure in Electrified Households

HH Energy Use	Ona-yena	Onta-nanga	Outapi	Oshi-kuku	Engela	Oshifo
Average monthly electricity expenditure (N$)	115	82	192	204	274	192
Average monthly firewood expenditure (N$)	14	16	87	84	29	41
% HHs buying batteries	27%	44%	4%	25%	16%	0%
# batteries/month	3	2	2	10	2	0
Avg. monthly battery expenditure (N$5/battery)	15	10	10	50	10	0
% HHs buying candles	47%	88%	73%	55%	68%	53%
# candles/month	11	21	4	3	9	8
Avg. monthly candle expenditure (N$2/candle)	22	42	8	6	18	16
% HHs buying paraffin	7%	44%	4%	15%	21%	0%
litres/month	4	6	3	1	9	0
Avg. monthly paraffin expenditure (N$6/litre)	24	36	18	6	51	0
% HHs buying gas	53%	50%	21%	70%	21%	16%
kg/month	9	8	10	8	4	5
Average monthly gas expenditure (N$2/kg)	18	16	20	16	8	10

TABLE 23: Energy Use and Expenditure in Unelectrified Households

HH Energy Use	Onayena	Onta-nanga	Outapi	Oshikuku	Engela	Oshifo	Ompu-ndja	Oma-kange
Average monthly firewood expenditure (N$)	0	0	380	85	163	0	163	n/a
% HHs buying batteries	67%	75%	75%	25%	100%	75%	64%	83%
# batteries/month	2	2	3	1	4	3	7	8
Avg. monthly battery expenditure (N$5/battery)	10	10	15	5	17.5	15	35	40
% HHs buying candles	67%	100%	88%	75%	100%	100%	82%	92%
# candles/month	18	16	25	17	53	24	21	25
Avg. monthly candle expenditure (N$2/candle)	36	32	50	34	105	48	42	50
% HHs buying paraffin	67%	50%	88%	75%	75%	75%	68%	88%
litres/month	10	6	17	11	22	11	8	9
Avg. monthly paraffin expenditure (N$6/litre)	60	36	102	64	130	66	48	54
% HHs buying gas	33%	50%	38%	75%	0%	25%	36%	54%
kg/month	1	9	19	37	0	48	22	15
Average monthly gas expenditure (N$2/kg)	2	18	38	73	0	96	44	30

Unelectrified households make more use of other energy sources than electrified households, but it is interesting to see that all energy sources are also still used by electrified households, although to a lesser extent. Access to electricity has clearly reduced consumption of and demand for other types of fuel, but very few households have made a complete switch to electricity. It is difficult to determine average energy expenditure per household, because the households have different

consumption patterns. A rough estimation of energy expenditures in electrified and unelectrified households in Outapi indicates that electrified households spend less on energy compared to unelectrified households (N$335 in electrified households compared to N$585 in unelectrified households). A similar calculation for Oshifo indicates that there is virtually no difference in energy expenditure in electrified and unelectrified households, and in Onayena unelectrified households spend less on energy than electrified households.

E.4 SMALL BUSINESS DEVELOPMENT

Some businesses embraced electrification overnight and quickly made use of it to expand production or to attract more customers. Tapscott (1992) found in Oshifo that within six months of the locality having been energized, eight new cuca shops[17] had opened up for business. People from the surrounding area came to Oshifo to socialize on weekends and business was good. Initially, electricity was perceived as providing a competitive advantage that allowed cuca shops to light up, power better sound systems to entertain their customers, and use refrigerators to keep the beverages cold and to store fresh food. The boom, however, was short lived as business owners realized that, although they were able to expand their shop, the number of customers and their buying power were not enough to support all the cuca shops in Oshifo in the long run (Davis et al, 1995).

Other than the anecdotal information from Oshifo, there are few known examples from the earlier years of businesses that have started up as a direct result of access to electricity. Both the 1995 and 1999 REIA studies tried to identify enterprises whose establishment could be directly attributed to electrification, but very few such businesses were found.

The 1995 REIA study (Davis et al) assessed the impacts of electrification on three types of commercial enterprises – cuca shops, larger retail places, and productive, income-generating activities. Virtually all cuca shops visited in the six electrified localities were found to have access to and use electricity for lighting, refrigeration and music systems. However, owners indicated that electricity-enhanced service had not necessarily improved business. Larger retail establishments were found to engage in more extensive electricity use – with larger refrigerators, electric cash registers, and in some cases computer equipment. Petrol stations visited had all switched to electric pumps, and at least one new station had opened. Access to electricity appeared to have been the driving force for the establishment of only a few income-generating productive enterprises though: a tailoring business in Oshikuku, a bakery in Onayena, and a workshop in Outapi. An existing brick making business benefited directly from access to electricity by converting to electric mixers and equipment and thus being able to increase production and create more employment opportunities.

The 1999 REIA study (James et al) examined the relationship between electrification and small business development, focusing on 'survivalist' small businesses, and

[17] Cuca Shops are small informal retail businesses, mostly found in Central-North. These establishments play an important role in rural areas as they are often the only retail outlets in a locality, offering basic groceries (like canned food, cool drinks, sugar, coffee, maize meal, sweets/candy, etc) and essential household goods (like candles, matches, batteries, toilet paper, washing powder, body lotion, etc). They also double as entertainment center/bar at night, offering music and beer. Many cuca shops incorporate a backroom where a person or family (either the owner or an employee) lives.

among these largely small retail businesses (cuca shops).[18] The impact assessment was based on information obtained from 14 were grid-electrified, 13 unelectrified, and one solar electrified business. Electrified cuca shops tended to have more appliances than unelectrified ones.[19] Access to electricity was found to lead to reductions in energy expenditure in cuca shops that had switched to electricity for their principal energy requirements – refrigeration, lighting, and entertainment (for powering hi-fis and radios).[20] Furthermore, where small businesses had shifted to electricity for a number of non-thermal energy services, greater reductions in energy expenditure had resulted than for small businesses with fewer energy requirements. It was also apparent that unelectrified cuca shops paid a lot more for the same energy services than electrified ones (N$104 - N$158 versus no more than N$50 per month, for lighting, one fridge, and powering a radio or hi-fi set).

The impact of electrification on productivity and income was assessed in terms of the role electricity played in attracting customers, extending working hours, and diversifying goods and services, and the impact of these benefits on income generated and profit earned. Electricity was found to be a possible contributor to the quality of services offered by small businesses and to play a role in attracting and keeping a client base. But the ability to attract customers also depended on other factors, including location, range of goods and services, condition of the building, and quality of the service. Electrified cuca shops tended to stay open longer than unelectrified ones, but this was due to a range of factors (not only electricity), in particular whether a shop had customers. As well, some women owners were not in a position to keep shops open late, because of household responsibilities. Generally very little diversification of goods and services was observed. The impact of any productivity-related benefits on income and profits was found to be minimal. While electrified small businesses tended to have higher earnings, on average, than unelectrified ones, this could not be attributed to access to electricity. None of previously unelectrified businesses reported an increase in daily income after electrification. Even where some shops had managed to diversify their services, this was not necessarily reflected in higher incomes. It was clear that other factors, such as access to finance and business location, were important determinants of the income earned.

Overall, the 1999 study concluded that electrification is a marginal issue in small business development, given the innumerable constraints confronting rural small businesses, in particular their limited access to markets, finance and/or information. In the absence of other complementary inputs that are necessary for small business development – access to finance and credit, markets, training and information – access to electricity by itself is unlikely to contribute significantly to poverty alleviation and economic growth. On the basis of these conclusions, the study recommends that i) electrification should be integrated with general strategies and plans for small business development, and ii) those geographic areas should be

[18] Thereby excluding community income-generating projects (such as brick making or sewing projects) as well as more diversified businesses with greater access to capital and markets. Very few non-retail 'survivalist' businesses were encountered and interviewing them proved to be difficult, such that only three small businesses – offering phone & fax, photocopying, and welding services, respectively – were included in the sample of small businesses.

[19] Some businesses had electric stoves and micro-wave ovens, but generally for personal use only, not to prepare food which was sold. In larger businesses electric cash registers were encountered.

[20] Unelectrified cuca shops were found to use candles and paraffin to provide lighting, gas to power fridges, dry cell batteries to run radios, and car batteries to operate hi-fis.

prioritised where there are ongoing initiatives to improve small business access to complimentary inputs (finance, markets, information and training), and/or which are characterised by an already dynamic and growing local economy.

A more recent study (EMCON, 2003) had found that a number of grid-electrified and solar home system households had started a business after electrification. It must be emphasized though that such developments often do not happen as a direct result of access to electricity alone, but that other factors like access to markets, finance and information are important preconditions that need to be satisfied for small businesses to emerge.

There is also some evidence that utility outsourcing has resulted in some business development. Notably, the introduction of prepayment metering as an integral part of the national rural electrification programme has created business opportunities at the local level. In the early days, pre-paid electricity sales were made by means of shoe-box vending (meaning that a local vendor kept stock of magnetic tokens for different denominations) which required the appointment of local vendors. With the later introduction of key-pad type prepayment systems, some local vendors were issued mobile vending machines. While the sale of pre-paid electricity earns the vendors a commission, those that are shop owners have the added advantage that electricity customers are likely to also purchase other goods on offer in the shop.

All 2007 REIA survey respondents said that electrification has created employment opportunities, and that more people have work, either as employees or through different types of self-employment. However, no concrete examples of employment that has been generated as a direct result of electrification were provided. The majority of business owners felt that electricity was an important precondition for a successful business, and that it creates the potential to increase profitability as long as the business meets customers' demands and needs. Before electrification, businesses often relied on diesel-generated electricity, gas, paraffin, candles and/or batteries, which survey respondents generally perceived to be expensive energy sources compared to grid electricity.

E.5 INSTITUTIONAL DEVELOPMENT

Electricity is considered to be crucial for institutions to develop and function properly and has had an overall positive impact on service delivery. Where institutions have established offices or outlets in electrified localities, the local community's access to services has improved, which is a significant development factor as it is not necessary any longer for that community to travel to other centers for those services. Most likely, such offices or outlets have not been established as a direct result of electrification alone, but because of a combination of market considerations and development policy initiatives. Interestingly, respondents in the 2007 survey believe that the extension of Outapi Hospital is directly attributable to electrification.

Electrification has had a positive impact on the energy consumption of institutions in general, and most institutions have switched from other energy sources to grid-electricity shortly after being connected. Initially there was a delay in switching to electricity as institutions had no budget allocations for the acquisition of electric appliances, but this was soon addressed and continues to be a budget item with the major institutional service providers (like the Ministry of Education and the Ministry

of Health & Social Services) who gradually acquire and use more electric appliances that contribute to better and more reliable service provision. However, institutions in rural areas are often satellites and have little or no control over budget allocations of central umbrella institutional bodies that have to cater for the needs of many competing institutions, with the consequence that appliance acquisition can be a lengthy process.

In addition to the direct impacts of electrification, access to electricity also plays an important role in attracting qualified staff to rural areas.

E.5.1 Institutional energy use

Institutions' energy needs vary considerably according to their activities and their dependency on electric appliances. All hospitals and secondary schools with hostels had diesel generators before grid electrification, some of which have been retained to serve as back-up systems during power outages.

Secondary schools have benefited greatly from grid-electrification, which has enabled these institutions to offer evening classes and an overall better learning environment. Computers with internet access and science laboratories provide the learners with access to modern technology and prepare them better for further studies and employment. The 2007 REIA survey respondents believe that learners without access to electric appliances like computers lose out in comparison to learners that enroll in schools with modern technology. In Ompundja, for instance, some students are said to have left the locality to study in better equipped schools elsewhere. Typical electric appliances in secondary schools include copiers, fax machines, computers, printers, telecommunication and intercom systems, and air conditioning. Since 1999 computers have been introduced in most secondary schools in Central-North, with access to the internet positively impacting on students' access to information.

In the school hostels electricity is mainly used for lighting, as well as for some electric kitchen appliances. Most hostel kitchens have cold rooms, fridges and extractor fans that run on electricity. The 1995 REIA study found that cooking in hostel kitchens is still widely done with gas, and this was confirmed by the 2007 survey findings.

Hospitals make extensive use of electric appliances and equipment, and it is today inconceivable for a hospital to function without electricity. The switch from diesel generators to grid electricity has improved the energy supply reliability and cost-effectiveness.

Rural health centers and clinics use electricity mainly for lighting and running fridges for appropriate storage of medicines. Electric lighting has had an enormous positive impact on the ability of attending to emergencies. Previously most clinics relied on light from torches, candles and paraffin lamps for emergency consultations outside normal opening hours. Improved telecommunication has also made it easier to call for ambulance in emergencies.

Police stations use electricity mainly for lighting and telecommunication, which has positively impacted on service delivery and operational effectiveness. Street and area lights in larger centers have contributed to reduction in crime rates.

The Directorate of Water Affairs' switch from diesel pumps to electric pumps has had a positive impact on water supply in rural areas and has benefited a large number of people, providing them with safe, potable water. Electric pumps are considered to be more cost effective and reliable than diesel pumps.

E.6 COMMUNITY BENEFITS OF ELECTRIFICATION

The community living in an electrified locality benefits in various ways from access to electricity. The most direct benefit comes from being users of electricity in their homes and workplaces. Some people have benefited by acquiring employment directly related to electrification, like a second shift in a cuca shop (because the shop can stay open longer) or as hammer mill operator milling people's crops. As customers of businesses and institutions, community members are the receivers of improved service delivery due to electrification, benefiting from previously unavailable services (eg electronic banking, evening classes), as well as from expanding shops and businesses that offer a wider range of services (eg better entertainment, electronic processes) and goods (eg perishable groceries and cold drinks) than previously.

Night-time activity has increased considerably in electrified localities, with cuca shops entertaining customers until late, churches offering evening services, and community groups holding evening meetings. Street- and area lighting has improved security, allowing people to move about more freely and without concern for their safety.

Many survey respondents believed that electrification increases productivity, but there are limited signs that this is the case. Electrification has freed up time for many beneficiaries who previously spent hours for certain household tasks and chores (eg firewood collection and traditional flour production). The present tendency is for the acquired free time to be spent watching TV and socializing.

There is a firm belief among survey respondents that lack of access to electricity stagnates development. In unelectrified Omakange, for example, various investment projects (among them a lodge and a service station) are waiting for electrification, keeping development on hold. In Ompundja it was found that learners are leaving to go to schools in Oshakati where they have access to computers and modern technology. In Tsumkwe, the electricity provided by the diesel generator is used mainly by businesses, schools and government offices. Only a few households benefit from it and it is only available certain times of the day. Not having access to grid electricity is hampering development.

Onayena and Ontananga are electrified localities where the expansion in service delivery has been slow and few other development initiatives have been implemented. Also, the high unemployment rate in these localities remains a challenge. This is a clear indication that electrification alone is not sufficient to ensure growth and development.

Outapi and Oshikuku, on the other hand, have experienced rapid growth since being electrified. This growth, however, cannot be attributed to access to electricity alone, with other development initiatives (decentralization, better access to social services) and infrastructural improvement projects (water supply, roads, telecommunications) having been implemented concurrently.

E.7 AFFORDABILITY PERCEPTIONS, TRADITIONAL VALUES AND FUEL SWITCHING

A major constraint to making the switch to electric appliances is the high investment cost of new appliances. Many households and small businesses stated that, despite a keen interest to use electricity, they cannot afford to make the appliance investments[21], at least not immediately and without saving up over a period of time, and therefore remain with more traditional energy sources and appliances for quite a while.

Similar financial constraints exist for institutions that are usually required to include appliances in their annual budgets, a process that may sometimes take considerable time as it is coordinated at regional or even national level

Amongst small business owners there is a perception that electricity is cheap compared to other sources of energy, but no one was able to quantify this perception. Although some households felt that electricity is expensive, there is widespread willingness to pay as electricity is perceived as a superior energy source that is worth the extra costs because it is convenient, easy to use, efficient and effective, and because it eases the burden of time-consuming chores like gathering firewood.

TABLE 24: Preferred Household Fuel Choice for Cooking and Lighting

	Households' preferred choice of fuel for cooking and lighting (%)							
	Onayena	Ontananga	Outapi	Oshikuku	Engela	Oshifo	Ompu-ndja	Oma-kange
Electrified households	15	16	48	20	19	19	0	0
Fuel for cooking								
Electricity	40	6	77	60	58	63	n/a	n/a
Wood	53	81	15	15	32	37	n/a	n/a
Gas	0	6	6	20	10	0	n/a	n/a
Paraffin	0	0	2	5	0	0	n/a	n/a
Dung	0	6	0	0	0	0	n/a	n/a
Fuel for lighting							n/a	n/a
Electricity	100	94	100	100	100	100	n/a	n/a
Gas	0	6	0	0	0	0	n/a	n/a
Unelectrified households	3	4	8	4	4	4	22	24
Fuel for cooking								
Wood	100	100	75	75	75	100	73	63
Gas				25	0	0	4	37
Paraffin	0	0	25	0	25	0	0	0
Dung	0	0	0	0	0	0	23	0
Fuel for lighting								
Candles	67	50	50	75	75	25	42	21
Gas	0	0	0	0	0	0	4	0
Paraffin	33	50	50	25	0	75	50	67
Dung	0	0	0	0	25	0	4	0
Wood	0	0	0	0	0	0	0	12

[21] Interestingly, most households prefer to purchase new instead of second-hand appliances.

Many households use a combination of energy sources for different purposes to save on the electricity costs. Firewood is still widely used for cooking, which is partly attributable to traditional practices, and partly to the availability of free firewood, which saves the household money. The perception among the majority of households that still use firewood for cooking is that firewood is a cheaper source of energy than electricity. However, firewood is getting scarce in many areas of Central-North, and the cost of buying firewood is becoming comparable with the cost of using electricity. All electrified households use electric lighting, with the switch from candles and paraffin lamps to electric lamps having been quick and easy because of its low impact on household expenses. The shift from cooking over an open fire to electric stoves, however, is a much longer process, for both affordability and cultural reasons. Survey respondents clearly stated that it is not the cost of the electricity consumption that limits people's use of this energy source, but the high prices of appliances.

Firewood remains the most important fuel in Central-North, and the majority of the households in the region rely on firewood for cooking. In the surveyed localities, however, electricity has gradually taken over as the most important source of energy for cooking. In 1999 only 10% of the grid-electrified households used electricity as their main source of energy for cooking, while in 2007 the majority of the electrified households used electricity for cooking, indicating that although the shift from firewood to electricity has been relatively slow, there is a clear tendency that people use electricity for more domestic purposes. People are generally not able to quantify how much money the household could save by shifting to electric appliances.

The availability of firewood varied considerably throughout Central-North. In 1999 they survey team found that firewood was readily available in the western part of the survey area, and more scarce in the east (Wamukonya et al 1999). Almost all the households in Omakange, Ompundja, Ontananga and Onayena gather firewood, while the majority of the households in Outapi, Engela and Oshikuku are buying firewood, both for affordability and availability reasons.

Roughly half of the electrified households still rely on firewood as a source of energy. Gathering firewood is far more common among unelectrified households, with almost all unelectrified households collecting firewood, while only 45% of the electrified households collect firewood on a regular basis. The same number of electrified households buys firewood. Only 40% of the unelectrified households buy wood.

There are considerable variations in household electricity expenditure. Households in Outapi, Oshikuku and Engela pay more for electricity than households in Oshifo, Onayena and Ontananga. Electricity expenditures are lowest in Oshifo. Not only are there considerable variations between localities, but there are monthly variations as well. The respondents agree that electricity has made life easier, but when it comes to determining whether grid electrification is saving the household money, the respondents' answers vary. Rough calculations of household energy expenditure in the target localities show that there are great variations between localities, as well as within each locality. Electrification has reduced household energy expenditure in some areas, but increased it in others. The majority of the households in Onayena and Ontananga say electrification is saving money compared to other energy sources, while households in the other four localities claim electricity is more expensive than other energy sources. It is important to note that although people

think electricity is more expensive, they feel it is worth the extra cost because of all the benefits.

When asked about the most important benefits and disadvantages with electricity, the 2007 REIA respondents mentioned that electricity is versatile or flexible, time saving and easy to use. The main disadvantages with electricity are related to affordability. The electric appliances are expensive and so are the prepaid cards. The respondents also say electricity can be unreliable, especially during the rainy season.

E.8 ELECTRICITY SERVICE DELIVERY PERCEPTIONS

The responsible electricity supply authority in Central-North is NORED Electricity. The company has its head office in Ongwediva and operates four regional service centers across Central-North (in Ondangwa, Outapi, Ohangwena and Okongo). The service centers are staffed by technical and commercial personnel who attend to all electricity supply needs in their service areas. Vending of pre-paid electricity is outsourced to local vendors in selected electrified localities, such that customers do not have to travel more than 30km to a vendor.

E.8.1 Availability of Prepaid Electricity

The general perception among 2007 REIA survey respondents was that prepaid electricity is readily available. Onayena, however, does not have a local vendor and respondents felt that this is a burden as it adds transport and time costs to the cost of electricity. Customers in all electrified localities without a local vendor are in a similar position and may not always have an immediate opportunity to travel to the nearest vendor when their credit runs out. Until such an opportunity arises these customers are forced to rely on other more easily accessible fuels.

E.8.2 Cost of Connections

The rural electrification programme provided free connection of all institutions, businesses and households that were within specified distances of distribution transformers and reticulation networks in the newly electrified localities. All subsequent connections have to be paid for, although in Central-North NORED Electricity subsidises about 50% of that cost.

The general impression is that private households and businesses normally can afford to pay for prepaid electricity, but not many can afford to pay for the initial connection. In all study areas, perhaps except Oshifo, there are households that cannot afford to pay for having electricity installed, although they would be able to pay for prepaid cards if installation was provided for free. To apply for grid connection and be connected is quick and easy if you are able to pay for it, participants in Oshikuku said. To live in an electrified area, but not have electricity was by many respondents seen as a form of discrimination or marginalization. People living without electricity were considered to be deprived of opportunities to make a better living. That there are areas that are unelectrified was seen as a constraint and a problem, and the respondents gave a clear indication that they believe all are entitled to electricity and that NORED Electricity should review their

policies and tariffs to make grid electricity available for all. In Outapi some of the respondents said community members feel that electricity is a basic necessity that should be provided for free. Generally, there is an expressed willingness to pay for electricity in all sample areas, and people are even willing to pay a bit more to have electricity instead of other sources of energy. The introduction of prepaid electricity has clearly been a success in the rural electrification programme, in that it gives customers control over their consumption. That electricity was never offered as a free service has also ensured that people remain willing to pay, but people fail to see how one household qualifies for free grid connection, while the neighbor is forced to pay. The problem could be a combination of lack of information sharing and awareness regarding the electrification programme, but it might also be a form of 'collective amnesia' within the community. Communities tend to cry out if a few selected households are given benefits and unequal treatment is strongly reacted upon, even though the criteria for free grid connection have been clearly explained to them.

E.8.3 Power Outages

All NORED Electricity customers experience power outages now and then, and they tend to be a more common during the rainy season. The perception is that outages are caused by supply system collapse due to high demand, and that the system is not capable of supplying everybody. In Outapi, respondents said outages are often caused by a tree that is standing too close to the power line. The impact of outages varies. Hospitals and institutions that are completely dependent on electricity often have a back-up system in place. Smaller businesses on the other hand, do not and a longer outage can damage fresh produce and have serious negative consequences for the business. Private households are of course affected by outages, but they normally do not cause expensive damage in the household. Some respondents mentioned that outages tend to increase crime, and that thieves appear to become active if there is no electricity. Overall, the issue of power outages does not seem to be a very serious problem, although many respondents mention them as one of the dislikes of electricity.

E.8.4 Quality of Service

People are generally satisfied with NORED Electricity's service provision, and although issues and complaints are mentioned, they should be seen as suggestions to improvements rather than harsh criticisms of the rural electrification programme. Almost all respondents said electrification has had a positive impact on their lives and contributed to improved living standards.

A general observation is that community members are unsure of who to contact regarding electricity supply problems and enquiries. People in several target localities indicated they did not know whether to contact the local authorities or NORED Electricity when they have questions regarding electricity. Also, many respondents pointed out that the time from when a problem is reported until it is solved is too long. The town council in Outapi said it does not have a close cooperation with NORED Electricity, and a more coordinated effort and clearly defined areas of responsibilities could improve the overall service provision.

There is need for more transparency in NORED Electricity's pricing policy. In Outapi people claimed NORED Electricity was corrupt and taking advantage of people because they lack information.

In Onayena the community is requesting a local NORED Electricity office that can attend to the local community's needs.

APPENDIX F: COST-BENEFIT ANALYSIS

The economic cost-benefit analysis (CBA) of the rural electrification programme outlined in this section is a partial analysis and applies to the former Owamboland only; it is not an analysis of the effects of the RE programme on the national economy of Namibia. In accordance with the ToR, the CBA is an overall analysis including private customers, public institutions and small and large enterprises.

F.1 METHODOLOGY

The methodology for the CBA follows Davis and Horvei (1995) to be consistent with the previously performed economic analysis in Davis and Nghikembua (1995).

The analysis uses data compiled during the 2007 REIA survey, as well as complimentary secondary data, to estimate benefits for typical households, small businesses, health care facilities (clinics, health centres, hospitals), and primary and secondary schools.

In order to estimate the benefits of electrification for households and small businesses, data on the following was collected to derive a demand curve for energy (kWh) that would be displaced by electricity:

- Monthly energy expenditures per energy source and quantity of un-electrified households;
- Monthly electricity expenditure[22] and consumption of electricity consuming households;
- Monthly incomes;
- Unit prices of paraffin, candles, diesel (VAT exclusive), and electricity tariffs.

Regarding the benefits for institutions and large businesses, the following information was used to estimate the avoided costs associated with diesel generation:

- Number and types of public facilities;
- Diesel genset capacity (kW), fuel consumption, O&M costs and hours of operation per day;
- Average demand per public facility (kWh/day).

F.1.1 General Assumptions

The following assumptions have been made in the cost-benefit analysis:

- ✓ The base year is 2007, and all costs and benefits have been adjusted to reflect 2007 N$ prices[23].
- ✓ A discount rate of 8 percent has been applied.[24] However, the sensitivity of the analysis to this assumption is tested.

[22] Electricity tariff (N$/kWh, including VAT)

[23] Inflation data from International Monetary Fund, World Economic Outlook, April 2007.

[24] Refer to Davis and Horvei (1995).

- ✓ The project lifetime is 25 years.
- ✓ The cost of the RE programme in Central-North includes all capital expenditures on rural electrification for the period 1991/92 until 2005/06[25]. This includes all donor grants as well as government investments[26]. The capital costs have been adjusted by a factor of 0.95 to cater for taxes and import subsidies.[27]

TABLE 25: Total RE-related Expenditures in Central-North

YEAR	Nominal N$	Constant N$ (2007)
1991/92	15,645,624	64,433,992
1992/93	6,770,741	24,565,990
1993/94	2,580,282	7,704,866
1994/95	487,474	1,331,895
1995/96	1,203,255	2,932,524
1996/97	2,126,010	4,663,282
1997/98	38,301,823	77,291,835
1998/99	10,606,100	19,519,323
1999/00	19,929,928	34,404,685
2000/01	10,330,711	16,300,025
2001/02	11,728,361	16,784,278
2002/03	16,517,327	21,439,388
2003/04	4,586,022	5,279,981
2004/05	11,622,585	12,417,866
2005/06	4,646,638	4,761,038
TOTAL	**157,082,881**	**313,830,968**

Table compiled by EMCON Consulting Group

- ✓ Operating costs include costs of sales, operation and maintenance costs and cost of customer service. NORED Electricity's operating expenses for the years 2003/04 to 2006/07 have been available for the analysis, and these have been adjusted down to 67%, which is the estimated portion applicable to Central-North[28]. These operating expenses have also been adjusted by a factor of 0.95 to cater for taxes and import duties. The real operating expenses, as a percentage of accumulated capital expenditures, have been calculated for these years, yielding a result of 50 percent, adjusted for inflation. The analysis has assumed that this ratio remains constant, such that previous and future years' operating expenses could be determined by linear extrapolation.[29] Operating costs are assumed to continue through the lifetime of the infrastructure investment.

25 No investments after 2006/2007 were included in accordance with the TOR, which stipulated that the analysis should cover the years 1991/1992 to 2006/2007.

26 Sources of investments include NORAD, Department of Works, MRLGH, MME, Northern Electricity, RCC, NamPower, NamWater and Outapi Town Council.

27 For a discussion on methodology, refer to Davis and Nghikembua (1995).

28 Estimation made in consultation with NORED Electricity.

29 This methodology was considered to be the best methodology for an estimation of the O&M costs given the limited data availability.

- ✓ Due to data constraints, it is assumed that no households, institutions and businesses were connected before the start of the project[30]. It is further assumed that the connections increased linearly with investments until 2005/06.

F.1.2 Estimation of RE Benefits for Households

Once installed, electricity provides benefits to the household in the form of reduced expenditures on alternative energy sources and improved quality of service. While it is relatively straightforward to estimate the magnitude of the benefits of displaced expenditure, quantifying all of the benefits associated with quality-of-service improvements (e.g. reliability of service) and including them in a proxy for willingness to pay is a difficult exercise. Nonetheless, accounting for the displaced expenditures and estimating the consumer surplus gains from introducing electricity service provides a conservative estimate of the benefits that are expected to accrue to individual households, and thus also a conservative willingness to pay estimate. This section summarizes the methodology employed in estimating these benefits.

Regarding expenditures, it has been assumed that electricity has replaced households' expenditures on paraffin, candles, batteries and LPG.[31] Such data has been collected for the three unelectrified comparative localities, covering 43 unelectrified households, to serve for the comparative analysis and was used to estimate the avoided costs on alternative energy sources once a household switches to grid electricity.

Text Box 2 provides a description of the demand estimation technique applied. A constant elasticity demand curve was determined using consumption and cost data for the various energy sources that are utilised by households. All energy consumption data was converted into kWh to allow for comparison of the previously used energy sources with the new improved electricity service.

The demand curve is applied to estimate the increase in consumer surplus resulting from the substantial increase in the number of kWh at a lower price per kWh. In FIGURE 10, this involves a shift from α to β. The gross benefit of replaced costs is represented by area B+D. The gross benefit due to improved quality and increased time use of service, which results from a lower price per kWh, is represented by area C+E, while area D+E represents the cost of service to the household (i.e. the monthly bill). Hence the *net* consumer surplus is represented by area B+C. The entire gross benefits experienced by a typical household have been estimated on a monthly basis and then translated into yearly benefits and aggregated over the total number of households connected. It was assumed that household connections began in year two of the NREP and progressed at the same rate as capital investments.

In the CBA, the gross benefit to a typical household (B+C+D+E) is estimated and the economic costs of the program (D+E) are then subtracted, to arrive at net benefits (B+C).

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30 Refer to NVE et al (1991), and Davis and Nghikembua (1995).

31 Although the 2007 REIA survey included data on wood, it was decided to exclude this energy source from the analysis since wood is still widely used for cooking, even by electrified households. Also, most households still collect wood instead of purchasing it, thus having little influence on household expenditure.

TEXT BOX 2: Estimation of consumer surplus gains for households

The methodology to estimate demand and consumer surplus uses the 2007 REIA survey dataset that includes monthly expenditures on and purchased quantities of paraffin, candles, batteries and electricity of households in Central-North. The dataset also includes other household information, such as number of rooms in the house, the number of people in the household, the number of income earners, and the housing types. Household income was used as a control variable in the analysis.

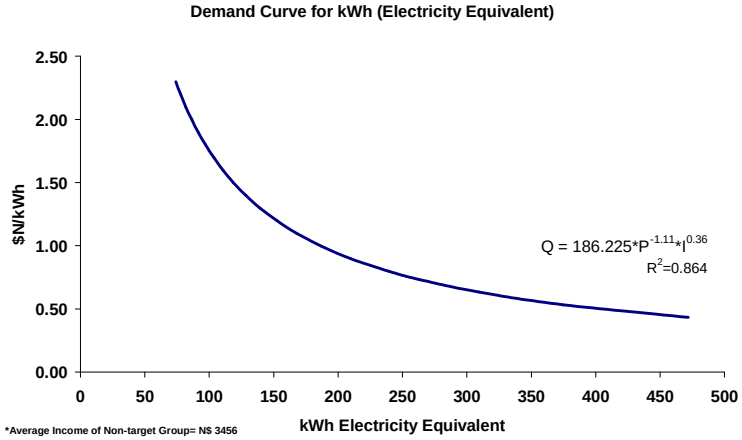
For each household, the monthly total expenditure on energy sources was calculated. The purchased quantities of each source were transformed into kWh equivalents (data used to convert into kWh is based on Davis and Horvei, 1995, Handbook for Economic Analysis of Energy Projects). This allows us to derive a unit cost per kWh and the quantities of kWh purchased. The relationship between these two variables made up the basis for the demand estimation. The specific functional form for the demand curve is as follows: demand for kWh Q_{kWh} is a function of the price per kWh based on the following relationship: $Q_{kWh} = \theta_i p^{\mu i} I^{\alpha i}$ where p is the price per kWh, μ_i and αi are the (negative) price elasticity and income elasticity of demand, respectively, and θ_i is a constant. By taking the logarithm of both sides, we obtain log (Q_{kWh}) = log (θ_i) + μ_i log (p) + α log (I), an equation that was estimated with a linear regression.

After estimating μ_i, α_i and θ_i, we insert the values into the relationship between price and quantity demanded in order to derive the exact demand curve. Average income among non-electrified households was estimated, and the constant was adjusted accordingly. Consumer surplus was then calculated as the area below the demand curve, which is obtained by taking the integral of the inverse demand function (solved for p) over Q. The limits of integration are determined by Q(un-electrified) and Q(electrified). The table below provides an outline of the results from estimation of the demand equation. We will also discuss the robustness of the results.

Estimation of Parameters of Demand Equation, by Household Income Group

Variable	Coefficient	Standard-error*	t-stat		
Price Elasticity	-1.109	0.035	0.000	R-square	0.864
Income Elasticity	0.357	0.065	0.000		
Constant	2.41			Obs.	197

* Heteroscedasticity Robust Standard Errors



Estimated Demand Curve for kWh, Households

Davis (1994) recommends simplifying the assessment by using a linear shape since the consumer surplus is not very sensitive to the exact shape of the demand curve as such. In the Davis and Nghikembua (1995) analysis, the shape of the demand curve was assumed to be linear in order to estimate the consumer surplus. In this current analysis, we assume a log-linear function and hence take a conservative approach to the estimation of consumer surplus since the demand function takes a concave shape by using a log-form rather than a linear form.

In terms of the values of the estimated price elasticity of 1.109 implies an elastic demand that is sensitive to price changes. This is a valid result since electricity is assumed to be perceived as a luxury good in rural areas where households are not yet fully electrified and are on tighter budget constraints. A study made in Pakistan gave a price elasticity of 1.64, which the author explained by the fact that 70% of the Pakistani population lives in rural areas, not yet electrified.[1] A study on the demand for electricity in urban India resulted in price elasticity of 0.16 to 0.39 depending on season, pointing to the fact that electricity is more of a necessity in urban areas than in rural areas.[2]

1) Dr Abdul Qayyum and Muhammad Arshad Khan, 'The Demand for Energy in Pakistan', Pakistan Institute of Development Economics (PIDE)

2) Massimo Filippini and Shonali Pachauri, 'Elasticities of electricity demand in urban Indian households', Centre for Energy Policy and Economics, Swiss Federal Institute of Technology, 2002

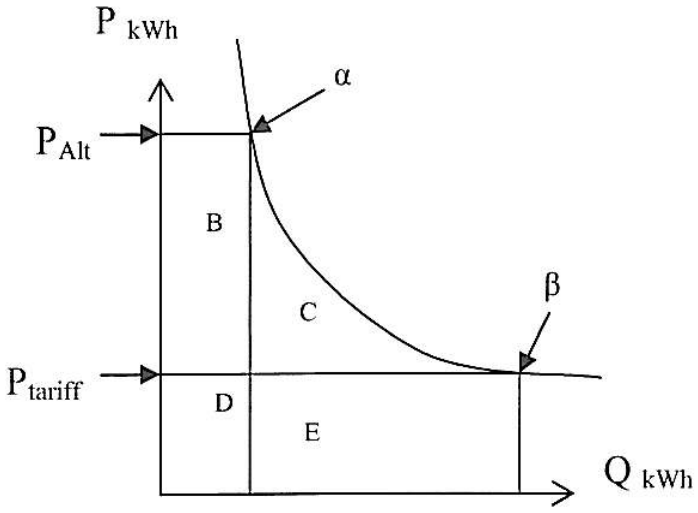


FIGURE 10: Contributions to Total Benefits

F.1.3 Estimation of RE Benefits for Small Businesses

Due to limited data, it was not possible to determine a specific demand curve for small businesses. It was thus (conservatively) assumed that the demand curve for small businesses has the same price elasticity as that for households. However, the demand curve for businesses was shifted horizontally to reflect the observation that small businesses demand more kWh at any given price[32]. Hence, the same approach was used to derive the benefits for a typical small business as for a typical household, with the benefits being a combination of the avoided cost and the net gain in consumer surplus. As small businesses are on two different tariffs[33], the consumer surplus was estimated for two categories. In estimating the number of connections per year, the same approach as was used for households was applied for small businesses.

F.1.4 Estimation of RE Benefits for Institutions

The benefits to society of electricity services provided to public institutions are generally significant. These benefits can include an element of energy expenditure displacement and, in many cases, improved quality of electricity service, such as improved lighting, allowing for studying and health services at night. However, these benefits are very difficult to quantify. This section describes the methodology applied in this study.

For the cost-benefit analysis, the institutions have been divided into two groups, namely 1) clinics, health centres and primary schools, and 2) secondary schools and hospitals.

For **clinics, health centres and primary schools**, it is observed that a) these institutions generally rely on energy sources other than diesel generation, and b) electricity consumption of these institutions, once electrified, is similar to that

[32] An average small business from the sample consumes 1,000kWh/month.

[33] Based on secondary information from NORED Electricity, NENA Database, and Oshakati Premier Electric.

observed for small businesses[34]. These observations lead to an estimated benefit that is somewhat conservative if some institutions in fact utilize a diesel generator, and the sensitivity of the economic analysis is also tested against this possibility. The methodology used for determining the benefits of electrification for these institutions follows the same approach as that used for small businesses, ie estimating the avoided costs and the net gain in consumer surplus. All health centres are assumed to have been connected to the grid within the first five years of the NREP. For clinics and primary schools, it is assumed that only 50 percent of these are connected in Central-North as of today[35], and that these were connected in line with the rate of capital investments.

For **secondary schools and hospitals**, it is assumed that the costs associated with diesel generation are displaced. It is further assumed, taking into account the critical social services provided, that electricity consumption is perfectly price inelastic – meaning that the institutions do not increase consumption despite a reduction in the effective kWh price. Appropriate generator sets, and the associated costs, were assigned to each institution based on expert assessments as to the required capacity and the average number of days and hours/day a diesel generator would be in operation[36]. The corresponding O&M costs were also estimated.

TABLE 26: Diesel Genset Assumptions

Variable	Hospital	Secondary School
Electricity consumption (kWh/month)	40,000	5,000
Genset operation per day (hours)	20	13
Genset operation per month (hours)	600	390
Average output (kW per hour)	66.67	12.82
Maximum output (kW per hour)	100	19.23
Generator rating	150	28.85
Genset size (kW)	150	30
Diesel consumption - half load (litres per hour)	21	6
Diesel consumption - rated load (litres per hour)	41.7	9.8
Genset lifetime (years)	20	16
Diesel consumption (litres per month)	12,600	2,340
Maintenance cost (N$ per year)	**60,635**	**27,791**
Capital Cost (N$)	**242,542**	**111,165**

The connection of health centres, hospitals and secondary schools was of high priority in the NREP and it is assumed that in Central-North all such institutions have been connected to the grid during the first five years of the programme.

34 NORED Electricity estimates combined with data from the field survey, results in the following estimates on energy consumption for electrified institutions: clinics 500kWh/month, health centres 1,000kWh/month, and primary schools 600kWh/month.

35 Information obtained from NORED Electricity.

36 In terms of generator hours of operation per day for the secondary school, this assumption is based on a field report from Tsumkwe which is not grid connected but has a diesel generator that supplies power to the major institutions and a few businesses and households. The size of the generator has been assigned based on the kwh/month used by a secondary school only, and the hours of operation have been estimated based on the Tsumkwe report.

F.1.5 Estimation of RE Benefits for Large Business

The 2007 REIA surveys provided information on five electrified large businesses with an average consumption of 10,000kWh/month. It is assumed that these businesses were previously on diesel generators and keep on consuming the same amount of electrical energy. The benefits are therefore determined by the avoided cost associated with a switch to grid electricity.

The same assumption was used to estimate the number of connected large businesses per year from the start of the RE program as for small businesses and households (described above).

F.1.6 Treatment of Subsidies/Taxes

It is worth noting that the total benefits, as well as the distribution described above would also be affected by any taxes or subsidies placed on paraffin and/or electricity. Firstly, according to authorities, the price of paraffin is not regulated, and there are no levies – thus, no adjustment is needed. The price applied in the analysis for electricity, on the other hand, does include VAT. Thus, it could be postulated that 1) this has resulted in a 'deadweight loss' that should be subtracted from the total benefits of the program, and 2) some of the benefits attributed to consumers above have in fact accumulated to the state in the form of increased revenues. Both would be consequences of consumers paying more than the 'true cost' of electricity. However, the fact that the consumers in the sample were also beneficiaries of a subsidized rural electrification program means that consumers would be paying less than the true cost. Additionally, this comes at the cost of the state. These two effects are counter-veiling and the net result is uncertain. Thus, no adjustment has been made.

F.2 COST-BENEFIT ANALYSIS RESULTS

The methodologies described above have been applied to a CBA of the rural electrification program in Central-North.

F.2.1 Estimated RE Benefits per Connection, by Type

For a typical rural household, the estimated value of area B+D in Figure 10 is N$3,816 per year and area C+E is N$3,185 per year for a typical rural household. This represents a gross benefit of about N$19 (US$2.64) per day.

For the typical small business, the value of area B+D for is N$12,525 per year, while the value for area C+E is N$528 or N$1,304, depending on the tariff regime. A small business that is on a pre-paid meter and pays a tariff at N$0.73/kWh would have a gross benefit of N$36/day, while a small business on a credit meter at N$0.55/kWh has a gross benefit of N$38/day.

The benefits for clinics, health centres and primary schools include avoided costs and consumer surplus. The avoided costs are estimated at N$12,525 per year, while the gross gain in consumer surplus is estimated at N$1,304 per year. These annual benefits are conservative in comparison with the annual avoided cost from a diesel generator – including capital, fuel, maintenance and replacement costs. The cost of a diesel generator for a clinic is estimated to vary between N$20,000 and N$60,000

over the lifetime of the generator, while for a health centre and a primary school this cost is estimated to vary between N$40,000 and N$70,000.

The yearly benefits for a typical hospital and secondary school arise due to the replacement of a diesel generator by grid electricity. The cost of a diesel generator over its lifetime is estimated to vary between N$240,000 and N$1.1 million for a hospital, and between N$100,000 and N$300,000 for a secondary school.

The yearly benefits for a typical large business arise in the same line of thinking as for the hospital and secondary school. The cost of a diesel generator for a large business is estimated to vary between N$140,000 and N$320,000 over the lifetime of the generator.

F.2.2 Cost-Benefit Analysis

The CBA reveals that the rural electrification programme in Namibia has generated (and continues to generate) substantial economic returns. As illustrated in Table 28, the economic internal rate of return (EIRR) over the lifetime of the project is calculated at 33 percent. This could be compared with an upper bound EIRR of 36 percent if all institutions were assumed to be on diesel gensets before grid electrification. With an 8 percent discount rate, the benefit-cost ratio is estimated at 2.03. The high economic return of the project means that the economic viability of the investment is robust to changes in the discount rate, with a 12 percent discount rate resulting in an estimated cost-benefit ratio of 1.69. The high economic rate of return and benefit-cost ratio reflect both significant energy expenditures among non-electrified homes and a significant willingness to pay for improved electricity service. Table 27 demonstrates the distribution of the benefits across the individual user groups. The present value represents the sum of the discounted benefitsfor each user group over the 25-year period. These benefits compare with a present value of the costs equivalent to N$691 million. As indicated in the table, the largest benefits accrue to households, as well as large and small businesses.

TABLE 27: Present Value (PV) of Benefits Per Customer Group, Over Time Period 1991-2016

Customer Category	PV at 8%
Households	549,980,512
Clinics	15,303,054
Health Centres	886,620
Hospitals	56,897,918
Primary Schools	22,005,898
Secondary Schools	94,550,292
Small Businesses	228,639,021
Large Businesses	435,603,057

TABLE 28: Break-Down of the Cost-Benefit Analysis

YEAR	Costs (N$)			Partial Benefits (N$)							Total Benefits (N$)	Total Net Benefits (N$)
	Capital Cost	O&M Cost	Total Cost	Avoided Lighting Costs (Households)	Avoided Lighting Costs (Small Business)	Avoided Costs (Institutions)	Avoided Diesel Genset Costs (Large Business)	Benefit from Increased kWh Consumption (Households)	Benefit from Increased kWh Consumption (Small Business)	Benefit from Increased kWh Consumption (Institutions)		
1991/92	64,433,992	-	64,433,992	-	-	2,243,510	6,588,231	-	-	-	8,831,741	- 55,602,251
1992/93	24,565,990	27,110,779	51,676,769	5,980,300	4,343,672	5,777,332	8,784,281	4,990,393	217,087	71,852	30,164,917	- 21,511,852
1993/94	7,704,866	24,880,460	32,585,326	8,568,312	6,223,423	8,919,727	9,587,338	7,150,017	311,032	102,946	40,862,795	8,277,469
1994/95	1,331,895	23,209,586	24,541,481	9,554,585	6,939,783	11,376,179	9,183,516	7,973,034	346,834	114,796	45,488,727	20,947,246
1995/96	2,932,524	21,680,458	24,612,982	9,740,914	7,075,120	14,074,409	9,660,015	8,128,521	353,598	117,034	49,149,611	24,536,629
1996/97	4,663,282	21,066,840	25,730,122	10,200,840	7,409,178	14,560,699	10,480,762	8,512,316	370,294	122,560	51,656,649	25,926,527
1997/98	77,291,835	45,145,438	122,437,273	11,013,475	7,999,419	14,654,467	26,477,685	9,190,437	399,792	132,324	69,867,599	- 52,569,674
1998/99	19,519,323	47,679,080	67,198,403	25,653,760	18,633,099	15,786,969	27,675,549	21,407,345	931,239	308,223	110,396,184	43,197,781
1999/00	34,404,685	56,191,205	90,595,890	29,707,779	21,577,656	16,254,751	35,269,472	24,790,311	1,078,401	356,931	129,035,301	38,439,411
2000/01	16,300,025	56,792,103	73,092,128	37,325,688	27,110,773	19,360,976	43,339,211	31,147,244	1,354,934	448,458	160,087,284	86,995,156
2001/02	16,784,278	57,105,197	73,889,475	41,274,444	29,978,874	19,816,613	48,052,474	34,442,370	1,498,275	495,901	175,558,951	101,669,476
2002/03	21,439,388	58,940,876	80,380,264	45,757,430	33,235,002	20,055,491	53,951,957	38,183,297	1,661,008	549,763	193,393,948	113,013,684
2003/04	5,279,981	54,085,018	59,364,999	52,070,925	37,820,684	20,783,989	55,412,272	43,451,732	1,890,190	625,618	212,055,410	152,690,411
2004/05	12,417,866	56,554,484	68,972,350	53,823,862	39,093,894	27,111,093	80,875,010	44,914,508	1,953,822	646,679	248,418,868	179,446,518
2005/06	4,761,038	62,603,376	67,364,414	58,266,417	42,320,656	27,623,708	82,457,481	48,621,696	2,115,088	700,055	262,105,101	194,740,687
2006/07	-	67,125,330	67,125,330	58,452,746	42,455,993	31,264,429	95,798,552	48,777,183	2,121,852	702,294	279,573,049	212,447,719
2007/08	-	67,125,330	67,125,330	58,452,746	42,455,993	32,998,602	102,386,783	48,777,183	2,121,852	702,294	287,895,453	220,770,123
2008/09	-	67,125,330	67,125,330	58,452,746	42,455,993	32,998,602	98,649,650	48,777,183	2,121,852	702,294	284,158,320	217,032,990
2009/10	-	67,125,330	67,125,330	58,452,746	42,455,993	32,998,602	96,885,085	48,777,183	2,121,852	702,294	282,393,755	215,268,425
2010/11	-	67,125,330	67,125,330	58,452,746	42,455,993	32,998,602	96,003,822	48,777,183	2,121,852	702,294	281,512,492	214,387,162
2011/12	-	67,125,330	67,125,330	58,452,746	42,455,993	33,507,939	96,305,232	48,777,183	2,121,852	702,294	282,323,239	215,197,909
2012/13	-	67,125,330	67,125,330	58,452,746	42,455,993	31,773,767	96,693,795	48,777,183	2,121,852	702,294	280,977,630	213,852,300
2013/14	-	67,125,330	67,125,330	58,452,746	42,455,993	31,773,767	111,927,103	48,777,183	2,121,852	702,294	296,210,938	229,085,608
2014/15	-	67,125,330	67,125,330	58,452,746	42,455,993	31,773,767	100,264,685	48,777,183	2,121,852	702,294	284,548,520	217,423,190
2015/16	-	67,125,330	67,125,330	58,452,746	42,455,993	31,773,767	104,190,864	48,777,183	2,121,852	702,294	288,474,699	221,349,369
PV			691,099,070	323,787,410	235,176,562	186,041,727	435,603,057	270,191,543	11,753,580	3,890,217	1,403,866,370	763,959,824
Discount rate @ 8%											**EIRR**	**33%**
											B/C	**2.03**

APPENDIX G: NORTHERN ELECTRICITY – NAMIBIA'S PRIVATE ELECTRICITY DISTRIBUTOR

Northern Electricity has within the first few months of its existence put in place the systems and procedures that are essential for the sound management, operation and maintenance of an electricity supply system.

Contrary to early suggestions that commercial electricity supply is not feasible in northern Namibia, the company showed that it can indeed be a self-sustaining and successful venture that is able to support a reasonable growth if managed properly, while at the same time remaining affordable by rural customers.

The secret of the company's success was a combination of strong customer and community focus, sound management and fiscal control.

G.1 BACKGROUND

Shortly after Namibia's independence in 1990, the Government embarked on a national rural electrification programme, commencing in the most densely populated areas of central northern Namibia and moving clock-wise around the country. While the electricity supply infrastructure rapidly expanded to reach many rural settlements, the Government soon realised that the administration and management of its electricity supply function was severely impaired due to a lack of the necessary systems and resources (particularly a shortage of managerial and technical manpower). Faced with a growing debt burden as a result of this deficiency, the Government in 1994 decided to investigate the possibility of commercialising electricity supply in rural areas and a feasibility study was conducted.

Although the feasibility study indicated that the prospects for successful commercialisation were limited, the Government had the foresight to press ahead with its plan by inviting proposals from the private sector through an open bidding process. Cabinet accepted Northern Electricity's proposal as the most promising and the contract agreements were negotiated. The agreements were signed on 29 July 1996 and Northern Electricity officially took over the electricity supply responsibility from the Government on 1 December 1996.

This development lifted a huge financial burden off the shoulders of Government and ensured the success and sustainability of the national rural electrification programme.

G.2 CONTRACT AGREEMENTS

The contract between the Government and Northern Electricity comprised of three separate agreements.

G.2.1 License Agreement

The License Agreement gave Northern Electricity the right to supply electricity in its area of responsibility, on behalf of the Government. The electricity supply contracts between NamPower and the Government are not affected by any of the three agreements, since Northern Electricity acts as an agent for the Government. NamPower's electricity accounts are made out to the Government, but Northern Electricity is responsible for paying them.

G.2.2 Franchise Agreement

The Franchise Agreement prescribed Northern Electricity's electricity supply responsibilities, including a limited electrification obligation. Government provided electrification funding requirements beyond the company's obligation.

G.2.3 Lease Agreement

The Lease Agreement covered the conditions for the leasing of the electricity supply infrastructure from Government. Government remained the owner of the infrastructure, and all new infrastructure that was created by Northern Electricity automatically became the property of Government.

The Lease Agreement Government also provided for Government-funded upgrading, rehabilitation and strengthening older electricity supply infrastructure that was in a bad state of repair on 1 December 1996.

G.3 SYSTEM REHABILITATION AND STRENGTHENING

G.3.1 State of the Existing Electricity Distribution Networks

The newer networks that have been built since Namibia's independence, were generally in a good condition and had sufficient capacity for future connections. Those networks built before independence, however, had been neglected for years and were consequently in a poor condition and in urgent need for upgrading and strengthening. These were in many instances overloaded and did not have spare capacity for additional connections. The areas most affected by this were Ondangwa, Ongwediva and Rundu.

G.3.2 Network Rehabilitation and Strengthening

On 1 December 1996 Northern Electricity took over an electricity supply infrastructure that was in many instances inadequate and in need of repair. During the December 1996 to March 1997 rainy season, extensive power failures due to electrical system faults and inadequacies were experienced in the three towns.

In terms of the contract the Government was responsible for all upgrading, rehabilitation and strengthening of existing infrastructure as at 1 December 1996. Since no Government funds had been budgeted for this purpose at the time of take-over, Northern Electricity had to implement emergency measures and attend to the most pressing repair and strengthening needs with its own funds. In Ondangwa new network protection equipment was installed and emergency maintenance was

done. In Rundu the main protection equipment was re-calibrated and repaired, and additional protection equipment was installed on the overhead network.

The condition of these electricity networks was restored to a reasonable state, and further upgrading and strengthening was implemented in other areas to prevent similar problems.

G.3.3 Infrastructure Maintenance

No planned maintenance had been done on the electricity infrastructure before Northern Electricity took over the responsibility from the Government. The company immediately developed and implemented a computerized planned maintenance programme to bring the electricity networks up to an acceptable standard.

Northern Electricity furthermore offered to repair minor defects from the past at no cost to the Government.

G.3.4 Technical Planning

Older networks had deteriorated due to insufficient technical planning. No significant master planning had been done and scheduled maintenance was virtually absent. New customers were connected without consideration of system capacity.

Northern Electricity appointed a team of consulting engineers, composed of experienced individuals from Namibian consulting firms. This team was responsible for master planning, electricity network analysis and upgrading, and special technical advice.

G.4 IMPROVED CUSTOMER SERVICES

Northern Electricity's head office was located in the town of Tsumeb, which is strategically situated between the company's Ondangwa Area and Rundu Area.

G.4.1 Decentralized Service Centers and Prepaid Electricity Vendors

As provider of electricity supply services in its area of responsibility, Northern Electricity has an obligation towards its customers.

Immediately after take-over, Northern Electricity devised a customer service charter and implemented its service-oriented approach. Five regional Service Centers were established, in Rundu, Ondangwa, Ongwediva, Ohangwena and Uutapi. In more remote areas Northern Electricity appointed prepaid electricity vendors to make its services accessible to all its customers. These vendors were members of the community they serve.

G.4.2 Fault Reporting Center

In order to improve the response time to power outages, Northern Electricity established a Fault Reporting Centre, which was operational 24 hours of the day all year round. Customers could report their power distresses at any time of the day or night, free of charge, by phoning a "Toll Free" number.

For customers using cell phones, or living outside Northern Electricity's area of supply, the Fault Reporting Service has been made accessible through Northern Electricity's head office telephone number. This number may also be accessed at any time of the day or night.

The Fault Reporting Centre included a sophisticated computer system that automatically recorded and logged all telephone calls. Once a technician was instructed to attend to the outage or fault, the system at pre-determined intervals followed up progress until power had been restored. If progress was slow, the system automatically informed a higher authority of the persistent fault.

G.4.3 Radio Communication

In order to improve the response time to power outages, Northern Electricity introduced a dedicated long distance two-way radio system with which all its technicians can be reached wherever they are in the regions. Prompt reaction to outages and reported faults was thereby guaranteed, even in remote areas where there are no telephones.

G.5 ELECTRICITY METERING AND BILLING

G.5.1 Electricity Metering

Northern Electricity divided its customers into the following metering categories:

- Large power user (kVA maximum demand/kWh energy consumption metering): xx%
- Small power user, three phase (kWh energy consumption metering): yy%
- Small power user, single phase (kWh energy consumption metering): zz%
- Three phase pre-payment user: aa%
- Single phase pre-payment user: bb%

Northern Electricity found that many customers have not been metered nor billed in accordance with the applicable electricity tariff structure. The company actively assisted customers to determine their electricity needs and therefore the correct metering category.

Northern Electricity implemented an intensive meter reader training programme, as correct meter reading was essential for the company's revenue generation and image. No consumption estimates were allowed without a proper reason. With Northern Electricity's new computer system, checks were placed on the meter readers to ensure reliable information.

G.5.2 Electricity Billing

Northern Electricity inherited from Government several inadequate electricity billing and accounting systems, ranging from manual cardex data bases to an outdated customized computer package. The adoption of these systems was not a feasible option for Northern Electricity and other alternatives were investigated. Market

research indicated that no appropriate billing system for the company's needs was commercially available, and Northern Electricity thus commissioned a Namibian computer firm to develop an appropriate system.

This new computer system incorporated a detailed customer database that enabled easy access to information for enquiries. Other features of the system included the generation of informative electricity accounts, as well as managerial and statistical reports. The system was successfully implemented in Northern Electricity, and was subsequently marketed among other supply authorities (e.g. small municipalities).

G.5.3 Customer Data Base

When Northern Electricity took over the electricity supply function from the Ministry of Regional and Local Government and Housing, it was found that less than half of the customers that were connected to the electricity grid were recorded on the Government's customer data base. This resulted in only a fraction of the customers receiving accounts and paying for their consumption.

Northern Electricity made a concerted effort to capture all its customers on a central database. To achieve this a detailed customer survey was conducted and customer records updated with the latest information. As a result of this survey, the number of conventionally metered customers increased by 58%!

G.5.4 Electricity Accounts

MRLGH's electricity accounts included little information and consumption was often estimated. Northern Electricity endeavoured to send out regular monthly bills, with accurate consumption figures measured over similar periods every month. The account contained sufficient information for the customer to verify the accuracy of the figures, and reached the customer well before the due payment date.

Northern Electricity designed customer friendly and informative accounts with the following detail being reflected on the account:

- Customer name and address
- Stand number
- Deposit amount paid
- Meter serial number(s)
- Meter reading dates
- Units consumed
- Average consumption for the last six months (for comparison purposes)
- Account number
- Date of the account
- Due date for payment
- Total amount due
- Special messages or notes

Accounts for Large Power Users contained additional information, e.g. current transformer ratio, meter constant, etc.

G.5.5 Payment Of Accounts

Before Northern Electricity, the electricity supply authorities in northern Namibia were neither strict nor consistent with non-payment of accounts by the due date.

Northern Electricity introduced strict control over account payments, with computerized actions regarding non-payment. Electricity accounts were being posted monthly before the 20th, and payment was due by the 7th of the next month. This normally allowed sufficient time for payment. A grace period of one week was allowed before a supply maybe cut off, but no supply was cut off without a warning.

Customers with outstanding balances on the due date received a "FINAL NOTICE". This notice reflected the amount in arrears, a final due date and a description of the intended action(s) to be implemented upon failure to comply with the conditions contained in the notice. If the customer failed to meet the conditions of the notice by the final due date, the supply was terminated. This action was logged on computer and no re-connection could occur without full settlement of the amount in arrears. The computer system continuously scanned meter readings to determine if disconnected customers had illegally re-instated their electricity supply.

G.6 ELECTRICITY TARIFFS

G.6.1 MRLGH Tariffs

Prior to Northern Electricity, the Ministry of Regional and Local Government and Housing set electricity tariffs for rural localities, with the approval from the Ministry of Finance.

Northern Electricity found that, in the past, tariffs were often not correctly applied. The two most common mistakes made by supply authorities were that customers were billed on the wrong tariff and that meter constants (multiplication factors) were applied incorrectly or not at all. The consequence of these mistakes was that such customers paid far less or more for their electricity consumption than the tariff structure prescribes, resulting in substantial losses to the Ministry of Regional and Local Government and Housing. When Northern Electricity applied the tariffs as per tariff structure, many customers that had previously been undercharged were up in arms.

Northern Electricity implemented the Government tariffs, and where it appeared that a customer was on the wrong tariff, the company brought this to the attention of the customer, assisting with the determination of the customer's requirements.

G.6.2 Revision Of Tariffs

The Ministry of Regional and Local Government and Housing usually only revised electricity tariffs when NamPower adjusted its tariff. Increases were determined by using an "across the board percentage" increase, which has resulted in medium size businesses paying an abnormally high charge for electricity, while small businesses enjoyed the benefit of domestic user tariffs.

Northern Electricity conducted a detailed tariff analysis and proposed appropriate tariff changes to the Government. Due to the generally good level of payment by

customers, as well as the additional income generated from customers not previously receiving or paying accounts, a very low overall increase was proposed.

The recommendations included:

- a tariff decrease for Large Power Users
- a moderate increase in the Small Business category
- no changes to the Domestic and Pre-Payment tariffs

G.7 ELECTRIFICATION

G.7.1 Progress with Electrification

Substantial numbers of potential customers had not been connected to the grid yet, even in areas where electricity was available. Applications for new connections were increasing by the day.

Northern Electricity was contractually bound to invest an amount of N$2.7 million in electrification over the 5 years of its term. The company exceeded this amount by N$14 million.

G.7.2 Additional Funding for Electrification

Although the Government was lacking additional funds for electrification, Northern Electricity was dedicated to carry on connecting as many customers as possible for the benefit of local communities.

The company took the initiative to investigate alternative ways of funding electrification and engaged in the following initiative:

a) With approval from the Government, development institutions such as the Development Bank of Southern Africa (DBSA) were approached for **long term funding for electrification**. The response to Northern Electricity's application was very positive, with the DBSA expressing confidence in Northern Electricity's management and technical ability. The deal was not struck, however, because Northern Electricity's term was running out and Government did not want to provide the necessary guarantees.

b) Northern Electricity proposed the implementation of an **Electrification Surcharge of 1.5c/kWh**. This was approved by the Government and resulted in substantially more funds being available for electrification, without great cost to customers.

c) The company contributed all revenue generated from street lighting and public sewerage pump stations to its Electrification Fund.

G.8 COMMUNITY DEVELOPMENT

Although the Government has in the past employed people from local communities and constructed lines in the area, no development resulted directly from the distribution of electricity.

Northern Electricity saw itself as part of the community and therefore endeavored to actively contribute to community development.

G.8.1 Employment Creation

Northern Electricity had, with the exception of a few employees, employed personnel residing in their respective areas of responsibility. A large number of jobs were thus created in local communities. Northern Electricity even went further and additionally appointed 32 vendors to sell electricity on behalf of the company, on an agency basis. This, and the frequent utilization of local people for specific tasks, created a fair amount of employment in the region.

G.8.2 Training

All of Northern Electricity's personnel underwent intensive training for their specific functions. Northern Electricity also implemented schedules for ongoing training to further enhance the company's performance. A special study scheme was been made available to all employees.

G.8.3 Community Development Fund

Municipalities usually depend heavily on revenue generated from electricity sales to supplement their budgets for other infrastructure development. In order to let the community at large benefit from Northern Electricity's electricity revenue, the company proposed the establishment of a Community Development Fund. 1.1c for every kWh sold in a local or regional authority area was contributed to this fund, and then made available to the local or regional authority for identified community development projects.

G.9 NORTHERN ELECTRICITY'S NATIONAL ROLE

Northern Electricity, as the first commercialized electricity supply authority in Namibia, played an important part in the Namibian electricity supply industry (ESI). As such, the company took an active and sometimes leading role in national ESI matters during its term.

G.9.1 Tariff Determination

The tariff proposals tabled by Northern Electricity for implementation in the supply areas of Northern Electricity were accepted by Government and have subsequently been implemented throughout Namibia in all areas of responsibility of the Ministry of Regional and Local Government and Housing.

G.9.2 Technical Assistance

Northern Electricity actively participated in Namibia's ESI, often providing technical assistance to other role players, such as:

- Staff training for the Government and Tsumeb Municipality
- Assistance to the Japanese International Cooperation Agency with the electricity master planning for Namibia
- Serving on the Ministry of Mines and Energy's Electricity Master Plan committee for the northern regions

- Participation in the establishment of an Energy Policy for Namibia
- Serving on the Task Group for the draughting of regulations under the new Electricity Act
- Co-ordination of pre-payment metering systems in the country.

APPENDIX H: HOUSEHOLD SURVEY RESULTS

NAMIBIA RURAL ELECTRIFICATION IMPACT ASSESSMENT

HOUSEHOLD SURVEY SUMMARY

	HOUSEHOLD DATA				INCOME & EXPENDITURE		ELECTRICITY					FIRE WOOD				
locality	HH sample size	# electrified	# unelectrified	avg # years electrified	avg monthly HH income [N$]	avg monthly HH expenditure [N$]	avg max electricity purchase value [N$]	avg min electricity purchase value [N$]	avg electricity purchase frequency per HH per month	avg max electricity purchase value per HH per month [N$]	avg min electricity purchase value per HH per month [N$]	# HH purchasing wood	avg cost of a bundle of wood [N$]	avg # wood bundles purchased per HH	avg wood purchase frequency per HH per month	avg wood purchase value per HH per month [N$]
Onayena	18	15	3	4.4	3,088.82	1,622.94	143.33	83.33	0.98	139.95	81.37	4	5.00	3.25	0.88	14.22
Ontananga	20	16	4	6.0	2,514.50	939.00	140.63	71.88	1.09	153.81	78.61	5	10.00	4.20	1.07	44.77
Outapi	56	48	8	6.0	4,907.29	1,923.57	181.04	82.50	1.85	334.46	152.41	28	13.36	2.43	4.46	144.82
Oshikuku	24	20	4	6.5	4,614.01	1,952.08	191.00	99.00	1.52	289.65	150.13	14	9.50	2.07	4.06	79.88
Engela	23	19	4	6.3	4,980.00	1,544.78	204.74	103.68	2.45	501.07	253.75	13	11.73	2.23	1.82	47.65
Oshifo	23	19	4	8.9	2,242.04	1,231.30	122.11	40.00	2.60	317.68	104.07	13	7.62	1.69	2.83	36.51
Ompundja	22	0	22		2,887.73	1,016.36						14	36.14	2.36	5.67	482.79
Omakange	24	0	24		4,399.67	2,049.58						2	0.00	0.00	2.00	0.00
Tsumkwe	6	1	5	10.0	1,727.60	1,210.00	200.00	100.00	1.00	200.00	100.00	0	0.00	0.00	0.00	0.00

	PARAFFIN (KEROSENE)					LP GAS					CANDLES					RADIO/TORCH BATTERIES				
locality	# HH purchasing paraffin	avg cost of a litre of paraffin [N$]	avg # litres of paraffin purchased per HH	avg paraffin purchase frequency per HH per month	avg paraffin purchase value per HH per month [N$]	# HH purchasing gas	avg cost of a 9kg bottle of gas [N$]	avg kg qty of gas purchased per HH	avg gas purchase frequency per HH per month	avg gas purchase value per HH per month [N$]	# HH purchasing candles	avg cost of a six pack of candles [N$]	avg # candles purchased per HH	avg candle purchase frequency per HH per month	avg candle purchase value per HH per month [N$]	# HH purchasing batteries	avg cost of PM9 battery [N$]	avg # batteries purchased per HH	avg battery purchase frequency per HH per month	avg battery purchase value per HH per month [N$]
Onayena	4	6.50	3.00	2.13	41.44	8	136.75	16.25	0.50	123.45	12	6.00	10.25	2.46	25.20	6	18.50	3.33	1.08	66.81
Ontananga	9	6.65	6.11	0.93	37.61	8	136.75	17.28	0.65	169.56	18	6.20	6.53	4.14	27.91	9	19.00	2.30	1.15	50.16
Outapi	9	5.95	6.67	2.00	79.33	13	141.30	12.35	0.85	164.01	41	8.50	7.63	1.61	17.40	9	21.75	2.33	1.38	70.04
Oshikuku	4	5.93	4.50	1.06	28.35	15	142.00	23.17	0.71	260.08	17	8.50	5.65	1.56	12.47	5	21.80	5.20	1.40	158.70
Engela	6	6.00	4.43	2.42	64.21	4	150.00	12.33	0.83	171.13	16	7.20	8.17	2.92	28.59	6	21.50	2.33	1.33	66.89
Oshifo	3	6.10	5.00	1.00	30.50	4	148.45	32.00	0.48	253.35	17	8.75	6.00	3.74	32.68	3	22.20	1.67	1.17	43.17
Ompundja	16	6.00	9.86	1.76	104.13	9	155.00	53.50	1.11	1,023.77	18	8.20	6.94	4.28	40.60	14	22.50	8.50	1.49	284.55
Omakange	21	6.15	22.75	3.29	459.71	13	155.00	13.47	0.97	226.04	21	8.50	9.41	5.81	77.46	20	25.00	18.40	1.85	852.91
Tsumkwe	0	5.90	0.00	0.00	0.00	5	150.00	12.50	1.07	222.08	6	6.50	3.00	11.83	38.46	3	20.75	1.33	1.00	27.67

ONAYENA Household Survey Summary

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Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE		11th RESPONSE		12th RESPONSE		13th RESPONSE	
1	Enumerator number: 1=Doufi, 2=Jeanne, 3=Julius, 4=Onesmus, 5=Hanna, 6=Leonard																										
2	Questionnaire number																										
3	Date																										
4	Respondent gender	Male	5	Female	13																						
5	Respondent age	<20	1	20 to 30	4	30 to 50	7	>50	6																		
6	Respondent education	None	0	Primary school	4	Secondary school	12	Tertiary education	2																		
7	Respondent's relation to HH head	HH head	6	Spouse of head	4	Other adult	8																				
8a	Number of ADULTS living in this HH	Average	3.3																								
8b	Number of CHILDREN living in this HH	Average	3.6																								
9	Number of structures on this erf	Average	3.0																								
10	Total number of rooms	Average	11.2																								
11	House construction material	Cement brick	17	Wooden sticks	6	Corrugated iron	4	mud/clay bricks	1	Other	0																
11e	Other construction material																										
12	Electrification status	Electrified	15	Unelectrified	3																						
13	If unelectrified, would HH prefer electricity?	Yes	3	No	0																						
14	Number of employed HH members	Average	1.7																								
15	Number of self-employed HH members	Average	0.2																								
16	Monthly HH income	Average	3,088.8																								
16	Monthly HH expenditure	Average	1,622.9																								
17	Does HH own a car?	Yes	5	No	12																						
18	Number of years HH is electrified	Average	4.4																								
19	Electricity in all structures?	Yes	9	No	6																						
20	Electricity in all rooms?	Yes	8	No	7																						
21	House wiring:	House wired	13	Readyboard	1																						
22-1	Fuel for cooking: first choice	Electricity	6	Wood	11	Gas	1	Paraffin	0	Dung	0																
22-2	Fuel for cooking: second choice	Electricity	2	Wood	4	Gas	5	Paraffin	0	Dung	3																
23-1	Fuel for water heating: first choice	Electricity	10	Wood	6	Gas	0	Paraffin	0	Dung	0																
23-2	Fuel for water heating: second choice	Electricity	1	Wood	7	Gas	4	Paraffin	0	Dung	3																
24-1	Fuel for space heating: first choice	Electricity	4	Wood	9	Gas	0	Paraffin	0	Dung	0																
24-2	Fuel for space heating: second choice	Electricity	0	Wood	1	Gas	0	Paraffin	0	Dung	2																
25-1	Fuel for refrigeration: first choice	Electricity	13	Wood	0	Gas	0	Paraffin	0	Dung	0																
25-2	Fuel for refrigeration: second choice	Electricity	0	Wood	0	Gas	2	Paraffin	0	Dung	0																
26-1	Fuel for lighting: first choice	Electricity	14	Wood	0	Gas	0	Paraffin	1	Dung	0	Candles	2														
26-2	Fuel for lighting: second choice	Electricity	0	Wood	1	Gas	0	Paraffin	1	Dung	0	Candles	12														
27	Fuel for HiFi/TV: electricity	HiFi and TV	10	HiFi only	2	TV only	3	Radio only	0																		
27	Fuel for HiFi/TV: batteries	HiFi and TV	0	HiFi only	5	TV only	0	Radio only	0																		
28a	Electrical appliance ownership: Lights	Lights	11																								
28b	Electrical appliance ownership: Electric iron	Electric iron	11																								
28c	Electrical appliance ownership: Hotplate	Hotplate	8																								
28d	Electrical appliance ownership: Stove	Stove	8																								
28e	Electrical appliance ownership: Radio/HiFi	Radio/HiFi	12																								
28f	Electrical appliance ownership: TV	TV	14																								
28g	Electrical appliance ownership: Refrigerator	Refrigerator	13																								
28h	Electrical appliance ownership: Electric fan	Electric fan	6																								
28i	Electrical appliance ownership: other	Washing machine	1	Electric kettle	1																						
29a	Other appliance ownership: paraffin refrigerator	paraffin refrigerator	0																								
29b	Other appliance ownership: gas refrigerator	gas refrigerator	0																								
29c	Other appliance ownership: wood/coal stove	wood/coal stove	0																								
29d	Other appliance ownership: paraffin stove	paraffin stove	0																								
29e	Other appliance ownership: gas stove	gas stove	9																								
29f	Other appliance ownership: solar stove	solar stove	1																								
29g	Other appliance ownership: paraffin lamp	paraffin lamp	3																								
29h	Other appliance ownership: 3-stone fireplace	3-stone fire place	8																								
29i	Other appliance ownership: non-electric iron	non-electric iron	6																								
30	Acquisition of expensive appliances	Buy second hand	1	buy cash	7	lay-bye	2	Hire purchase	7	Present	1																
31	Planned acquisition of appliances	HiFi	1	VCR	1	Electric stove	3	DVD	1	Fan	1	TV	1	Refrigerator	1	Computer	3	Washing machine	1	Electric kettle	1	Radio	1				
32	Wood collection from area	Yes	16	No	2																						
33	Frequency of wood collection: every x number of days	Average	14																								
34	Length of collection trip in hours	Average	1.0																								
35	Less wood usage with electricity?	Yes	5	No	8																						
36	Does HH buy wood?	Yes	4	No	11																						
37a	Frequency of fuel purchases: wood	monthly	2	every 2nd month	1	irregularly (when needed)	1																				
37b	Frequency of fuel purchases: electricity	twice per month	2	monthly	8	every 2nd month	2	every 3rd month	2																		
37c	Frequency of fuel purchases: paraffin	weekly	1	twice a month	2	every 2nd month	1																				
37d	Frequency of fuel purchases: gas	monthly	2	every 2nd month	2	every 3rd month	2	every 4th month	1	yearly	1																
37e	Frequency of fuel purchases: candles	3 times a week	1	weekly	2	3 times per month	1	twice per month	1	monthly	2	every 3rd month	1	yearly	2	irregular (when ne	2										
37f	Frequency of fuel purchases: batteries	every 2nd week	1	monthly	4	every 2nd month	1																				
38	Number of wood bundles purchased each time	Average	3.3																								
39	Cost of a bundle of wood	Average N$	5.0																								
40a	Max expenditure on electricity (per purchase)	Average N$	143																								
40b	Min expenditure on electricity (per purchase)	Average N$	83																								
41	Has electricity made life easier?	Yes	15	No	0																						
42	Has electricity saved HH money?	Yes	9	No	6																						
43	Estimate of savings due to electricity	Average N$/month	129																								
44a	Quantity of paraffin purchased each time	Average litres	3																								
44b	Quantity of gas purchased each time	Average kg	16																								
44c	Quantity of candles purchased each time	Average number	10																								
44d	Quantity of batteries purchased each time	Average number	3																								
45-1	First thing I like about electricity	Cheap	0	Safe	1	Clean	6	Easy to use	2	Versatile	5	Saves time	3	Streetlights	0												
45-2	Second thing I like about electricity	Cheap	0	Safe	0	Clean	1	Easy to use	9	Versatile	2	Saves time	5	Streetlights	0												

ONAYENA Household Survey Summary

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Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE		11th RESPONSE		12th RESPONSE		13th RESPONSE	
45-3	Third thing I like about electricity	Cheap	1	Safe	3	Clean	2	Easy to use	3	Versatile	3	Saves time	6	Streetlights	0												
46-1	First thing I dislike about electricity	Expensive to use	7	Dangerous	5	Expensive applianc	3	Difficult to use	0	Difficult to obtain	0	Unreliable	2														
46-2	Second thing I dislike about electricity	Expensive to use	1	Dangerous	3	Expensive applianc	6	Difficult to use	1	Difficult to obtain	5	Unreliable	1														
46-3	Third thing I dislike about electricity	Expensive to use	1	Dangerous	3	Expensive applianc	6	Difficult to use	0	Difficult to obtain	2	Unreliable	5														
47	Easy access to pre-paid electricity?	Yes	2	No	16																						
48	prefered method of pre-paid electricity vending	local agent	17																								
49	Importance of streetlights/area lights	Not important	0	Fairly important	2	Very important	16																				
50	Ever experienced a fire in house?	Yes	3	No	14																						
51	Cause of fire	cigarette	1	child playing with firewood	2																						
52	Was this before or after obtaining electricity?	before	1	after	2																						
53	Anyone been burnt by paraffin or gas?	Yes	0	No	18																						
54	Was this before or after obtaining electricity?																										
55	Children ever been poisoned by paraffin?	Yes	0	No	18																						
56	Have such hazards motivated HH to get electricity?	Yes	1	No	0																						
57	Has electricity improved safety of home and children?	Yes	13	No	2																						
58	Ever had an accident with electricity?	Yes	2	No	13																						
59	if yes, what was the cause?	overload	1																								
60a	First important thing for community																										
60b	Second important thing for community																										
60c	Third important thing for community																										

QUESTION 60 RESPONSES	1st PRIORITY	2nd PRIO	3rd PRIORITY	TOTAL
Electricity supply	2	6	2	10
Employment	11	2	1	14
Health services	1	2	4	7
Streetlights	0	0	0	0
Roads	0	0	3	3
Schools	1	2	1	4
Wood supply	0	1	1	2
Sanitation	2	0	2	4
Water supply	1	3	1	5
Public tansport	0	1	0	1
Recreational facilities	0	0	0	0
More shops	0	0	0	0
Community projects	0	0	0	0
Telephone services	0	1	2	3
Credit/loans	0	0	0	0
TOTAL	18	18	17	53

ONTANANGA Household Survey Summary

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Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE		11th RESPONSE		12th RESPONSE		13th RESPONSE	
1	Enumerator number: 1=Doufi, 2=Jeanne, 3=Julius, 4=Onesmus, 5=Hanna, 6=Leonard																										
2	Questionnaire number																										
3	Date																										
4	Respondent gender	Male	7	Female	13																						
5	Respondent age	<20	0	20 to 30	4	30 to 50	8	>50	8																		
6	Respondent education	None	0	Primary school	8	Secondary school	9	Tertiary education	3																		
7	Respondent's relation to HH head	HH head	9	Spouse of head	2	Other adult	9																				
8a	Number of ADULTS living in this HH	Average	5.2																								
8b	Number of CHILDREN living in this HH	Average	4.3																								
9	Number of structures on this erf	Average	3.0																								
10	Total number of rooms	Average	14.0																								
11	House construction material	Cement brick	20	Wooden sticks	10	Corrugated iron	7	mud/clay bricks	3	Other	0																
11e	Other construction material																										
12	Electrification status	Electrified	16	Unelectrified	4																						
13	If unelectrified, would HH prefer electricity?	Yes	4	No	0																						
14	Number of employed HH members	Average	1.4																								
15	Number of self-employed HH members	Average	0.4																								
16	Monthly HH income	Average	2,514.5																								
16	Monthly HH expenditure	Average	939.0																								
17	Does HH own a car?	Yes	6	No	14																						
18	Number of years HH is electrified	Average	6.0																								
19	Electricity in all structures?	Yes	5	No	11																						
20	Electricity in all rooms?	Yes	1	No	15																						
21	House wiring:	House wired	8	Readyboard	8																						
22-1	Fuel for cooking: first choice	Electricity	1	Wood	17	Gas	1	Paraffin	0	Dung	1																
22-2	Fuel for cooking: second choice	Electricity	0	Wood	3	Gas	5	Paraffin	0	Dung	11																
23-1	Fuel for water heating: first choice	Electricity	1	Wood	17	Gas	1	Paraffin	0	Dung	1																
23-2	Fuel for water heating: second choice	Electricity	0	Wood	3	Gas	5	Paraffin	0	Dung	11																
24-1	Fuel for space heating: first choice	Electricity	0	Wood	17	Gas	0	Paraffin	0	Dung	1																
24-2	Fuel for space heating: second choice	Electricity	0	Wood	1	Gas	0	Paraffin	0	Dung	10																
25-1	Fuel for refrigeration: first choice	Electricity	13	Wood	0	Gas	1	Paraffin	0	Dung	0																
25-2	Fuel for refrigeration: second choice	Electricity	0	Wood	0	Gas	4	Paraffin	1	Dung	0																
26-1	Fuel for lighting: first choice	Electricity	15	Wood	0	Gas	0	Paraffin	2	Dung	0	Candles	3														
26-2	Fuel for lighting: second choice	Electricity	0	Wood	3	Gas	0	Paraffin	3	Dung	1	Candles	12														
27	Fuel for HiFi/TV: electricity	HiFi and TV	4	HiFi only	3	TV only	3	Radio only	0																		
27	Fuel for HiFi/TV: batteries	HiFi and TV	0	HiFi only	8	TV only	0	Radio only	0																		
28a	Electrical appliance ownership: Lights	Lights	9																								
28b	Electrical appliance ownership: Electric iron	Electric iron	12																								
28c	Electrical appliance ownership: Hotplate	Hotplate	9																								
28d	Electrical appliance ownership: Stove	Stove	1																								
28e	Electrical appliance ownership: Radio/HiFi	Radio/HiFi	13																								
28f	Electrical appliance ownership: TV	TV	5																								
28g	Electrical appliance ownership: Refrigerator	Refrigerator	12																								
28h	Electrical appliance ownership: Electric fan	Electric fan	3																								
28i	Electrical appliance ownership: other	DVD	1																								
29a	Other appliance ownership: paraffin refrigerator	paraffin refrigerator	0																								
29b	Other appliance ownership: gas refrigerator	gas refrigerator	3																								
29c	Other appliance ownership: wood/coal stove	wood/coal stove	0																								
29d	Other appliance ownership: paraffin stove	paraffin stove	2																								
29e	Other appliance ownership: gas stove	gas stove	8																								
29f	Other appliance ownership: solar stove	solar stove	0																								
29g	Other appliance ownership: paraffin lamp	paraffin lamp	9																								
29h	Other appliance ownership: 3-stone fireplace	3-stone fire place	19																								
29i	Other appliance ownership: non-electric iron	non-electric iron	7																								
30	Acquisition of expensive appliances	Buy second hand	2	buy cash	7	lay-bye	2	Hire purchase	5	Present	3																
31	Planned acquisition of appliances	TV	9	DVD	2	Computer	3	Electric kettle	1	Refrigerator	2	Stove	3	Electric iron	1	Radio/HiFi	3										
32	Wood collection from area	Yes	19	No	1																						
33	Frequency of wood collection: every x number of days	Average	3																								
34	Length of collection trip in hours	Average	0.6																								
35	Less wood usage with electricity?	Yes	5	No	11																						
36	Does HH buy wood?	Yes	5	No	15																						
37a	Frequency of fuel purchases: wood	Twice per month	1	monthly	1	every 3rd month	1	irregular (when needed)	2																		
37b	Frequency of fuel purchases: electricity	4 times per month	1	twice per month	1	monthly	10	every 2nd month	2	every 3rd month	1	every 6 months	1														
37c	Frequency of fuel purchases: paraffin	twice per month	1	monthly	5	every 2nd month	2	every 3rd month	1																		
37d	Frequency of fuel purchases: gas	every 3rd week	1	monthly	2	every 2nd month	1	every 3rd month	4																		
37e	Frequency of fuel purchases: candles	daily	1	every 2nd day	1	weekly	4	twice per month	2	monthly	6	every 2nd month	1	irregularly (when needed)	3												
37f	Frequency of fuel purchases: batteries	twice per month	2	monthly	6	every 3rd month	1																				
38	Number of wood bundles purchased each time	Average	4																								
39	Cost of a bundle of wood	Average N$	10																								
40a	Max expenditure on electricity (per purchase)	Average N$	141																								
40b	Min expenditure on electricity (per purchase)	Average N$	72																								
41	Has electricity made life easier?	Yes	16	No	0																						
42	Has electricity saved HH money?	Yes	12	No	4																						
43	Estimate of savings due to electricity	Average N$/month	107																								
44a	Quantity of paraffin purchased each time	Average litres	6																								
44b	Quantity of gas purchased each time	Average kg	17																								
44c	Quantity of candles purchased each time	Average number	7																								
44d	Quantity of batteries purchased each time	Average number	2																								
45-1	First thing I like about electricity	Cheap	1	Safe	4	Clean	3	Easy to use	3	Versatile	7	Saves time	1	Streetlights	1												
45-2	Second thing I like about electricity	Cheap	0	Safe	1	Clean	4	Easy to use	5	Versatile	5	Saves time	5	Streetlights	0												
45-3	Third thing I like about electricity	Cheap	3	Safe	1	Clean	0	Easy to use	4	Versatile	4	Saves time	6	Streetlights	1												
46-1	First thing I dislike about electricity	Expensive to use	8	Dangerous	2	Expensive applianc	1	Difficult to use	0	Difficult to obtain	3	Unreliable	6														

ONTANANGA Household Survey Summary

20

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE		11th RESPONSE		12th RESPONSE		13th RESPONSE	
46-2	Second thing I dislike about electricity	Expensive to use	0	Dangerous	7	Expensive applianc	4	Difficult to use	1	Difficult to obtain	8	Unreliable	0												
46-3	Third thing I dislike about electricity	Expensive to use	5	Dangerous	1	Expensive applianc	9	Difficult to use	0	Difficult to obtain	4	Unreliable	1												
47	Easy access to pre-paid electricity?	Yes	0	No	20																				
48	prefered method of pre-paid electricity vending	local agent	20																						
49	Importance of streetlights/area lights	Not important	0	Fairly important	3	Very important	17																		
50	Ever experienced a fire in house?	Yes	6	No	14																				
51	Cause of fire	child playing with fire wood	3	candle burnt table cloth	1	firewood blown by wind	1	smoking out bees burnt thatch roof	1																
52	Was this before or after obtaining electricity?	before	3	after	3																				
53	Anyone been burnt by paraffin or gas?	Yes	1	No	19																				
54	Was this before or after obtaining electricity?	before	1	after	0																				
55	Children ever been poisoned by paraffin?	Yes	0	No	19																				
56	Have such hazards motivated HH to get electricity?	Yes	0	No	0																				
57	Has electricity improved safety of home and children?	Yes	16	No	0																				
58	Ever had an accident with electricity?	Yes	2	No	14																				
59	if yes, what was the cause?	microwave exploded	1	lightning	1																				
60a	First important thing for community																								
60b	Second important thing for community																								
60c	Third important thing for community																								

QUESTION 60 RESPONSES	1st PRIORITY	2nd PRIO	3rd PRIORITY	TOTAL
Electricity supply	2	5	1	8
Employment	10	4	3	17
Health services	0	0	2	2
Streetlights	0	0	0	0
Roads	3	6	2	11
Schools	3	1	4	8
Wood supply	0	0	2	2
Sanitation	1	1	1	3
Water supply	1	1	3	5
Public tansport	0	2	2	4
Recreational facilities	0	0	0	0
More shops	0	0	0	0
Community projects	0	0	0	0
Telephone services	0	0	0	0
Credit/loans	0	0	0	0
TOTAL	20	20	20	60

OUTAPI Household Survey Summary

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE		11th RESPONSE		12th RESPONSE		13th RESPONSE	
1	Enumerator number: 1=Doufi, 2=Jeanne, 3=Julius, 4=Onesmus, 5=Hanna, 6=Leonard																										
2	Questionnaire number																										
3	Date																										
4	Respondent gender	Male	24	Female	32																						
5	Respondent age	<20	2	20 to 50	16	30 to 50	31	>50	7																		
6	Respondent education	None	2	Primary school	9	Secondary school	21	Tertiary education	24																		
7	Respondent's relation to HH head	HH head	28	Spouse of head	15	Other adult	13																				
8a	Number of ADULTS living in this HH	Average	3.1																								
8b	Number of CHILDREN living in this HH	Average	2.1																								
9	Number of structures on this erf	Average	1.4																								
10	Total number of rooms	Average	7.8																								
11	House construction material	Cement brick	52	Wooden sticks	5	Corrugated iron	8	mud/clay bricks	0	Other	0																
11e	Other construction material																										
12	Electrification status	Electrified	48	Unelectrified	8																						
13	If unelectrified, would HH prefer electricity?	Yes	8	No	0																						
14	Number of employed HH members	Average	1.8																								
15	Number of self-employed HH members	Average	0.4																								
16	Monthly HH income	Average	4,907.3																								
16	Monthly HH expenditure	Average	1,923.6																								
17	Does HH own a car?	Yes	21	No	35																						
18	Number of years HH is electrified	Average	6.0																								
19	Electricity in all structures?	Yes	44	No	4																						
20	Electricity in all rooms?	Yes	42	No	6																						
21	House wiring:	House wired	38	Readyboard	10																						
22-1	Fuel for cooking: first choice	Electricity	37	Wood	13	Gas	3	Paraffin	3	Dung	0																
22-2	Fuel for cooking: second choice	Electricity	5	Wood	17	Gas	9	Paraffin	3	Dung	1																
23-1	Fuel for water heating: first choice	Electricity	41	Wood	12	Gas	1	Paraffin	2	Dung	0																
23-2	Fuel for water heating: second choice	Electricity	3	Wood	13	Gas	10	Paraffin	3	Dung	1																
24-1	Fuel for space heating: first choice	Electricity	11	Wood	9	Gas	0	Paraffin	0	Dung	0																
24-2	Fuel for space heating: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	1																
25-1	Fuel for refrigeration: first choice	Electricity	44	Wood	0	Gas	2	Paraffin	0	Dung	0																
25-2	Fuel for refrigeration: second choice	Electricity	0	Wood	0	Gas	3	Paraffin	0	Dung	0																
26-1	Fuel for lighting: first choice	Electricity	48	Wood	0	Gas	0	Paraffin	4	Dung	0	Candles	4														
26-2	Fuel for lighting: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	2	Dung	1	Candles	30														
27	Fuel for HiFi/TV: electricity	HiFi and TV	34	HiFi only	2	TV only	6	Radio only	0																		
27	Fuel for HiFi/TV: batteries	HiFi and TV	0	HiFi only	6	TV only	0	Radio only	1																		
28a	Electrical appliance ownership: Lights	Lights	48																								
28b	Electrical appliance ownership: Electric iron	Electric iron	37																								
28c	Electrical appliance ownership: Hotplate	Hotplate	21																								
28d	Electrical appliance ownership: Stove	Stove	27																								
28e	Electrical appliance ownership: Radio/HiFi	Radio/HiFi	42																								
28f	Electrical appliance ownership: TV	TV	39																								
28g	Electrical appliance ownership: Refrigerator	Refrigerator	45																								
28h	Electrical appliance ownership: Electric fan	Electric fan	27																								
28i	Electrical appliance ownership: other	Hair dryer	1	DVD	5	VCR	2	Electric kettle	12	Microwave oven	7	Washing machine	2	Computer	4	Griller	1	Oven	1	cell phone	11						
29a	Other appliance ownership: paraffin refrigerator	paraffin refrigerator	1																								
29b	Other appliance ownership: gas refrigerator	gas refrigerator	4																								
29c	Other appliance ownership: wood/coal stove	wood/coal stove	0																								
29d	Other appliance ownership: paraffin stove	paraffin stove	6																								
29e	Other appliance ownership: gas stove	gas stove	9																								
29f	Other appliance ownership: solar stove	solar stove	0																								
29g	Other appliance ownership: paraffin lamp	paraffin lamp	6																								
29h	Other appliance ownership: 3-stone fireplace	3-stone fire place	29																								
29i	Other appliance ownership: non-electric iron	non-electric iron	8																								
30	Acquisition of expensive appliances	Buy second hand	1	buy cash	34	lay-bye	1	Hire purchase	18	Present	1																
31	Planned acquisition of appliances																										
32	Wood collection from area	Yes	18	No	38																						
33	Frequency of wood collection: every x number of days	Average	31																								
34	Length of collection trip in hours	Average	1.0																								
35	Less wood usage with electricity?	Yes	31	No	8																						
36	Does HH buy wood?	Yes	28	No	28																						
37a	Frequency of fuel purchases: wood	Daily	2	3 times a week	2	every third day	1	twice a week	1	weekly	1	three times a month	1	twice a month	3	monthly	4	every 3rd month	1	3 times a year	1	twice a year	2	yearly	1	irregularly (when needed)	7
37b	Frequency of fuel purchases: electricity	6 times a month	1	5 times a month	1	weekly	4	3 times a month	3	twice a month	13	monthly	24	every 2nd month	1	every 3rd month	1										
37c	Frequency of fuel purchases: paraffin	twice a week	1	twice a month	2	monthly	6																				
37d	Frequency of fuel purchases: gas	weekly	1	monthly	5	every 2nd month	2	every 3rd month	2	twice a year	1	yearly	2														
37e	Frequency of fuel purchases: candles	3 times a week	1	weekly	3	monthly	9	every 3rd month	1	3 times a year	2	yearly	14	irregularly (when needed)	11												
37f	Frequency of fuel purchases: batteries	twice a month	4	every 3rd week	1	monthly	3	yearly	1																		
38	Number of wood bundles purchased each time	Average	2																								
39	Cost of a bundle of wood	Average N$	13																								
40a	Max expenditure on electricity (per purchase)	Average N$	181																								
40b	Min expenditure on electricity (per purchase)	Average N$	83																								
41	Has electricity made life easier?	Yes	48	No	0																						
42	Has electricity saved HH money?	Yes	22	No	26																						
43	Estimate of savings due to electricity	Average N$/month	142																								
44a	Quantity of paraffin purchased each time	Average litres	7																								

OUTAPI Household Survey Summary

56

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE	9th RESPONSE	10th RESPONSE	11th RESPONSE	12th RESPONSE	13th RESPONSE
44b	Quantity of gas purchased each time	Average kg	12																		
44c	Quantity of candles purchased each time	Average number	8																		
44d	Quantity of batteries purchased each time	Average number	2																		
45-1	First thing I like about electricity	Cheap	4	Safe	9	Clean	3	Easy to use	8	Versatile	20	Saves time	9	Streetlights	3						
45-2	Second thing I like about electricity	Cheap	1	Safe	3	Clean	6	Easy to use	9	Versatile	19	Saves time	16	Streetlights	2						
45-3	Third thing I like about electricity	Cheap	3	Safe	2	Clean	5	Easy to use	17	Versatile	6	Saves time	12	Streetlights	11						
46-1	First thing I dislike about electricity	Expensive to use	32	Dangerous	13	Expensive applianc	1	Difficult to use	0	Difficult to obtain	1	Unreliable	8								
46-2	Second thing I dislike about electricity	Expensive to use	5	Dangerous	18	Expensive applianc	21	Difficult to use	2	Difficult to obtain	0	Unreliable	9								
46-3	Third thing I dislike about electricity	Expensive to use	6	Dangerous	6	Expensive applianc	18	Difficult to use	0	Difficult to obtain	0	Unreliable	24								
47	Easy access to pre-paid electricity?	Yes	56	No	0																
48	prefered method of pre-paid electricity vending																				
49	Importance of streetlights/area lights	Not important	0	Fairly important	0	Very important	56														
50	Ever experienced a fire in house?	Yes	2	No	54																
51	Cause of fire	curtain caught fire from candle	1	children playing with matches	1																
52	Was this before or after obtaining electricity?																				
53	Anyone been burnt by paraffin or gas?	Yes	0	No	56																
54	Was this before or after obtaining electricity?																				
55	Children ever been poisoned by paraffin?	Yes	0	No	56																
56	Have such hazards motivated HH to get electricity?	Yes	0	No	2																
57	Has electricity improved safety of home and children?	Yes	46	No	2																
58	Ever had an accident with electricity?	Yes	1	No	47																
59	if yes, what was the cause?	forgot pot on stove	1																		
60a	First important thing for community																				
60b	Second important thing for community																				
60c	Third important thing for community																				

QUESTION 60 RESPONSES	1st PRIORITY	2nd PRIO	3rd PRIORITY	TOTAL
Electricity supply	12	9	3	24
Employment	20	3	7	30
Health services	4	6	7	17
Streetlights	1	1	0	2
Roads	3	7	9	19
Schools	6	8	9	23
Wood supply	1	2	1	4
Sanitation	2	3	7	12
Water supply	7	14	3	24
Public tansport	0	2	2	4
Recreational facilities	0	1	0	1
More shops	0	0	2	2
Community projects	0	0	1	1
Telephone services	0	0	4	4
Credit/loans	0	0	1	1
TOTAL	56	56	56	168

OSHIKUKU Household Survey Summary

24

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE	10th RESPONSE	11th RESPONSE	12th RESPONSE	13th RESPONSE
1	Enumerator number: 1=Doufi, 2=Jeanne, 3=Julius, 4=Onesmus, 5=Hanna, 6=Leonard																					
2	Questionnaire number																					
3	Date																					
4	Respondent gender	Male	5	Female	19																	
5	Respondent age	<20	0	20 to 30	6	30 to 50	17	>50	1													
6	Respondent education	None	0	Primary school	3	Secondary school	14	Tertiary education	7													
7	Respondent's relation to HH head	HH head	12	Spouse of head	2	Other adult	9															
8a	Number of ADULTS living in this HH	Average	2.6																			
8b	Number of CHILDREN living in this HH	Average	3.2																			
9	Number of structures on this erf	Average	1.0																			
10	Total number of rooms	Average	6.4																			
11	House construction material	Cement brick	24	Wooden sticks	1	Corrugated iron	1	mud/clay bricks	0	Other	0											
11e	Other construction material																					
12	Electrification status	Electrified	20	Unelectrified	4																	
13	If unelectrified, would HH prefer electricity?	Yes	4	No	0																	
14	Number of employed HH members	Average	1.8																			
15	Number of self-employed HH members	Average	0.1																			
16	Monthly HH income	Average	4,614.0																			
16	Monthly HH expenditure	Average	1,952.1																			
17	Does HH own a car?	Yes	14	No	10																	
18	Number of years HH is electrified	Average	6.5																			
19	Electricity in all structures?	Yes	19	No	1																	
20	Electricity in all rooms?	Yes	18	No	2																	
21	House wiring:	House wired	18	Readyboard	2																	
22-1	Fuel for cooking: first choice	Electricity	12	Wood	6	Gas	6	Paraffin	0	Dung	0											
22-2	Fuel for cooking: second choice	Electricity	2	Wood	7	Gas	5	Paraffin	3	Dung	0											
23-1	Fuel for water heating: first choice	Electricity	17	Wood	5	Gas	2	Paraffin	0	Dung	0											
23-2	Fuel for water heating: second choice	Electricity	2	Wood	5	Gas	5	Paraffin	3	Dung	0											
24-1	Fuel for space heating: first choice	Electricity	6	Wood	2	Gas	0	Paraffin	0	Dung	0											
24-2	Fuel for space heating: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	1											
25-1	Fuel for refrigeration: first choice	Electricity	19	Wood	0	Gas	0	Paraffin	0	Dung	0											
25-2	Fuel for refrigeration: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	0											
26-1	Fuel for lighting: first choice	Electricity	20	Wood	0	Gas	0	Paraffin	1	Dung	0	Candles	2									
26-2	Fuel for lighting: second choice	Electricity	0	Wood	0	Gas	1	Paraffin	0	Dung	0	Candles	15									
27	Fuel for HiFi/TV: electricity	HiFi and TV	14	HiFi only	1	TV only	4	Radio only	0													
27	Fuel for HiFi/TV: batteries	HiFi and TV	0	HiFi only	4	TV only	0	Radio only	0													
28a	Electrical appliance ownership: Lights	Lights	20																			
28b	Electrical appliance ownership: Electric iron	Electric iron	18																			
28c	Electrical appliance ownership: Hotplate	Hotplate	12																			
28d	Electrical appliance ownership: Stove	Stove	8																			
28e	Electrical appliance ownership: Radio/HiFi	Radio/HiFi	19																			
28f	Electrical appliance ownership: TV	TV	19																			
28g	Electrical appliance ownership: Refrigerator	Refrigerator	21																			
28h	Electrical appliance ownership: Electric fan	Electric fan	14																			
28i	Electrical appliance ownership: other	hair clipper	2	TV game machin	1	micro wave oven	5	DVD	2	Hair dryer	1	Kettle	7	VCR	1	Cell phone	6					
29a	Other appliance ownership: paraffin refrigerator	paraffin refrigerator	0																			
29b	Other appliance ownership: gas refrigerator	gas refrigerator	0																			
29c	Other appliance ownership: wood/coal stove	wood/coal stove	0																			
29d	Other appliance ownership: paraffin stove	paraffin stove	3																			
29e	Other appliance ownership: gas stove	gas stove	13																			
29f	Other appliance ownership: solar stove	solar stove	1																			
29g	Other appliance ownership: paraffin lamp	paraffin lamp	2																			
29h	Other appliance ownership: 3-stone fire place	3-stone fire place	13																			
29i	Other appliance ownership: non-electric iron	non-electric iron	1																			
30	Acquisition of expensive appliances	Buy second hand	0	buy cash	12	lay-bye	1	Hire purchase	11	Present	0											
31	Planned acquisition of appliances	washing machine	2	airconditioner	3	DVD	4	Refrigerator	5	TV	1	Electric stove	7	Microwave oven	3	Gas stove	1					
32	Wood collection from area	Yes	2	No	22																	
33	Frequency of wood collection: every x number of days	Average	1.5																			
34	Length of collection trip in hours	Average	0.4																			
35	Less wood usage with electricity?	Yes	16	No	4																	
36	Does HH buy wood?	Yes	14	No	10																	
37a	Frequency of fuel purchases: wood	4 times per week	1	3 times a week	2	weekly	2	twice a month	1	monthly	6	every 2nd month	1	every 3rd or 4th month	1							
37b	Frequency of fuel purchases: electricity	5 times a month	2	every 3rd week	1	twice per month	2	monthly	15													
37c	Frequency of fuel purchases: paraffin	twice per month	1	monthly	1	every 4th month	1	irregular (when needed)	1													
37d	Frequency of fuel purchases: gas	twice per month	1	monthly	7	every 2nd month	1	every 3rd month	1	every 4th month	1	twice a year	3	yearly	1							
37e	Frequency of fuel purchases: candles	3 times a week	1	weekly	1	monthly	3	every 2nd month	2	twice per year	2	yearly	2	irregularly (when needed)	6							
37f	Frequency of fuel purchases: batteries	twice a month	2	monthly	3																	
38	Number of wood bundles purchased each time	Average	2																			
39	Cost of a bundle of wood	Average N$	10																			
40a	Max expenditure on electricity (per purchase)	Average N$	191																			
40b	Min expenditure on electricity (per purchase)	Average N$	99																			
41	Has electricity made life easier?	Yes	18	No	2																	
42	Has electricity saved HH money?	Yes	8	No	12																	
43	Estimate of savings due to electricity	Average N$/month	109																			
44a	Quantity of paraffin purchased each time	Average litres	5																			
44b	Quantity of gas purchased each time	Average kg	23																			
44c	Quantity of candles purchased each time	Average number	6																			

OSHIKUKU Household Survey Summary

24

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE	9th RESPONSE	10th RESPONSE	11th RESPONSE	12th RESPONSE	13th RESPONSE
44d	Quantity of batteries purchased each time	Average number	5																		
45-1	First thing I like about electricity	Cheap	0	Safe	2	Clean	3	Easy to use	5	Versatile	5	Saves time	6	Streetlights	3						
45-2	Second thing I like about electricity	Cheap	0	Safe	2	Clean	7	Easy to use	4	Versatile	9	Saves time	2	Streetlights	0						
45-3	Third thing I like about electricity	Cheap	4	Safe	3	Clean	1	Easy to use	5	Versatile	2	Saves time	6	Streetlights	3						
46-1	First thing I dislike about electricity	Expensive to use	12	Dangerous	7	Expensive applianc	1	Difficult to use	1	Difficult to obtain	0	Unreliable	3								
46-2	Second thing I dislike about electricity	Expensive to use	5	Dangerous	5	Expensive applianc	7	Difficult to use	1	Difficult to obtain	0	Unreliable	6								
46-3	Third thing I dislike about electricity	Expensive to use	3	Dangerous	0	Expensive applianc	5	Difficult to use	2	Difficult to obtain	4	Unreliable	10								
47	Easy access to pre-paid electricity?	Yes	22	No	2																
48	prefered method of pre-paid electricity vending	local agent	2																		
49	Importance of streetlights/area lights	Not important	0	Fairly important	0	Very important	24														
50	Ever experienced a fire in house?	Yes	0	No	24																
51	Cause of fire																				
52	Was this before or after obtaining electricity?																				
53	Anyone been burnt by paraffin or gas?	Yes	0	No	24																
54	Was this before or after obtaining electricity?																				
55	Children ever been poisoned by paraffin?	Yes	0	No	24																
56	Have such hazards motivated HH to get electricity?	Yes	0	No	0																
57	Has electricity improved safety of home and children?	Yes	20	No	0																
58	Ever had an accident with electricity?	Yes	1	No	19																
59	if yes, what was the cause?	electric shock, trying to connect cable	1																		
60a	First important thing for community																				
60b	Second important thing for community																				
60c	Third important thing for community																				

QUESTION 60 RESPONSES	1st PRIORITY	2nd PRIO	3rd PRIORITY	TOTAL
Electricity supply	2	2	6	10
Employment	12	2	1	15
Health services	1	1	3	5
Streetlights	0	0	0	0
Roads	3	4	5	12
Schools	2	5	3	10
Wood supply	0	1	1	2
Sanitation	1	1	0	2
Water supply	2	5	3	10
Public tansport	0	0	1	1
Recreational facilities	0	0	0	0
More shops	0	0	0	0
Community projects	0	0	0	0
Telephone services	1	3	0	4
Credit/loans	0	0	1	1
TOTAL	24	24	24	72

ENGELA Household Survey Summary

23

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE		11th RESPONSE		12th RESPONSE		13th RESPONSE
1	Enumerator number: 1=Doufi, 2=Jeanne, 3=Julius, 4=Onesmus, 5=Hanna, 6=Leonard																									
2	Questionnaire number																									
3	Date																									
4	Respondent gender	Male	12	Female	11																					
5	Respondent age	<20	1	20 to 30	8	30 to 50	5	>50	9																	
6	Respondent education	None	0	Primary school	1	Secondary school	14	Tertiary education	8																	
7	Respondent's relation to HH head	HH head	13	Spouse of head	3	Other adult	7																			
8a	Number of ADULTS living in this HH	Average	3.8																							
8b	Number of CHILDREN living in this HH	Average	2.6																							
9	Number of structures on this erf	Average	2.1																							
10	Total number of rooms	Average	9.7																							
11	House construction material	Cement brick	17	Wooden sticks	6	Corrugated iron	3	mud/clay bricks	6	Other	1															
11e	Other construction material	Boards	1																							
12	Electrification status	Electrified	19	Unelectrified	4																					
13	If unelectrified, would HH prefer electricity?	Yes	4	No	0																					
14	Number of employed HH members	Average	2.2																							
15	Number of self-employed HH members	Average	0.3																							
16	Monthly HH income	Average	4,980.0																							
16	Monthly HH expenditure	Average	1,544.8																							
17	Does HH own a car?	Yes	7	No	16																					
18	Number of years HH is electrified	Average	6.3																							
19	Electricity in all structures?	Yes	12	No	7																					
20	Electricity in all rooms?	Yes	10	No	9																					
21	House wiring:	House wired	14	Readyboard	5																					
22-1	Fuel for cooking: first choice	Electricity	11	Wood	9	Gas	2	Paraffin	1	Dung	0															
22-2	Fuel for cooking: second choice	Electricity	3	Wood	10	Gas	2	Paraffin	1	Dung	1															
23-1	Fuel for water heating: first choice	Electricity	13	Wood	8	Gas	1	Paraffin	1	Dung	0															
23-2	Fuel for water heating: second choice	Electricity	2	Wood	11	Gas	2	Paraffin	0	Dung	0															
24-1	Fuel for space heating: first choice	Electricity	3	Wood	8	Gas	0	Paraffin	0	Dung	0															
24-2	Fuel for space heating: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	0															
25-1	Fuel for refrigeration: first choice	Electricity	16	Wood	0	Gas	0	Paraffin	0	Dung	0															
25-2	Fuel for refrigeration: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	0															
26-1	Fuel for lighting: first choice	Electricity	19	Wood	0	Gas	0	Paraffin	0	Dung	1	Candles	3													
26-2	Fuel for lighting: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	3	Dung	1	Candles	11													
27	Fuel for HiFi/TV: electricity	HiFi and TV	11	HiFi only	2	TV only	5	Radio only	0																	
27	Fuel for HiFi/TV: batteries	HiFi and TV	1	HiFi only	4	TV only	0	Radio only	0																	
28a	Electrical appliance ownership: Lights	Lights	18																							
28b	Electrical appliance ownership: Electric iron	Electric iron	16																							
28c	Electrical appliance ownership: Hotplate	Hotplate	12																							
28d	Electrical appliance ownership: Stove	Stove	7																							
28e	Electrical appliance ownership: Radio/HiFi	Radio/HiFi	17																							
28f	Electrical appliance ownership: TV	TV	17																							
28g	Electrical appliance ownership: Refrigerator	Refrigerator	17																							
28h	Electrical appliance ownership: Electric fan	Electric fan	10																							
28i	Electrical appliance ownership: other	DVD	2	cellphone	5	stove	2	electric kettle	4	micro wave oven	3	computer	1	electric frying pan	1	VCR	1	washing machine	1							
29a	Other appliance ownership: paraffin refrigerator	paraffin refrigerator	0																							
29b	Other appliance ownership: gas refrigerator	gas refrigerator	0																							
29c	Other appliance ownership: wood/coal stove	wood/coal stove	0																							
29d	Other appliance ownership: paraffin stove	paraffin stove	0																							
29e	Other appliance ownership: gas stove	gas stove	7																							
29f	Other appliance ownership: solar stove	solar stove	0																							
29g	Other appliance ownership: paraffin lamp	paraffin lamp	5																							
29h	Other appliance ownership: 3-stone fireplace	3-stone fire place	19																							
29i	Other appliance ownership: non-electric iron	non-electric iron	2																							
30	Acquisition of expensive appliances	Buy second hand	2	buy cash	14	lay-bye	0	Hire purchase	5	Present	2															
31	Planned acquisition of appliances	Refrigerator	5	electric stove	5	TV only	3	electric fan	2	washing machine	1	computer	2	HiFi	3	geyser	1	DVD	1	hotplate	1	microwave oven	2	VCR	1	
32	Wood collection from area	Yes	16	No	7																					
33	Frequency of wood collection: every x number of days	Average	4.9																							
34	Length of collection trip in hours	Average	0.8																							
35	Less wood usage with electricity?	Yes	11	No	7																					
36	Does HH buy wood?	Yes	13	No	10																					
37a	Frequency of fuel purchases: wood	5 times per month	1	weekly	2	3 times per month	1	twice per month	1	monthly	4	every 3rd month	1	twice per year	2	irregular (when needed)	1									
37b	Frequency of fuel purchases: electricity	3 times a week	1	twice a week	1	4 times a month	1	2-3 times a month	1	monthly	11	twice a month	3	three times per month	1											
37c	Frequency of fuel purchases: paraffin	weekly	2	4 times per mont	1	monthly	2	every 2nd month	1																	
37d	Frequency of fuel purchases: gas	twice a month	1	every 2nd month	2	every 3rd month	1																			
37e	Frequency of fuel purchases: candles	daily	1	weekly	1	bi weekly	1	3 times a month	1	twice a month	1	monthly	4	yearly	4	irregularly (when	3									
37f	Frequency of fuel purchases: batteries	bi-weekly	1	twice a month	1	monthly	4																			
38	Number of wood bundles purchased each time	Average	2																							
39	Cost of a bundle of wood	Average N$	12																							
40a	Max expenditure on electricity (per purchase)	Average N$	205																							
40b	Min expenditure on electricity (per purchase)	Average N$	104																							
41	Has electricity made life easier?	Yes	19	No	0																					
42	Has electricity saved HH money?	Yes	7	No	12																					
43	Estimate of savings due to electricity	Average N$/month	414																							
44a	Quantity of paraffin purchased each time	Average litres	4																							
44b	Quantity of gas purchased each time	Average kg	12																							
44c	Quantity of candles purchased each time	Average number	8																							
44d	Quantity of batteries purchased each time	Average number	2																							

ENGELA Household Survey Summary

23

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE	9th RESPONSE	10th RESPONSE	11th RESPONSE	12th RESPONSE	13th RESPONSE
45-1	First thing I like about electricity	Cheap	3	Safe	1	Clean	3	Easy to use	4	Versatile	6	Saves time	5	Streetlights	1						
45-2	Second thing I like about electricity	Cheap	2	Safe	3	Clean	0	Easy to use	7	Versatile	10	Saves time	1	Streetlights	0						
45-3	Third thing I like about electricity	Cheap	1	Safe	1	Clean	5	Easy to use	2	Versatile	4	Saves time	9	Streetlights	1						
46-1	First thing I dislike about electricity	Expensive to use	9	Dangerous	6	Expensive applianc	2	Difficult to use	0	Difficult to obtain	2	Unreliable	4								
46-2	Second thing I dislike about electricity	Expensive to use	5	Dangerous	6	Expensive applianc	4	Difficult to use	1	Difficult to obtain	4	Unreliable	3								
46-3	Third thing I dislike about electricity	Expensive to use	1	Dangerous	3	Expensive applianc	7	Difficult to use	0	Difficult to obtain	2	Unreliable	10								
47	Easy access to pre-paid electricity?	Yes	10	No	13																
48	prefered method of pre-paid electricity vending	local agent	13																		
49	Importance of streetlights/area lights	Not important	0	Fairly important	1	Very important	22														
50	Ever experienced a fire in house?	Yes	2	No	20																
51	Cause of fire	table cloth caught fire from candle	1	children playing with matches	1																
52	Was this before or after obtaining electricity?	before	1	after	0																
53	Anyone been burnt by paraffin or gas?	Yes	0	No	23																
54	Was this before or after obtaining electricity?																				
55	Children ever been poisoned by paraffin?	Yes	1	No	22																
56	Have such hazards motivated HH to get electricity?	Yes	0	No	0																
57	Has electricity improved safety of home and children?	Yes	17	No	2																
58	Ever had an accident with electricity?	Yes	3	No	16																
59	if yes, what was the cause?	electric shock	1	lightning strike	2																
60a	First important thing for community																				
60b	Second important thing for community																				
60c	Third important thing for community																				

QUESTION 60 RESPONSES	1st PRIORITY	2nd PRIO	3rd PRIORITY	TOTAL
Electricity supply	10	2	0	12
Employment	4	4	2	10
Health services	1	3	4	8
Streetlights	2	1	0	3
Roads	0	2	1	3
Schools	2	4	7	13
Wood supply	0	0	2	2
Sanitation	1	2	1	4
Water supply	3	4	3	10
Public tansport	0	0	0	0
Recreational facilities	0	0	0	0
NORED office	0	1	0	1
Community projects	0	0	0	0
Telephone services	0	0	1	1
Credit/loans	0	0	2	2
TOTAL	23	23	23	69

OSHIFO Household Survey Summary

23

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE		11th RESPONSE		12th RESPONSE		13th RESPONSE	
1	Enumerator number: 1=Doufi, 2=Jeanne, 3=Julius, 4=Onesmus, 5=Hanna, 6=Leonard																										
2	Questionnaire number																										
3	Date																										
4	Respondent gender	Male	8	Female	15																						
5	Respondent age	<20	1	20 to 30	8	30 to 50	14	>50	0																		
6	Respondent education	None	4	Primary school	4	Secondary school	12	Tertiary education	3																		
7	Respondent's relation to HH head	HH head	11	Spouse of head	5	Other adult	6																				
8a	Number of ADULTS living in this HH	Average	2.5																								
8b	Number of CHILDREN living in this HH	Average	2.7																								
9	Number of structures on this erf	Average	1.1																								
10	Total number of rooms	Average	5.6																								
11	House construction material	Cement brick	22	Wooden sticks	2	Corrugated iron	0	mud/clay bricks	0	Other	0																
11e	Other construction material																										
12	Electrification status	Electrified	19	Unelectrified	4																						
13	If unelectrified, would HH prefer electricity?	Yes	4	No	0																						
14	Number of employed HH members	Average	1.4																								
15	Number of self-employed HH members	Average	0.2																								
16	Monthly HH income	Average	2,242.0																								
16	Monthly HH expenditure	Average	1,231.3																								
17	Does HH own a car?	Yes	7	No	16																						
18	Number of years HH is electrified	Average	8.9																								
19	Electricity in all structures?	Yes	19	No	0																						
20	Electricity in all rooms?	Yes	18	No	1																						
21	House wiring:	House wired	12	Readyboard	7																						
22-1	Fuel for cooking: first choice	Electricity	12	Wood	11	Gas	0	Paraffin	0	Dung	0																
22-2	Fuel for cooking: second choice	Electricity	3	Wood	7	Gas	4	Paraffin	0	Dung	0																
23-1	Fuel for water heating: first choice	Electricity	12	Wood	11	Gas	0	Paraffin	0	Dung	0																
23-2	Fuel for water heating: second choice	Electricity	3	Wood	6	Gas	2	Paraffin	0	Dung	0																
24-1	Fuel for space heating: first choice	Electricity	4	Wood	7	Gas	0	Paraffin	0	Dung	0																
24-2	Fuel for space heating: second choice	Electricity	0	Wood	1	Gas	0	Paraffin	0	Dung	0																
25-1	Fuel for refrigeration: first choice	Electricity	14	Wood	0	Gas	1	Paraffin	0	Dung	0																
25-2	Fuel for refrigeration: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	0																
26-1	Fuel for lighting: first choice	Electricity	19	Wood	0	Gas	0	Paraffin	3	Dung	0	Candles	1														
26-2	Fuel for lighting: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	0	Candles	16														
27	Fuel for HiFi/TV: electricity	HiFi and TV	8	HiFi only	4	TV only	1	Radio only	0																		
27	Fuel for HiFi/TV: batteries	HiFi and TV	0	HiFi only	3	TV only	0	Radio only	0																		
28a	Electrical appliance ownership: Lights	Lights	19																								
28b	Electrical appliance ownership: Electric iron	Electric iron	12																								
28c	Electrical appliance ownership: Hotplate	Hotplate	15																								
28d	Electrical appliance ownership: Stove	Stove	3																								
28e	Electrical appliance ownership: Radio/HiFi	Radio/HiFi	15																								
28f	Electrical appliance ownership: TV	TV	11																								
28g	Electrical appliance ownership: Refrigerator	Refrigerator	15																								
28h	Electrical appliance ownership: Electric fan	Electric fan	8																								
28i	Electrical appliance ownership: other	electric kettle	5	microwave oven	2	computer	1	cell phone	6	shaver	1	sewing machine	1	VCR	1												
29a	Other appliance ownership: paraffin refrigerator	paraffin refrigerator	0																								
29b	Other appliance ownership: gas refrigerator	gas refrigerator	1																								
29c	Other appliance ownership: wood/coal stove	wood/coal stove	0																								
29d	Other appliance ownership: paraffin stove	paraffin stove	2																								
29e	Other appliance ownership: gas stove	gas stove	3																								
29f	Other appliance ownership: solar stove	solar stove	0																								
29g	Other appliance ownership: paraffin lamp	paraffin lamp	3																								
29h	Other appliance ownership: 3-stone fireplace	3-stone fire place	16																								
29i	Other appliance ownership: non-electric iron	non-electric iron	2																								
30	Acquisition of expensive appliances	Buy second hand	0	buy cash	11	lay-bye	0	Hire purchase	11	Present	1																
31	Planned acquisition of appliances	Electric fan	2	HiFi	4	DVD	3	washing machine	1	TV	10	electric stove	7	refrigerator	3	computer	1	music equipment	1	microwave over	1						
32	Wood collection from area	Yes	13	No	10																						
33	Frequency of wood collection: every x number of days	Average	10.1																								
34	Length of collection trip in hours	Average	1.0																								
35	Less wood usage with electricity?	Yes	11	No	8																						
36	Does HH buy wood?	Yes	13	No	10																						
37a	Frequency of fuel purchases: wood	3 times per week	1	weekly	2	4 times per month	1	twice per month	2	monthly	6																
37b	Frequency of fuel purchases: electricity	4 times a week	1	5 times a month	1	weekly	2	twice per month	4	monthly	8	every third week	1	every second month	1												
37c	Frequency of fuel purchases: paraffin	monthly	3																								
37d	Frequency of fuel purchases: gas	monthly	1	every 3rd month	2	yearly	1																				
37e	Frequency of fuel purchases: candles	daily	1	3 times per week	1	weekly	1	3 times a month	1	twice a month	2	monthly	7	every 2nd or 3rd month	1	irregularly (when	3										
37f	Frequency of fuel purchases: batteries	twice a month	1	monthly	1	every 2nd month	1																				
38	Number of wood bundles purchased each time	Average	2																								
39	Cost of a bundle of wood	Average N$	8																								
40a	Max expenditure on electricity (per purchase)	Average N$	122																								
40b	Min expenditure on electricity (per purchase)	Average N$	40																								
41	Has electricity made life easier?	Yes	19	No	0																						
42	Has electricity saved HH money?	Yes	4	No	15																						
43	Estimate of savings due to electricity	Average N$/month	34																								
44a	Quantity of paraffin purchased each time	Average litres	5																								
44b	Quantity of gas purchased each time	Average kg	32																								
44c	Quantity of candles purchased each time	Average number	6																								
44d	Quantity of batteries purchased each time	Average number	2																								

OSHIFO Household Survey Summary

23

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE		11th RESPONSE		12th RESPONSE		13th RESPONSE	
45-1	First thing I like about electricity	Cheap	0	Safe	5	Clean	4	Easy to use	6	Versatile	1	Saves time	4	Streetlights	3												
45-2	Second thing I like about electricity	Cheap	0	Safe	0	Clean	1	Easy to use	3	Versatile	13	Saves time	4	Streetlights	2												
45-3	Third thing I like about electricity	Cheap	1	Safe	3	Clean	2	Easy to use	3	Versatile	5	Saves time	9	Streetlights	0												
46-1	First thing I dislike about electricity	Expensive to use	13	Dangerous	7	Expensive applianc	1	Difficult to use	0	Difficult to obtain	1	Unreliable	0														
46-2	Second thing I dislike about electricity	Expensive to use	4	Dangerous	5	Expensive applianc	8	Difficult to use	0	Difficult to obtain	0	Unreliable	5														
46-3	Third thing I dislike about electricity	Expensive to use	1	Dangerous	2	Expensive applianc	8	Difficult to use	1	Difficult to obtain	0	Unreliable	10														
47	Easy access to pre-paid electricity?	Yes	20	No	2																						
48	prefered method of pre-paid electricity vending	local agent	2																								
49	Importance of streetlights/area lights	Not important	0	Fairly important	0	Very important	22																				
50	Ever experienced a fire in house?	Yes	1	No	21																						
51	Cause of fire	table cloth caught fire from candle	1	children playing with matches	1																						
52	Was this before or after obtaining electricity?	before	1	after	0																						
53	Anyone been burnt by paraffin or gas?	Yes	0	No	23																						
54	Was this before or after obtaining electricity?																										
55	Children ever been poisoned by paraffin?	Yes	0	No	23																						
56	Have such hazards motivated HH to get electricity?	Yes	0	No	0																						
57	Has electricity improved safety of home and children?	Yes	19	No	0																						
58	Ever had an accident with electricity?	Yes	1	No	18																						
59	if yes, what was the cause?	electric shock	1	lightning strike	2																						
60a	First important thing for community																										
60b	Second important thing for community																										
60c	Third important thing for community																										

QUESTION 60 RESPONSES	1st PRIORITY	2nd PRIO	3rd PRIORITY	TOTAL
Electricity supply	10	2	0	12
Employment	4	4	2	10
Health services	1	3	4	8
Streetlights	2	1	0	3
Roads	0	2	1	3
Schools	2	4	7	13
Wood supply	0	0	2	2
Sanitation	1	2	1	4
Water supply	3	4	3	10
Public tansport	0	0	0	0
Recreational facilities	0	0	0	0
NORED office	0	1	0	1
Community projects	0	0	0	0
Telephone services	0	0	1	1
Credit/loans	0	0	2	2
TOTAL	23	23	23	69

OMPUNDJA Household Survey Summary

22

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE		11th RESPONSE		12th RESPONSE		13th RESPONSE	
1	Enumerator number: 1=Doufi, 2=Jeanne, 3=Julius, 4=Onesmus, 5=Hanna, 6=Leonard																										
2	Questionnaire number																										
3	Date																										
4	Respondent gender	Male	6	Female	16																						
5	Respondent age	<20	1	20 to 30	4	30 to 50	7	>50	10																		
6	Respondent education	None	0	Primary school	7	Secondary school	15	Tertiary education	0																		
7	Respondent's relation to HH head	HH head	6	Spouse of head	8	Other adult	8																				
8a	Number of ADULTS living in this HH	Average	3.9																								
8b	Number of CHILDREN living in this HH	Average	4.2																								
9	Number of structures on this erf	Average	2.6																								
10	Total number of rooms	Average	14.1																								
11	House construction material	Cement brick	5	Wooden sticks	2	Corrugated iron	0	mud/clay bricks	0	Other	0																
11e	Other construction material																										
12	Electrification status	Electrified	0	Unelectrified	22																						
13	If unelectrified, would HH prefer electricity?	Yes	21	No	0																						
14	Number of employed HH members	Average	1.5																								
15	Number of self-employed HH members	Average	0.3																								
16	Monthly HH income	Average	2,887.7																								
16	Monthly HH expenditure	Average	1,016.4																								
17	Does HH own a car?	Yes	11	No	11																						
18	Number of years HH is electrified	Average	#DIV/0!																								
19	Electricity in all structures?	Yes	0	No	0																						
20	Electricity in all rooms?	Yes	0	No	0																						
21	House wiring:	House wired	0	Readyboard	0																						
22-1	Fuel for cooking: first choice	Electricity	0	Wood	16	Gas	1	Paraffin	0	Dung	5																
22-2	Fuel for cooking: second choice	Electricity	0	Wood	5	Gas	7	Paraffin	0	Dung	5																
23-1	Fuel for water heating: first choice	Electricity	0	Wood	18	Gas	0	Paraffin	0	Dung	4																
23-2	Fuel for water heating: second choice	Electricity	0	Wood	4	Gas	6	Paraffin	0	Dung	6																
24-1	Fuel for space heating: first choice	Electricity	0	Wood	14	Gas	0	Paraffin	0	Dung	4																
24-2	Fuel for space heating: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	4																
25-1	Fuel for refrigeration: first choice	Electricity	0	Wood	0	Gas	5	Paraffin	0	Dung	0																
25-2	Fuel for refrigeration: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	0																
26-1	Fuel for lighting: first choice	Electricity	0	Wood	0	Gas	1	Paraffin	11	Dung	1	Candles	9														
26-2	Fuel for lighting: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	2	Dung	0	Candles	9														
27	Fuel for HiFi/TV: electricity	HiFi and TV	0	HiFi only	0	TV only	0	Radio only	0																		
27	Fuel for HiFi/TV: batteries	HiFi and TV	0	HiFi only	13	TV only	1	Radio only	1																		
28a	Electrical appliance ownership: Lights	Lights	0																								
28b	Electrical appliance ownership: Electric iron	Electric iron	1																								
28c	Electrical appliance ownership: Hotplate	Hotplate	0																								
28d	Electrical appliance ownership: Stove	Stove	2																								
28e	Electrical appliance ownership: Radio/HiFi	Radio/HiFi	12																								
28f	Electrical appliance ownership: TV	TV	7																								
28g	Electrical appliance ownership: Refrigerator	Refrigerator	3																								
28h	Electrical appliance ownership: Electric fan	Electric fan	0																								
28i	Electrical appliance ownership: other	welding machine	1	cell phone	5																						
29a	Other appliance ownership: paraffin refrigerator	paraffin refrigerator	0																								
29b	Other appliance ownership: gas refrigerator	gas refrigerator	2																								
29c	Other appliance ownership: wood/coal stove	wood/coal stove	0																								
29d	Other appliance ownership: paraffin stove	paraffin stove	3																								
29e	Other appliance ownership: gas stove	gas stove	10																								
29f	Other appliance ownership: solar stove	solar stove	0																								
29g	Other appliance ownership: paraffin lamp	paraffin lamp	14																								
29h	Other appliance ownership: 3-stone fireplace	3-stone fire place	22																								
29i	Other appliance ownership: non-electric iron	non-electric iron	9																								
30	Acquisition of expensive appliances	Buy second hand	0	buy cash	15	lay-bye	0	Hire purchase	2	Present	1																
31	Planned acquisition of appliances	Refrigerator	9	Electric stove	5	Sewing machine	1	washing machine	1	TV	8	electric iron	7	microwave oven	2	HiFi/radio	3	hotplate	3	lights	1	computer	1				
32	Wood collection from area	Yes	20	No	2																						
33	Frequency of wood collection: every x number of days	Average	5.5																								
34	Length of collection trip in hours	Average	0.6																								
35	Less wood usage with electricity?	Yes	0	No	0																						
36	Does HH buy wood?	Yes	14	No	8																						
37a	Frequency of fuel purchases: wood	daily	1	4 times a week	2	3 times per month	1	twice per month	1	monthly	4	every 3rd month	2	irregular (when needed)	2												
37b	Frequency of fuel purchases: electricity																										
37c	Frequency of fuel purchases: paraffin	5 times a month	1	4 times a month	1	weekly	2	twice per month	1	monthy	8	every 2nd month	1	every 3rd month	2												
37d	Frequency of fuel purchases: gas	monthly	8	twice per month	1																						
37e	Frequency of fuel purchases: candles	daily	1	twice per week	1	weekly	6	4 times a month	1	twice a month	2	monthly	7														
37f	Frequency of fuel purchases: batteries	4 times per month	1	twice per month	3	every 2nd week	2	monthly	6	every 2nd month	1	every 3rd month	1														
38	Number of wood bundles purchased each time	Average	2																								
39	Cost of a bundle of wood	Average N$	36																								
40a	Max expenditure on electricity (per purchase)	Average N$	#DIV/0!																								
40b	Min expenditure on electricity (per purchase)	Average N$	#DIV/0!																								
41	Has electricity made life easier?	Yes	0	No	0																						
42	Has electricity saved HH money?	Yes	0	No	0																						
43	Estimate of savings due to electricity	Average N$/month	-																								
44a	Quantity of paraffin purchased each time	Average litres	10																								
44b	Quantity of gas purchased each time	Average kg	54																								
44c	Quantity of candles purchased each time	Average number	7																								

OMPUNDJA Household Survey Summary

22

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE	9th RESPONSE	10th RESPONSE	11th RESPONSE	12th RESPONSE	13th RESPONSE
44d	Quantity of batteries purchased each time	Average number	9																		
45-1	First thing I like about electricity	Cheap	1	Safe	3	Clean	6	Easy to use	2	Versatile	4	Saves time	5	Streetlights	1						
45-2	Second thing I like about electricity	Cheap	0	Safe	2	Clean	2	Easy to use	7	Versatile	9	Saves time	2	Streetlights	0						
45-3	Third thing I like about electricity	Cheap	1	Safe	4	Clean	0	Easy to use	5	Versatile	4	Saves time	4	Streetlights	4						
46-1	First thing I dislike about electricity	Expensive to use	7	Dangerous	9	Expensive applianc	2	Difficult to use	0	Difficult to obtain	2	Unreliable	2								
46-2	Second thing I dislike about electricity	Expensive to use	1	Dangerous	4	Expensive applianc	6	Difficult to use	1	Difficult to obtain	4	Unreliable	6								
46-3	Third thing I dislike about electricity	Expensive to use	1	Dangerous	2	Expensive applianc	2	Difficult to use	1	Difficult to obtain	3	Unreliable	12								
47	Easy access to pre-paid electricity?	Yes	0	No	1																
48	prefered method of pre-paid electricity vending	local agent	0																		
49	Importance of streetlights/area lights	Not important	0	Fairly important	1	Very important	20														
50	Ever experienced a fire in house?	Yes	10	No	12																
51	Cause of fire	candle left unattended	1	children playing with matches/firewood/coals	8	thatch caught fire from 3-stone fire place	1														
52	Was this before or after obtaining electricity?																				
53	Anyone been burnt by paraffin or gas?	Yes	0	No	22																
54	Was this before or after obtaining electricity?																				
55	Children ever been poisoned by paraffin?	Yes	1	No	21																
56	Have such hazards motivated HH to get electricity?	Yes	1	No	0																
57	Has electricity improved safety of home and children?																				
58	Ever had an accident with electricity?																				
59	if yes, what was the cause?																				
60a	First important thing for community																				
60b	Second important thing for community																				
60c	Third important thing for community																				

QUESTION 60 RESPONSES	1st PRIORITY	2nd PRIO	3rd PRIORITY	TOTAL
Electricity supply	13	5	1	19
Employment	3	3	1	7
Health services	0	1	1	2
Streetlights	0	0	0	0
Roads	3	3	4	10
Schools	1	2	3	6
Wood supply	0	0	1	1
Sanitation	1	2	2	5
Water supply	0	4	3	7
Public tansport	0	2	3	5
Recreational facilities	0	0	0	0
NORED office	0	0	0	0
Community projects	0	0	1	1
Telephone services	1	0	1	2
Credit/loans	0	0	1	1
TOTAL	22	22	22	66

OMAKANGE Household Survey Summary

24

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE	10th RESPONSE	11th RESPONSE	12th RESPONSE	13th RESPONSE
1	Enumerator number: 1=Doufi, 2=Jeanne, 3=Julius, 4=Onesmus, 5=Hanna, 6=Leonard																					
2	Questionnaire number																					
3	Date																					
4	Respondent gender	Male	13	Female	11																	
5	Respondent age	<20	1	20 to 30	5	30 to 50	12	>50	6													
6	Respondent education	None	2	Primary school	5	Secondary school	4	Tertiary education	13													
7	Respondent's relation to HH head	HH head	15	Spouse of head	6	Other adult	3															
8a	Number of ADULTS living in this HH	Average	3.5																			
8b	Number of CHILDREN living in this HH	Average	4.3																			
9	Number of structures on this erf	Average	2.5																			
10	Total number of rooms	Average	3.8																			
11	House construction material	Cement brick	5	Wooden sticks	7	Corrugated iron	0	mud/clay bricks	11	Other	9											
11e	Other construction material	cow dung and clay	12	mountain stones	1																	
12	Electrification status	Electrified	0	Unelectrified	24																	
13	If unelectrified, would HH prefer electricity?	Yes	24	No	0																	
14	Number of employed HH members	Average	1.3																			
15	Number of self-employed HH members	Average	0.2																			
16	Monthly HH income	Average	4,399.7																			
16	Monthly HH expenditure	Average	2,049.6																			
17	Does HH own a car?	Yes	7	No	17																	
18	Number of years HH is electrified	Average	-																			
19	Electricity in all structures?	Yes	0	No	0																	
20	Electricity in all rooms?	Yes	0	No	0																	
21	House wiring:	House wired	0	Readyboard	0																	
22-1	Fuel for cooking: first choice	Electricity	0	Wood	15	Gas	9	Paraffin	0	Dung	0											
22-2	Fuel for cooking: second choice	Electricity	0	Wood	9	Gas	1	Paraffin	1	Dung	0											
23-1	Fuel for water heating: first choice	Electricity	0	Wood	15	Gas	9	Paraffin	0	Dung	0											
23-2	Fuel for water heating: second choice	Electricity	0	Wood	9	Gas	0	Paraffin	1	Dung	0											
24-1	Fuel for space heating: first choice	Electricity	0	Wood	17	Gas	0	Paraffin	1	Dung	0											
24-2	Fuel for space heating: second choice	Electricity	0	Wood	0	Gas	1	Paraffin	0	Dung	0											
25-1	Fuel for refrigeration: first choice	Electricity	0	Wood	0	Gas	7	Paraffin	0	Dung	0											
25-2	Fuel for refrigeration: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	0											
26-1	Fuel for lighting: first choice	Electricity	0	Wood	3	Gas	0	Paraffin	16	Dung	0	Candles	5									
26-2	Fuel for lighting: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	2	Dung	0	Candles	17									
27	Fuel for HiFi/TV: electricity	HiFi and TV	0	HiFi only	1	TV only	0	Radio only	0													
27	Fuel for HiFi/TV: batteries	HiFi and TV	0	HiFi only	17	TV only	2	Radio only	0													
28a	Electrical appliance ownership: Lights	Lights	0																			
28b	Electrical appliance ownership: Electric iron	Electric iron	2																			
28c	Electrical appliance ownership: Hotplate	Hotplate	3																			
28d	Electrical appliance ownership: Stove	Stove	3																			
28e	Electrical appliance ownership: Radio/HiFi	Radio/HiFi	13																			
28f	Electrical appliance ownership: TV	TV	6																			
28g	Electrical appliance ownership: Refrigerator	Refrigerator	4																			
28h	Electrical appliance ownership: Electric fan	Electric fan	1																			
28i	Electrical appliance ownership: other	hair clipper	2	TV game machin	1	micro wave oven	5	DVD	2	Hair dryer	1	Kettle	7	VCR	1	Cell phone	6					
29a	Other appliance ownership: paraffin refrigerator	paraffin refrigerator	0																			
29b	Other appliance ownership: gas refrigerator	gas refrigerator	4																			
29c	Other appliance ownership: wood/coal stove	wood/coal stove	0																			
29d	Other appliance ownership: paraffin stove	paraffin stove	2																			
29e	Other appliance ownership: gas stove	gas stove	10																			
29f	Other appliance ownership: solar stove	solar stove	1																			
29g	Other appliance ownership: paraffin lamp	paraffin lamp	19																			
29h	Other appliance ownership: 3-stone fireplace	3-stone fire place	19																			
29i	Other appliance ownership: non-electric iron	non-electric iron	8																			
30	Acquisition of expensive appliances	Buy second hand	1	buy cash	17	lay-bye	0	Hire purchase	6	Present	0											
31	Planned acquisition of appliances	washing machine	2	airconditioner	3	DVD	4	Refrigerator	5	TV	1	Electric stove	7	Microwave oven	3	Gas stove	1					
32	Wood collection from area	Yes	24	No	0																	
33	Frequency of wood collection: every x number of days	Average	5.1																			
34	Length of collection trip in hours	Average	1.1																			
35	Less wood usage with electricity?	Yes	0	No	0																	
36	Does HH buy wood?	Yes	2	No	22																	
37a	Frequency of fuel purchases: wood	3 times per month	1	monthly	1																	
37b	Frequency of fuel purchases: electricity																					
37c	Frequency of fuel purchases: paraffin	3 times per week	1	twice per week	1	weekly	8	3 times per month	1	twice per month	4	monthly	6									
37d	Frequency of fuel purchases: gas	3 times per month	1	twice per month	1	monthly	5	every 2nd month	4	every 3rd month	2											
37e	Frequency of fuel purchases: candles	daily	2	3 times per week	1	twice per week	2	weekly	4	twice per month	6	monthly	6									
37f	Frequency of fuel purchases: batteries	weekly	2	3 times per mont	1	twice a month	10	monthly	6	yearly	1											
38	Number of wood bundles purchased each time	Average	-																			
39	Cost of a bundle of wood	Average N$	-																			
40a	Max expenditure on electricity (per purchase)	Average N$	#DIV/0!																			
40b	Min expenditure on electricity (per purchase)	Average N$	#DIV/0!																			
41	Has electricity made life easier?	Yes	0	No	0																	
42	Has electricity saved HH money?	Yes	0	No	0																	
43	Estimate of savings due to electricity	Average N$/month	-																			
44a	Quantity of paraffin purchased each time	Average litres	23																			
44b	Quantity of gas purchased each time	Average kg	13																			
44c	Quantity of candles purchased each time	Average number	9																			

OMAKANGE Household Survey Summary

24

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE	9th RESPONSE	10th RESPONSE	11th RESPONSE	12th RESPONSE	13th RESPONSE
44d	Quantity of batteries purchased each time	Average number	18																		
45-1	First thing I like about electricity	Cheap	0	Safe	7	Clean	0	Easy to use	6	Versatile	9	Saves time	1	Streetlights	1						
45-2	Second thing I like about electricity	Cheap	2	Safe	1	Clean	1	Easy to use	5	Versatile	7	Saves time	8	Streetlights	0						
45-3	Third thing I like about electricity	Cheap	1	Safe	0	Clean	2	Easy to use	6	Versatile	6	Saves time	8	Streetlights	1						
46-1	First thing I dislike about electricity	Expensive to use	5	Dangerous	15	Expensive applianc	1	Difficult to use	0	Difficult to obtain	2	Unreliable	1								
46-2	Second thing I dislike about electricity	Expensive to use	0	Dangerous	5	Expensive applianc	9	Difficult to use	2	Difficult to obtain	2	Unreliable	6								
46-3	Third thing I dislike about electricity	Expensive to use	5	Dangerous	1	Expensive applianc	6	Difficult to use	1	Difficult to obtain	2	Unreliable	9								
47	Easy access to pre-paid electricity?	Yes	0	No	0																
48	prefered method of pre-paid electricity vending	local agent	2																		
49	Importance of streetlights/area lights	Not important	0	Fairly important	1	Very important	23														
50	Ever experienced a fire in house?	Yes	7	No	17																
51	Cause of fire																				
52	Was this before or after obtaining electricity?																				
53	Anyone been burnt by paraffin or gas?	Yes	0	No	24																
54	Was this before or after obtaining electricity?																				
55	Children ever been poisoned by paraffin?	Yes	4	No	20																
56	Have such hazards motivated HH to get electricity?	Yes	4	No	0																
57	Has electricity improved safety of home and children?	Yes	0	No	0																
58	Ever had an accident with electricity?	Yes	0	No	0																
59	if yes, what was the cause?	electric shock, trying to connect cable	1																		
60a	First important thing for community																				
60b	Second important thing for community																				
60c	Third important thing for community																				

QUESTION 60 RESPONSES	1st PRIORITY	2nd PRIO	3rd PRIORITY	TOTAL
Electricity supply	2	2	6	10
Employment	12	2	1	15
Health services	1	1	3	5
Streetlights	0	0	0	0
Roads	3	4	5	12
Schools	2	5	3	10
Wood supply	0	1	1	2
Sanitation	1	1	0	2
Water supply	2	5	3	10
Public tansport	0	0	1	1
Recreational facilities	0	0	0	0
NORED office	0	0	0	0
Community projects	0	0	0	0
Telephone services	1	3	0	4
Credit/loans	0	0	1	1
TOTAL	24	24	24	72

TSUMKWE Household Survey Summary

6

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE	
1	Enumerator number: 1=Doufi, 2=Jeanne, 3=Julius, 4=Onesmus, 5=Hanna, 6=Leonard																				
2	Questionnaire number																				
3	Date																				
4	Respondent gender	Male	2	Female	4																
5	Respondent age	<20	0	20 to 30	1	30 to 50	5	>50	0												
6	Respondent education	None	0	Primary school	1	Secondary school	5	Tertiary education	0												
7	Respondent's relation to HH head	HH head	6	Spouse of head	0	Other adult	0														
8a	Number of ADULTS living in this HH	Average	2.3																		
8b	Number of CHILDREN living in this HH	Average	5.3																		
9	Number of structures on this erf	Average	1.2																		
10	Total number of rooms	Average	2.7																		
11	House construction material	Cement brick	5	Wooden sticks	1	Corrugated iron	1	mud/clay bricks	0	Other	0										
11e	Other construction material																				
12	Electrification status	Electrified	1	Unelectrified	5																
13	If unelectrified, would HH prefer electricity?	Yes	5	No	0																
14	Number of employed HH members	Average	1.2																		
15	Number of self-employed HH members	Average	0.3																		
16	Monthly HH income	Average	1,727.6																		
16	Monthly HH expenditure	Average	1,210.0																		
17	Does HH own a car?	Yes	0	No	6																
18	Number of years HH is electrified	Average	10.0																		
19	Electricity in all structures?	Yes	1	No	0																
20	Electricity in all rooms?	Yes	1	No	0																
21	House wiring:	House wired	1	Readyboard	0																
22-1	Fuel for cooking: first choice	Electricity	1	Wood	5	Gas	0	Paraffin	0	Dung	0										
22-2	Fuel for cooking: second choice	Electricity	0	Wood	0	Gas	4	Paraffin	0	Dung	0										
23-1	Fuel for water heating: first choice	Electricity	1	Wood	5	Gas	0	Paraffin	0	Dung	0										
23-2	Fuel for water heating: second choice	Electricity	0	Wood	0	Gas	2	Paraffin	0	Dung	0										
24-1	Fuel for space heating: first choice	Electricity	0	Wood	2	Gas	0	Paraffin	0	Dung	0										
24-2	Fuel for space heating: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	0										
25-1	Fuel for refrigeration: first choice	Electricity	1	Wood	0	Gas	0	Paraffin	0	Dung	0										
25-2	Fuel for refrigeration: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	0										
26-1	Fuel for lighting: first choice	Electricity	1	Wood	0	Gas	0	Paraffin	0	Dung	0	Candles	5								
26-2	Fuel for lighting: second choice	Electricity	0	Wood	0	Gas	0	Paraffin	0	Dung	0	Candles	1								
27	Fuel for HiFi/TV: electricity	HiFi and TV	1	HiFi only	0	TV only	0	Radio only	0												
27	Fuel for HiFi/TV: batteries	HiFi and TV	0	HiFi only	1	TV only	0	Radio only	0												
28a	Electrical appliance ownership: Lights	Lights	1																		
28b	Electrical appliance ownership: Electric iron	Electric iron	2																		
28c	Electrical appliance ownership: Hotplate	Hotplate	1																		
28d	Electrical appliance ownership: Stove	Stove	0																		
28e	Electrical appliance ownership: Radio/HiFi	Radio/HiFi	3																		
28f	Electrical appliance ownership: TV	TV	1																		
28g	Electrical appliance ownership: Refrigerator	Refrigerator	3																		
28h	Electrical appliance ownership: Electric fan	Electric fan	0																		
28i	Electrical appliance ownership: other	Washing machine	0	Electric kettle	0																
29a	Other appliance ownership: paraffin refrigerator	paraffin refrigerator	0																		
29b	Other appliance ownership: gas refrigerator	gas refrigerator	0																		
29c	Other appliance ownership: wood/coal stove	wood/coal stove	0																		
29d	Other appliance ownership: paraffin stove	paraffin stove	0																		
29e	Other appliance ownership: gas stove	gas stove	4																		
29f	Other appliance ownership: solar stove	solar stove	0																		
29g	Other appliance ownership: paraffin lamp	paraffin lamp	0																		
29h	Other appliance ownership: 3-stone fireplace	3-stone fire place	5																		
29i	Other appliance ownership: non-electric iron	non-electric iron	0																		
30	Acquisition of expensive appliances	Buy second hand	0	buy cash	4	lay-bye	0	Hire purchase	1	Present	1										
31	Planned acquisition of appliances	Refrigerator	3	TV	5	Electric stove	3	HiFi	3	CD player	1	electric kettle	1	deep freezer	1	electric fan	1	computer	1	DVD	1
32	Wood collection from area	Yes	6	No	0																
33	Frequency of wood collection: every x number of days	Average	6																		
34	Length of collection trip in hours	Average	1.6																		
35	Less wood usage with electricity?	Yes	1	No	0																
36	Does HH buy wood?	Yes	0	No	6																
37a	Frequency of fuel purchases: wood																				
37b	Frequency of fuel purchases: electricity	monthly	1																		
37c	Frequency of fuel purchases: paraffin																				
37d	Frequency of fuel purchases: gas	twice per month	1	monthly	3	every 3rd month	1														
37e	Frequency of fuel purchases: candles	daily	2	weekly	2	twice per month	1	monthly	1			every 3rd month	0	yearly	0	irregular (when ne	0				
37f	Frequency of fuel purchases: batteries	monthly	3																		
38	Number of wood bundles purchased each time	Average	#DIV/0!																		
39	Cost of a bundle of wood	Average N$	#DIV/0!																		
40a	Max expenditure on electricity (per purchase)	Average N$	200																		

TSUMKWE Household Survey Summary

6

Q#		1st RESPONSE		2nd RESPONSE		3rd RESPONSE		4th RESPONSE		5th RESPONSE		6th RESPONSE		7th RESPONSE		8th RESPONSE		9th RESPONSE		10th RESPONSE	
40b	Min expenditure on electricity (per purchase)	Average N$	100																		
41	Has electricity made life easier?	Yes	1	No	0																
42	Has electricity saved HH money?	Yes	0	No	1																
43	Estimate of savings due to electricity	Average N$/month	-																		
44a	Quantity of paraffin purchased each time	Average litres	-																		
44b	Quantity of gas purchased each time	Average kg	13																		
44c	Quantity of candles purchased each time	Average number	3																		
44d	Quantity of batteries purchased each time	Average number	1																		
45-1	First thing I like about electricity	Cheap	2	Safe	0	Clean	1	Easy to use	1	Versatile	1	Saves time	1	Streetlights	0						
45-2	Second thing I like about electricity	Cheap	0	Safe	0	Clean	0	Easy to use	2	Versatile	4	Saves time	0	Streetlights	0						
45-3	Third thing I like about electricity	Cheap	0	Safe	2	Clean	1	Easy to use	1	Versatile	0	Saves time	2	Streetlights	0						
46-1	First thing I dislike about electricity	Expensive to use	4	Dangerous	1	Expensive applianc	0	Difficult to use	0	Difficult to obtain	0	Unreliable	1								
46-2	Second thing I dislike about electricity	Expensive to use	2	Dangerous	3	Expensive applianc	0	Difficult to use	1	Difficult to obtain	0	Unreliable	0								
46-3	Third thing I dislike about electricity	Expensive to use	0	Dangerous	0	Expensive applianc	4	Difficult to use	0	Difficult to obtain	0	Unreliable	2								
47	Easy access to pre-paid electricity?	Yes	5	No	0																
48	prefered method of pre-paid electricity vending	local agent	0																		
49	Importance of streetlights/area lights	Not important	0	Fairly important	0	Very important	6														
50	Ever experienced a fire in house?	Yes	0	No	6																
51	Cause of fire																				
52	Was this before or after obtaining electricity?	before	0	after	0																
53	Anyone been burnt by paraffin or gas?	Yes	0	No	6																
54	Was this before or after obtaining electricity?																				
55	Children ever been poisoned by paraffin?	Yes	0	No	6																
56	Have such hazards motivated HH to get electricity?	Yes	0	No	0																
57	Has electricity improved safety of home and children?	Yes	0	No	1																
58	Ever had an accident with electricity?	Yes	0	No	1																
59	if yes, what was the cause?																				
60a	First important thing for community																				
60b	Second important thing for community																				
60c	Third important thing for community																				

QUESTION 60 RESPONSES	1st PRIORITY	2nd PRIO	3rd PRIORITY	TOTAL
Electricity supply	1	0	1	2
Employment	2	0	0	2
Health services	1	0	0	1
Streetlights	0	0	0	0
Roads	0	0	0	0
Schools	0	3	0	3
Wood supply	0	0	0	0
Sanitation	1	0	0	1
Water supply	1	0	2	3
Public tansport	0	1	3	4
Bank facilities	0	1	0	1
More shops	0	0	0	0
Community projects	0	0	0	0
Telephone services	0	1	0	1
Credit/loans	0	0	0	0
TOTAL	6	6	6	18

APPENDIX I: KEY INFORMANT SURVEY RESULTS

The key informant (KI) survey had four focus areas, namely

- Community
- Institutions
- Business
- Electricity supply

The information presented in this section is a summary of the 55 KI interviews conducted, by focus area. The KI questionnaires are included in Appendix K.

1 Community Focus

1.1 Electrification influence on the community

Access to electricity has influenced business opportunities and growth, electricity has brought development to these settlements. New businesses like hair salons, barber shops, milling and much more are operational. There has been a gradual migration of people from the villages to the electrified towns. Due to electricity towns have become famous for their entertainment facilities, job opportunities and accessibility to formal houses. These houses have access to electricity, which makes life easy and comfortable compared to houses without electricity. Families are exposed to the outside world through the use of TV, DVD and internet in their electrified homes.

Outapi is one of the towns with a rapid growth due to electricity. Most private institutions, government agencies and large businesses have established themselves in Outapi Town because of the availability of electricity.

Church services and activities have increased and are available also after hours because of electricity. Churches are also excited by the fact that now they are able to use musical instruments during their worship services.

Ompundja respondents expressed their frustration about not having electricity. Many students have left the area to attend school in Oshakati, a town that is more developed due to electricity. Their education is viewed inferior because of the lack of electricity, a situation which makes them unable to make use of modern technology.

Oshikuku is also one of those settlements, which proves that electricity has the potential to develop the area. It is considered as a main town in the area because it has attracted a variety of goods and service providers, which include banking facilities, dry-cleaners, supermarket and butchery.

Oshifo town is expanding and growing because more people are opting to settle in town. They believe people's livelihood depends on the electricity which in turn has improved their standard of living. Today Oshifo hosts large businesses and private and government institutions.

The majority of the inhabitants of Tsumkwe do not have access to the diesel generated electricity. It caters for businesses, government agencies, schools and around 20 households only.

1.2 Other factors influencing the development

Other factors include roads, telecommunication network, and clean running water, construction, banking facilities, crime prevention agencies, regional offices, medical centres and postal services. Small settlement like Onayena and Ontananga still rely on Ondangwa town for these services. Oshifo has become a tourist destination because of its location.

1.3 Challenges and opportunities before electricity

Work was difficult and took long to finish. Access to wood was (and still is) a challenge to communities especially due to deforestation policy. Business opportunities and growth were limited. Businesses were not meeting customers' needs effectively. Non-availability of electricity affected students' performance in schools. People were forced to travel to nearby towns for their goods and services. People felt isolated from the rest of the world. Businesses were challenged to compete with one another. Most people relied on wood as the main sources of fuel. Women spent hours preparing meals and had little time left to do other activities or spend time with their families. Fire incidences were daily occurrences.

Places like Outapi and Oshikuku had diesel-generated electricity before electrification, which was mainly used by the hospital, church, secondary school and a small number of households.

Seventeen years after independence Omakange is still the same, no development has come to this place. Tsumkwe seems better off than Omakange because they are getting diesel electricity, however in terms of development they are the same.

1.4 Challenges and opportunities now

Although Onayena and Ontanaga are electrified, they lack services like banking facilities and supermarkets. A higher unemployment rate remains a challenge. There is a demand for new connections. Not everyone who is in the electrified settlement has electricity because they cannot afford the connections. People in Onayena travel long distances to buy electricity in Ondangwa, an inconvenient and costly affair. Single-phase connected households experience more power failures than three-phase connected customers.

There are still many households without electricity and they are crying for help. Outapi town has pockets which are not electrified, the electrical wires across the roof of the houses are a potential danger and they look unattractive, there is no maintenance plan or strategy in place, roads and sewerage are not well taken care off. Some people in Outapi town still have that attitude of entitlement, demanding and expecting free services from the town council.

New large and small businesses, infrastructure, hotel and conference facilities and institutional presence are a clear indication that development is taking place in Outapi. These developments are to a large extent made possible by the availability of electricity. However Outapi residents are experiencing either a lack of understanding or communication with NORED. People are not clear what the role of the town council and NORED is.

Oshifo Town Council indicated that they have a plan/strategy in place to provide electricity to all residences. There is no change in the situation of Tsumkwe.

1.5 People's perception of electricity compared to other fuels

People are open to other sources of energy, mainly due to the scarcity wood, poverty and HIV/AIDS pandemic. Although everybody wants electricity, not many can afford it due to their economic status. Hence they are forced to rely on energy sources that are 'cheap' or freely available. People are forced by circumstance to adjust and adapt to new ways/behaviour towards alternative energy sources. Some people are attracted to electricity due the advantages they see in it namely, safety, convenience, efficiency, and that it is readily available. To some it is a status symbol and fashionable. For most women having electricity is a dream come true.

1.6 Fuel switching to electricity from other fuels

Many people are not switching over completely; some are using other fuels as a back-up system while others prefer to use a combination of fuels as a way of saving money. Whether this is factual, it still needs to be determined. The general perception seems to be that food cooks faster on a wood fire than on an electric stove. The use of wood will always be favoured for the Namibian famous braai meat. Those who have single-phase connections are forced to complement it with other fuels in order to meet their energy needs.

People do not seem to have a problem with switching over but admit that it will take a while due to the cultural beliefs and attitude towards this issue. Some are discovering the benefits/advantages of electricity and see no problem with immediately switching over.

1.7 Community perception of access to electricity

LOCALITY	HOUSEHOLDS	BUSINESSES
Onayena	5%	1%
Ontananga	??	??
Outapi	85%	65%
Oshikuku	50%	60%
Oshifo	99%	99%
Tsumkwe	20	3

1.8 Electricity related problems

- In Onayena people have to travel 80km to buy pre-paid electricity cards.

- NORED's inability to respond to power failure promptly.
- NORED is not focused and systematic in their approach, doing piece work all over and by doing that raising expectation which are not met.
- The overhead town reticulation system in Outapi is not legal/safe and unattractive.
- The Regional Council in Tsumkwe spends about N$35,000 per month on electricity-related costs but they are not able to cover even half of their costs. This can partly be ascribed to way the project is run, maintenance cost are carried out by the council alone, it is expensive to run a diesel generator and not all users pay their electrical bills.

1.9 Impacts on income

People's income is improved by improved quality of products and services and meeting the needs of customers. More and more people are becoming self-employed and economically self-reliant. New businesses are coming up like welding, tailoring, hair saloons, barber shops and milling. The small and medium enterprise (SME) initiative by the Ministry of Trade and Industry in collaboration with the Namibian Chamber of Commerce and Industry (NCCI) has assisted entrepreneurs to improve their businesses to become productive and cost effective. It is evidence that people are making use of the opportunities brought about by investors to generate income for their livelihood. Omakange and Tsumkwe emphasized the fact that there is no electricity; development in these areas is hampered, hence the high rate of unemployment.

1.10 Productivity/Processes

Access to telecommunication networks, modern technology, machinery processes to meet targets, greater and new services and goods are all due to the availability of electricity. Sciences student are using electricity to conduct experiments that improve their understanding and ultimately their grades. Electrical equipment and appliances make services effective and efficient which in turn make people productive. The banking facilities in Outapi for instance avail small to big cash loans to business owners to trade with each other and members of the community in a mutually beneficial way. Modern shopping centres are designed such that they have become a one-stop centre for one's needs.

1.11 Employment impact

Electricity boosts entrepreneurship, attracts investors and exposes people to modern technology. As businesses grow, employment opportunities increase. Services on how to write a CV are provided in Outapi, this is an indication that there are vacancies available. Small and medium enterprise (SME) development is another initiative that has provided employment opportunities to people. Outapi is one of the towns that has managed to attract services like banking facilities, government agencies, private institutions and large businesses which have opened up doors for employment in the town. The tourist sector in Oshifo is growing which is also becoming a potential employment creation opportunity.

1.12 Affordability

The community feels that electricity is affordable if it is used economically. Compared to the other fuels electricity is in the long run more affordable. Some people say it is expensive but agree that it is worth having electricity because it is easy to use and reliable. The current nature and condition of fuel in the world will dictate and force people to use one or another fuel irrespective of the cost involved. Using a combination of fuels is believed to be economical but none of the respondents could quantify this perception. Connection fees are a problem for most new applicants because these are high. Affordability of electricity is relative because it depends on the economic status of the users.

Others are of the opinion that electricity has become a scarce commodity, that is why it is getting expensive. Many people cannot live without electricity. People assume that electricity brings development to a town, which in turn creates job opportunities that will eventually enable people to afford electricity. In Tsumkwe some consumers do not pay their bills because they are unemployed; one wonders however whether this is the only reason why people do not pay their electricity bills.

Some argue that if people can afford to buy alcohol everyday then they are also able to afford electricity. It is unthinkable to live in town without electricity.

1.13 Other comments

There is a big outcry in the community for electricity. The Regional Councils find it very difficult to meet all the electricity related needs of their constituencies. If more people can have access to electricity then productivity will increase, more people will produce goods and provide services, more people will be self-employed, many jobs will be created and the town will grow for the benefits of all inhabitants. Having electricity makes life pleasant, comfortable and easy.

Replace 11kV bare overheads lines with underground cabling in Outapi for safety and neatness. Outapi Town Council has awarded a business license for a plot, but development cannot take place because the plot does not have electricity. The Town Council does not have a master plan, which outlines the strategic plan on how to meet the town's growing electricity needs. The relationship between the Town Council and NORED appears to be poor, they are not working together for mutual benefit. The community stressed that NORED is monitoring and maintaining streetlights.

People strongly believe that without electricity there is no development. Omakange has potential for economic growth because it connects people to Opuwo, Tsandi, Ruacana and Kamanjab. Due to lack of electricity developmental projects have been put on hold. The council in Tsumkwe is paying a lot of money for diesel-generated power.

2 Institutional Focus

2.1 Influence of electricity

Electricity influences the learning and development of educational institutions. Schools rely heavily on electricity for processing and operating systems to run the school effectively and efficiently. It influences the telecommunication, which enables them to be on the cutting edge of what is happening around the globe. Schools in Tsumkwe get their electricity from diesel generator to run the school. This electricity is used where the need is crucial like for preparing meals and providing lights for students to study during the evening. It is almost impossible nowadays to run a school without electricity.

2.2 Factors other than electricity that influence development

Other factors that influence development include the decentralization process, infrastructure development (namely telecommunication network, roads) and professional personnel. In towns where there is no electricity development limited or non-existent. Places like Tsumkwe are perceived to have been neglected by not being provided with electricity which is one of the elements that attracts investors and brings about development in a town.

2.3 Challenges and Opportunities before electrification

Any institution needs electricity in order to develop to its full capacity. Doing work manually is proven to be ineffective and inefficient. Without electricity opportunities are very limited. Omakange for instance is strategically positioned because it is connecting motorists to Opuwo, Tsandi, Ruacana and Kamanjab towns. There is no development taking place in Omakange, people travel more then 20 km to get to other towns to buy goods and services, this also applies to patients who have to travel long distances before they get to a health facility. Omakange has a road block at the entrance to the settlement which invisible during the night, posing a danger to motorists. The police station services are not optimized as they have to close their offices at 18h00 when it gets dark. Schools are also not functioning as they should and their performances are negatively affected by the lack of electricity. Currently the school makes use of wood to prepare food for residential students. If the school money runs out the school principal is forced to use his own money to buy candles for the school.

2.4 Challenges and Opportunities since electrification

Institutions have become so used to having access to electricity, and rely heavily on this source of energy. Therefore when there is a black-out these institutions become unfunctional. There is no provision for regular check-up and maintenance of electrical installations, hence damages in wiring or fused bulbs are left in that state for a long time or forever in some instances. NORED does not have a good image in the public's eye, when it comes to responding to call-out or any other electricity-related problems. Another dilemma institutions are facing is uncertainty of who to report electricity problems to, as there are too many stakeholders involved (NORED, Regional Council, Town Council, Department of Works, Department of Education/Health). The lack of or inadequate streetlights is one of the concerns of the institutions. People are of the impression that the demand for electricity is higher than the supply and always wonder whether this has do to with regular black-outs. Sometimes the black-outs are on for days and not many institutions have back-up systems. In the case of Tsumkwe where they make use of a diesel generator, the electricity is available only at certain times in the day and its use is limited. They can only do certain activities during those times. The lack of clean running water is also due to the insufficient electricity supply. Everything in this town comes to a stand still when the generator is switched off or damaged.

2.5 Type of metering

Many institutions were not able to tell what type of electricity meters they are using. Schools for instance do not pay the electricity directly but this is taken care of by the regional education office. Some are of the opinion that they are using the 3-phase metering. In Tsumkwe the diesel generator provides electricity to the whole town.

2.6 Main uses of electricity

Most schools use electricity mainly for electrical equipment and appliances like photocopier and fax machines, computers, printer, air conditioning, telecommunications. Medical centres use electricity for lights, examination devices, for theatre, cooling, cooking. In the case of Tsumkwe diesel generated electricity is mainly used for lights, computers, telecommunication network, printing and photocopy machine.

2.7 Other energy sources used

Medical centres use diesel generators as back-up system, cook mainly with gas stoves. Some Government agencies use solar energy as an alternative source of energy. Schools in unelectrified settlements use wood, candles and paraffin.

2.8 Money saving

Most institutions operate as satellites offices and their operational budgets are managed from their head offices. They are therefore not able to tell if they are saving money with electricity. Some had electricity since their inception, making it difficult to tell whether or not they are saving by using electricity compared to other sources of energy. Tsumkwe was able to specify the margin but are convinced that the diesel generator is costing them a lot of money. They are looking forward to have grid electricity, which they believe is cheaper than diesel.

2.9 Problems encountered

Generally no serious problems are experienced except the regular black-outs. In some areas the demand is believed to be higher than the supply.

2.10 Net income/efficiency improvement

Modern technology like the use of internet has improved efficiency drastically. The use of electricity is convenient and makes life easy. More customers are attracted and retained because services are efficient. Jobs are streamlined, with human effort having been replaced by machines which bring the institution's overheads on personnel costs down.

2.11 Productivity/Processes

The availability of electricity attracts qualified personnel to rural areas. School academic performances can only compete with other schools if they are using modern technology that relies on electricity. Effectiveness and productivity has improved as a result of having electricity. Systems, modern equipment and machines need electricity to operate consistently in order to reach maximum targets of the institution. Nampost, for instance, has introduced the 'smart card' concept, an electronic system that manages financial transactions efficiently and productively. Today medical institutions make use of modern technology in order to deal with 20th century diseases. Tsumkwe reports that investors had shown interest to develop the settlement but due to the lack of electricity they have lost these opportunities.

2.12 Employment impact

The availability of electricity has a definite positive impact on employment. As businesses expand so are more jobs created. A certain school had to hire a special teacher to teach computer skills. More and more people have become self-employed due to the availability of electricity. Availability of electricity also attracts investors to develop the area, which in turn brings about employment creation.

2.13 Affordability of electricity

It is affordable if one uses it responsibly. Institutions can afford it because they are run like a business hence it is an expense that is budgeted for. More people desire to have electricity because

the use of wood (which is considered as the traditional source of energy) has became scarce and expensive. Some people who can afford electricity are not situated where the power lines are being put up.

People in the unelectrified areas believe that electricity is affordable because the use of wood, candles, gas and paraffin are both inefficient and expensive. Tsumkwe is not convinced that it is cost effective to supply a town with electricity generated by diesel machine. In settlements where there is a higher rate of unemployment it is not affordable. The availability of electricity has the potential to create and expand businesses, which will in turn create job opportunities.

2.14 Monthly electricity expenditure

Few institutions were able to estimate their average monthly electricity expenditure because their operational budget is managed by their head offices. Nampost indicated that they pay a minimum of N$1,200 and a maximum of N$1,800 per month. The Outapi Hospital pays N$50,000 per month. The Tsumkwe Police station pays N$15,000 per month, while the schools pay N$2,000 per month.

2.15 Electricity expenditure as % of total overheads

Institution could not respond to this question as their budgets are managed by their head offices. The Outapi Hospital gave an estimate of 2.5%.

3 Business Focus

3.1 Electrification influence on business development

Electrification has generally had a positive and favourable influence on businesses. Connected businesses are using electrical equipment and systems like the music box and gambling machines, amongst others, to increase sales. Access to electricity has also enabled businesses to provide a bigger variety of goods and services, which in turn attracts customers. Shops are able to sell fresh perishable food and cold drinks and are open until late at the night.

3.2 Other factors influencing business development

Growing customer base, improved employment opportunities, better infrastructure in place (amongst others good roads, effective telecommunication, office buildings, open markets, modern technology, clean running water, migration of people to town, business competitiveness).

3.3 Challenges before electrification

Before electrification businesses used mostly gas and/or diesel generators, which is perceived as expensive compared to electricity. Candles were used for lighting. Customers left when it was getting dark. Used to sell drinks at room temperature and 'old' food. Business opportunities were limited because of the limited variety of goods and services that could be offered, the effectiveness and efficiency of the business was hampered. Lack of access to telecommunication was a big challenge in the past.

3.4 Opportunities after electrification

All the challenges mentioned above can be met with electricity.

3.5 Type of metering

The small and medium business use pre-paid electricity while large businesses make use of the 3-phase electricity. Some businesses use a combination of both types.

3.6 Main uses of electricity

The electricity in businesses is mainly used for entertainment machines like the gambling machine, lights, electrical equipment like refrigerator, air condition, charging cell phones, alarm system, hot plates, freezers, HiFi and radio.

3.7 Other fuels used by businesses

Other energy sources include wood, gas, candles, paraffin and diesel. Shops will use candles or paraffin lamps to light and wood and gas to cook with. Diesel generators are used as back-up.

3.8 Money saving due to electricity

Generally there is a strong perception that electricity is the cheapest energy source compared to other fuels, but people are not able to quantify how much cheaper it is. In order to keep electricity bills low some businesses use a combination of energy sources e.g. cooking with wood or gas and electricity for lights. Some were of the opinion that gas is cheaper than electricity but have opted to acquire electricity of its multi purpose use nature. Most people are not aware how much they are saving by using electricity instead of other sources of energy. However they desire to have electricity in their business and home because it is convenient, easy to use, efficient and effective.

3.9 Electricity-related problems

Problems encountered by all are regular power failures and NORED's irregular response to rectify the problem. Regular power failures are bad for business because they damage perishable food and some electrical appliances. During the rainy season the problem of power failure gets worse.

3.10 Improved business income

All business owners agreed that electricity has the potential to increase their profit. They are of the opinion that one can only attract customers if you are meeting their needs and providing quality goods and services. Business owners are able to expand their businesses due to the availability of electricity. Entertainment equipment, like gambling machines, is widely used to attract customers and increase the income. Electricity has increased the confidence of customers in their local suppliers because what bigger towns can offer is also available locally. Business owners in settlements which are unelectrified feel that they are at a disadvantage compared to their electrified counterparts. . Without electricity business expansion or diversification is limited or impossible.

3.11 Improved productivity/processes

Businesses have acquired electrical equipment and appliances to run their businesses smoothly and productively. The cash register for example helps to manage their transactions in a more effective and efficient way.

3.12 Employment impact

New business opportunities result in employment creation. The availability of electricity has caused some business owners to expand their businesses, adding 1 or 2 employees to their existing staff complement depending on the performance of the business. Some businesses are too small and only need 1 employee. Business owners in unelectrified areas are optimistic that there is a great potential to employee more people as the availability of electricity allows them to expand their businesses.

3.13 Affordability

All business owners perceive electricity as affordable. This perception is not based on any comparable calculation of the usage of a variety of energy sources. Some have stated that electricity has become expensive lately but prefer to continue using it because it is convenient, safe and reliable. Some prefer to use a combination of two energy sources, for example using electricity for cooling and lights and using wood for cooking. Operating in this manner makes it difficult to judge whether or not you are able to save if you use one specific source of energy compared to another. Business owners believe that it is a must for a business to have electricity because it is the only efficient and effective source of energy.

3.14 Business average expenditure

Average monthly electricity expenditure depends on the size of the business. Small businesses estimate to have their electricity expenses ranging from N$200 – N$300 per month. For large businesses it is estimated at N$10,000 on average.

3.15 Electricity costs as % of total overheads

Most business owners were not able to provide the percentage of their business' total overheads for electricity. Some provided estimates ranging from 2% – 10% but were very unsure.

4 Electricity Focus

NORED staff in Ondangwa and Outapi were interviewed for this focus area.

4.1 Type of services offered

Pre-paid sales, maintenance and connections

4.2 Staff complement at stations

Ondangwa: 9 staff members
Outapi: 6 staff members and 2 on attachment for 6 months

4.3 Number of localities serviced by this office

Ondangwa: 15 localities
Outapi: the whole Omusati Region

4.4 Number of electricity consumers by type

Ondangwa: max demand is approx. 300
Outapi: do not know

4.5 Number of customers served per week on average

Ondangwa: approx. 65
Outapi: 20 in winter and 50 in summer

4.6 Value of pre-paid electricity sales per week on average

Ondangwa: approx. 43
Outapi: not able to tell

4.7 Average pre-paid purchase per customer (N$ or kWh)

Ondangwa: N$50 or 68kWh
Outapi: 230kWh

4.8 Number of power outages experienced per month on average

Ondangwa: approx. 37
Outapi: 5 times especially during winter

4.9 Primary reasons for these outages

Ondanwa: During rainy season, overloads, damaged cables
Outapi: Lightening, damaged cables

4.10 Length of time taken to restore power supply on average

Odangwa: within 3 hours
Outapi: in town 20 minutes and outside town 40 minutes

4.11 Time and staff availability to respond to calls for repairs and maintenance

Ondangwa: soonest depending on staff availability

Outapi: NORED has a call center in Ongwediva, they notify technicians by cell phone and depending on staff availability they respond

4.12 How could quality of supply be improved?

Ondangwa: It has improved recently because more customers have been fitted with new prepaid meters

Outapi: Do periodic/scheduled maintenance and not just respond to call-outs

4.13 Number of unelectrified HH in the area

Ondangwa: approx. 917

Outapi: 5%

4.14 Number of applications for connection received per month on average

Ondangwa: approx. 96

Outapi: not sure

4.15 Number of new customers connected per month on average

Ondangwa: approx. 50

Outapi: 20

4.16 Main electricity-related problems encountered

Ondangwa: objects thrown over power lines

Outapi: The connection is very expensive to most people, shortage of staff to take care of proper maintenance and to allocate specific tasks to teams.

APPENDIX J: FOCUS GROUP DISCUSSION RESULTS

The responses presented in this section refer to the questions posed in the focus group discussions. These questions can be found in the FGD interview guidelines in Appendix K. Focus groups varied between 3 and 8 persons in size.

FOCUS GROUP DISCUSSION 1:

Category A: Mixed Group (HH members, men and women) - OUTAPI

Fabius Erastus	Self-employed	Male
Michael Mwahafa	Self-employed	Male
Saima Williams	Self-employed	Female

1. The respondents agreed that electrification have influenced development in their community. The town has grown over the last couple of years. Most services are available in Outapi, meaning people do not have to travel to Oshakati. More people are self-employed running their own businesses or having people work for them. Shops/bars and cuca shops are able to sell cold drinks to customers. There are also those who are doing welding, burglar bars and beds. There are now telephones (land line and cell phone) making it possible for people to communicate with others. The hospital was also extended to be able to cater for the town. Businesses are able to open until late.
2. The increase in service providers.
3. Outapi was just a village but now it is a town. All of the service except the hospital, schools and church were only available in Oshakati.
4. There are so much opportunities now, the town is growing and fully developed to serve the community. Challenges are still those who don't have access to electricity even though they live close to the town
5. Electricity has helped to improve the standard of living. People have access to electricity for whatever they need. People are now able to own TVs, VRC, Hifis, computers and many other electrical types of equipment. People are able to relax and do other chores instead of spending time either collecting water or fire wood. Children in school have access to modern technology and learn many things.
6. More men have better employment opportunities which have been created because of electrification. More women are self-employed generating income for themselves. Children have better conditions at school. Those in high grades are able to have study sessions in the evening and have access to computers to learn new skills which will able to help them in the future. More people are now having access to TVs, able to keep up the current affairs in the country and outside.
7. There was electricity in Outapi but only a few had access to it. After independence when more people had access to it, cuca shops/shebeens/bars were established at a faster rate. Suddenly everyone had a business. More people also came to settle in Outapi, as the population grow so did the businesses.
8. All the services providers in Outapi have employed people, even though some are not from Outapi a great number of them are. There are so many businesses in Outapi. Outapi is a town with many opportunities and is still growing.
9. All the respondents agreed that electricity is, easy to use, reliable, convenient, safe time and it is safe.

10. All agreed that electricity is very expensive. Most people are using it for lighting and still use fire wood for cooking. More people are complaining that the units do not last. Pre-paid electricity is closely available and the procedures to apply are easy. The only problem is only if you don't have money to buy the electricity box to be put in your house or business. The town experience black-outs frequently especially when it is raining or when it is windy. This is a problem that they are experiencing every year but NORED is now doing anything to improve the situation. Sometimes one has products in the fridge that might be spoiled and the power goes off for a whole day. NORED is however quick in responding to complaints.
11. Because electricity is expensive people mainly use it for lighting and for the fridge. People are still using fire wood for cooking. Fire wood has also become scares because there are now many people living in Outapi, the town is overcrowded.
12. There are now fewer accidents caused by fire. But these types of incidents are still happening in the villages where there is no electricity. Having electricity is safe unless people are tampering with the wiring.
13. There are still more people using fire wood for cooking. All three respondents indicated that they are not sure whether people really do know that smoke caused respiratory problems.
14. Where there is light, the robbers a hesitant to come. Having electricity have decreased the risk of theft. But when the town had a black-out, the next morning one will hear about a certain shop which was broke in. So having electricity is contributing to safety.

FOCUS GROUP DISCUSSION 2

Category A: Mixed Group (HH members, men and women) - OUTAPI

Luise Shiimi	Self-employed	Female
Hilde Angala	Self-employed	Female
Werner Kapiya	Self-employed	Male
Louisa Endjala	Self-employed	Female
Tuyenikalawo Paulus	Self-employed	Female
Emilia Naunyango	Self-employed	Female
Lazarus Nanyala	Self-employed	Male
Cornelia Iiyambo	Self-employed	Female

1. More people own electrical equipments. More people are self-employed, having businesses such as cuca shops, bars, hair salon, stationery shops, sewing, cooking food and one who indicated that she owns a "zone machine", equipment used to take eliminate bad chemicals out of the body. Customers have access to cold drinks and they are able to but products such as better, milk, cheese and meat. There is a big hospital and people don't have to travel to Oshakati for medical care unless it is critical. There are enough schools. All different type of service providers are available.

   One respondent raised her concern that is only those who are living in the centre of Outapi are benefiting from electricity. She added that there are those who are part of Outapi and live on the outskirt but are not provided with electrification.
2. One of the participants indicated that the different people from all walk of lives are in Outapi. With mix cultures, people are learning from each other and this is also part of reconciliation.
3. All agreed that none of the issues mentioned in Q1 could be possible without electrification. People had to travel to Oshakati if they need access to the bank.
4. Those living in Outapi are okay, the problems is those who are on the out skirt. This people also need opportunities, they need to establish business for income. Some are even question whether they are really independent if they are still living in darkness. More people are moving to Outapi town looking for opportunities because there is no electrification in the rural area.

   The town council is demand people to build cement houses instead of corrugated iron in order to keep the town clean and neat. But those who are living in Outapi and do not have electricity are asking, "how can you live in a cement house if you don't have electricity?"

   NORED should try to solve the frequent power failure especially when it is raining or windy. Sometimes no notice is given when the technicians are repairing. They are also asking why the power station for Outapi is in Tsandi/Onesi. Outapi is a big town and should have its own power station. When there is power failure in Tsandi/Onesi than it affects Outapi. NORED is also at fault because some of the poles have been erected close to tree and when the branches get in contact with the wiring than there is power failure. NORED should increase the voltage to accommodate the whole town and to have less of these power failure incidents.
5. Those living in Outapi have better standard of living because they have access to everything that use electricity. They have access to modern technology and they are progressing in term of acquiring new knowledge and skills.
6. The children are benefiting in a positive way. Some schools have access to computers and this is good for the children for learning new skills. Every one regardless of the gender is benefiting from electrification. Men and women have different needs and different benefits.
7. Businesses have increase fast in Outapi. More people are self-employed and this is good for the economy of the town. More parents are able to send their children to school and also to study further. Another good factor is also that having more businesses creates competition

and prices of goods are decreasing. Electrification needs to be provided to the rural areas this will also create business opportunities.

8. The establishment of business, different government institutions and private sector using electricity has created employment opportunities. Some of these institutions provide different services thus required different skills such as computer, technician and others.
9. The participants indicated that they like electricity because it save time, it is safe compare to other energy sources, reliable and convenient.
10. Electricity is very expensive; all agreed that the units get finish faster. The main problem is the meters which have been allocated by NORED on who get free wiring. This policy is hindering people from having access to electricity. In some cases NORED is asking people to buy the transmitter which worth N$30,000.00 and then at the end of the day it become their properties. Because of these kinds of challenges and expenses people opt to use other energy sources such as the solar system and other fuels. A question was raised on how NORED determine pricing and who must pay. Somehow there is corruption within NORED. They are reaping people off.
11. There are still many people using fire wood for cooking because electricity is expensive and people are using it sparingly.
12. It is safe to use electricity and incidents associate with electricity are minor compare to other fuels.
13. Using electricity is safe, clean and doesn't cause pollution which is what is causing different type of diseases like cancer and respiratory problems.
14. Having electricity is making it difficult for robbers to commit criminal activities. The provision of street light is and would able people to work freely with fear.

FOCUS GROUP DISCUSSION 3

Category A: Mixed Group (HH members, men and women) - OMAKANGE

Petrina Asino	Self-employed	Female
Lucas Asser	Self-employed	Male
Hilma Aupindi	Unemployed	Female
Matheu Shimpingana	Self-employed	Male

1. There is no development in Omakange. There are no major shops, no clinic none of the government institutions except for the school and police station. The police station is a tent.
2. There is no development in the village.
3. No applicable.
4. There are no opportunities. The challenges are that people have top travel far to health facilities. There are no major shops. No petrol station. There is an investor who wants to build a service station and a lodge but this have been put on hold because of no electrification. There are no employment opportunities if they can get electricity it will attract investors and in this way employment would be created.

   People in Omakange are behind wit many things. They don't have access to modern technology not even TV to keep up what is happening in the country.
5. If they have electricity, it will help improve the standard of living. The children at the school who are in the hostel these poor children have to wake up in the early hours of the morning to make fire and heat water for bathing. The children have to do their homework and studies using candles and paraffin lamps. People do not have enough time to socialize because it get dark quickly and everyone have to go home.
6. No applicable.
7. No businesses opportunities as there is no electricity.
8. Electricity would be able to help create employment and income. When the petrol station and lodge is build this will create employment for the people. The opening of the clinic which will be soon will also create employment.
9. If they have electricity, some people might open up their own businesses to be self employed, it will be safe to use, it will be convenient and people will not spend many hours collecting fire wood. The children at school will be able to study whenever they want and will be able to enjoy bathing with warm water like all other children.
10. Not applicable.
11. Not applicable.
12. Having electricity will make homes safer as they will not use candles and paraffin lamps which is dangerous.
13. If more people are using electricity, it will there will be less air pollution but not sure if have any effect on health because people have always live in this condition and they were always healthy.
14. The crime rate in Omakange is very low but it will make the village safer if they perhaps have street light.

FOCUS GROUP DISCUSSION 4

Category B: Women's Group (HH members and others) - OMPUNDJA

Albertina Negonga	Unemployed	Female
Inona Iiyambo	Unemployed	Female
Jacobine Sheetekela	Self-employed	Female

1. There is no electricity in Ompundja.
2. nothing
3. No applicable.
4. People are crying out for electricity. There is no development in Ompundja. There are no employment opportunities. There are people who have attended course in cooking, sewing and welding but they are not able to use the skills as they required electrification. People are not able to drink cold drinks because the shops are not able to sell cold products. The women church group is not able to have meeting or gathering in the evening as there is no electricity.
5. Electricity would help improved the standard of living. Learners would have access to computers and able to have afternoon classes and study sessions. With employment opportunities, people would be able earned an income and improved their lives.
6. No applicable.
7. No businesses opportunities as there is no electricity.
8. There are no employment opportunities but having electricity would create employment. Maybe some government office will be brought the village and people would be employed. Having electricity will also be able school to recruit secretaries would be answering telephones and also work on the computers.
9. It will be safe to have electricity. It will be reliable and convenient.
10. Not applicable.
11. Not applicable.
12. Homes will be safer no fire incidents which is normally caused by candles or paraffin lamps.
13. Participants indicated that it will contribute to better health because more people will use electricity instead of fire wood.
14. Not applicable.

FOCUS GROUP DISCUSSION 5

Category A: Mixed Group (HH members, men and women) - OSHIKUKU

Maria Amunime	Employed	Female
Dorethea Nangolo	Self-employed	Female
Matheus Martinus	Unemployed	Male
Joseph Alisius	Self-employed	Male
Gisella Mwanyangapo	Employed	Female

1. Having electricity have made Oshikuku look like town, especially when driving through in the night one would be able to see that you have approached a town. More people are either employed full time or self employed. The establishment of the new town council office; the extension to the hospital adding on new department has also created employment. The new shoprite super market taking off the burden of travel up and down to Oshakati for shopping. The *omahangu* crusher, taking the load of pounding from women and young girls.
2. Some of the government institutions and also private sector employed people from other town such as doctors at the hospital; this is also part of development.
3. Having no electricity interfered with the development of the town. Most of the services that they people needed were only available in Oshakati.
4. Everyone should have access to electricity this will given everyone equal opportunities to work for themselves or someone else.
5. It has but it should be noted that electricity is very expensive and not everyone can afford it. NORED should revisit the tariffs so that everyone can have access to electricity.
6. Everyone is equally benefiting from electricity.
7. The new shoprite is evident that the town is developing and this would not have been possible if there was no electricity. More people are setting up businesses.
8. More people are self employed or full time employed. There are so many opportunities for everyone who is able to generate income for themselves.
9. It is safe, easy to use and reliable.
10. The procedures to get electricity is quick as long as you have the money required. The only problem is the power failure which happens regularly. During the rainy season and when it is windy it is worse but fortunately NORED is quick to respond to complaints.
11. Even if there is electricity, people will probably always use fire wood as a secondary source when they either don't have access to electricity or not able to recharge their electricity cards. It will be very difficult to break the cycle of using fire wood as it is something that have been there for many years.
12. Those that have electricity a safe but there are still people living in Oshikuku who do not have electricity and can be affected by this incidents.
13. The participants agreed that inhaling smoke is not good for ones health. But that there are still many people using fire wood, those who do not have electricity and also those who is using it sparingly.
14. Now that most shops in Oshikuku have electricity, crime rate have also dropped. Shop owners always leave the light on when they go home making it very difficult for the thieves to break in.

FOCUS GROUP DISCUSSION 6

Category A: Mixed Group (HH members, men and women) - OSHIFO

Namutenya Eilo	Employed	Female
Nekways Mikaela	Employed	Male
Ruusa Niipindi	Employed	Female

1. Almost everything depends on electricity. There are more people who have moved form the rural areas to Oshifo and this is mainly because of electrification and the opportunities which come along with it. They have a big hospital, banks, police station and other government institutes.
2. The lodges close to Oshifo has also an influence on the development of the town as the town council will be forced to better manage the town as more tourists visiting the lodges will visit the town.
3. There where not many shebeens/bars. People did not have access to cold drinks. There were no hair salon, no banks
4. No major challenges. The town is expanding creating job opportunities.
5. People have access to experienced many things because of electricity. More people especially the young one have cell phone, DVD and other electrical equipments. Even though the town is very far with electricity people are on the same level like those who are in bigger towns.
6. The young children are learning from an early age new things through the TV. Children are learning better in school because teachers are up to date with information form the internet. More women are self-employed selling *kapana*, sewing clothes, doing hair and selling of alcohol. A few men are involved in welding, car repair and other activities. Everyone is positively benefiting from electricity.
7. There are many businesses. More people are self employed as there are not many job opportunities in government institutions. Most people are those who have failed grade 10 many years ago and never had the opportunity to further their studies. If there was no electricity there will be a few businesses.
8. Same as Q7
9. Having electricity make everything easier. It is easy to use and also able people to own electrical equipments.
10. Participants indicated that they are happy with the service provided. They occasionally experience power black-out but not very often.
11. Even though people have access to electricity because it expensive and not everyone earned a good salary, people will always use fire wood especially for cooking.
12. In the town, cases of fire incidents are not heard off but in the rural areas people are losing their assets on a daily basis due to fire incidents caused by candles.
13. Many people are complaining that electricity is very expensive and mostly for cooking they are still using fire wood. So maybe health will always be an issue as long as the electricity is expensive.
14. There are still criminal activities being committed but having electricity decrease the risk. There are street lights in some of the streets but not all of them are functioning.

FOCUS GROUP DISCUSSION 7

Category A: Mixed Group - Onayena

Wilika Amaambo	Chief Clerk	Female
Simeon Shikongo	OVC official	Male
Lahja Mbwalala	HIV coordinator	Female
Selma Nuugulu	Cleaner at PS	Female
Simon Hango	Swapo coordinator	Male
Aktofeli Indongo	Forestry official	Male

1. Has enabled us to use electrical appliances, access to technology which provide a learning environment, new business opportunity been created provide access to services like printing shop, job opportunity created, Access to computers, access to clean water, children has more time to spent on their education and have fun
2. Construction business providing homes for people, Business providing employment to people, availability of public transport taxis, .
3. There where not many shebeens/bars. People did not have access to cold drinks. There were no hair salon, no milling machines, no copy machine, no entertainment during the night, no telecommunication
4. Having to buy the pre-paid electricity card at Ondangwa, it is far and you need transport fare, people are not notified in good time about cut offs.
5. Yes, improved passing rate, education system has improved, improved health status, improved quality of food
6.

Women	Men	Children
Cooking is easy and timeously, access to clean water, access to milling machine - more free time to do other things l	Father spent time at home with family watching TV, Barber shop for grooming, Ironed clothing, opportunity created to use modern technology - welding	Have more time to play and study, expand knowledge through watching TV, Exposure to technology like computers – easy access to information, life much easier

7. There are many businesses. More people are self employed as there are not many job opportunities in government institutions. New businesses include mini markets, welding, saloons, entertainment activities like music box, gabbling, saving services at Nampost, employment opportunities are created
8. Same as Q7
9. Schools which do not have electricity are lagging behind and are not able to attract professional personnel, promote deforestation, attract investors, improved telecommunication,
10. NORED is far from them, all business dealings are conducted in Ondangwa, they provide bad service – making people to wait for long before they react to their queries, bleak outs are not notified in good time, connections are expensive, black out damage electricity appliances, their response to repairs are good.
11. Improved deforestation, helped prevent hazardous incidence like fires, paraffin and gas
12. Same as 11
13. Improved quality of food
14. No street lights to help reduced crime, new police station provide a safer environment

FOCUS GROUP DISCUSSION 8

Category A: Women Group - Outapi

Susanna Nekondo	TC licensing officer	Female
Rauna Kalenga	PA to TC CEO	Female
Julia Shaanika	Admin clerk TC	Female
Agripine Sheimi	Labourer	Female

1. Petrol stations, bank services, use of elec. Appliances, street lights, business diversification.
2. Telecommunication and network coverage, computer training institution, medical center, shopping centers, access to clean water
3. Criminal activities, house fires, underdeveloped, scares wood
4. Black outs caused by rain, black outs are often has a devastating effect on business
5. Fresh food, effective and efficient way of cooking food, improved health status, leisure time, improved school results, night entertainment
6.

Women	Men	Children
Cooking is easy and timeously, lightening is easy, easy ironing, use of radio and TV, using washing machine and saving time	Ironed clothes, barber shop for grooming, opening up new businesses	Able to study during the night, watching TV, educational opportunities like computer training,

7. Construction companies, Barbershops, Milling machines, sophisticated open markets, salons, tailoring, ice-cream palour
8. More jobs created, more people self employed
9. Lightening, computer use, kitchen appliances
10. Pre-paid is available 24/7, urgent response to maintenance need be improved,
11. Fewer people depending on wood because it is scares and expensive, but most people pefer to cook with wood, Those without elec. Depend heavily on wood, Wood industry has open up because people do not fetch wood anymore but buy
12. more safer, chances are rare
13. Health hazardous, cleaning of homes, street lights prevent people to use toilets, clean running water, light in the home to clean properly
14. street lights

FOCUS GROUP DISCUSSION 9

Category A: Mixed Group - Outapi

Monika Andjamba	Owner of shop	Female
Pedro mayumbi	Owner of shop	Male
Johny Sheedelwako	Owner of shop	Male
Veronika Nepembe	Owner of shop	Female

1. Running the business until very late in the night, selling fresh and cold drinks
2. TC provide services – new business area has been developed, construction of houses, street light not enough, sewage system is needed
3. Black out very often, supply is insufficient, most small business can only afford one phase which is not enough given he many appliances they are using
4. The increase in electricity consumption is frequent and higher
5. Most shops use one hase which is not sufficient
6. Dee freezers,big fridges, stove light
7. Wood to spent little on elec.
8. It is getting expensive
11. effective and efficient
12. yes
13. not anymore
14. 600-1000 N$

APPENDIX K: SURVEY INSTRUMENTS

Household Questionnaire
Key Informant Interview Scheets
Focus Group Discussion Guideline

Household Questionnaire

(for both electrified and unelectrified households)

ENUMERATOR: .....

1 Settlement: ..... **2 Questionnaire #:** ..... **3 Date:** ...../...../2007

Respondent details

4 Gender: a☐ Male b☐ Female

5 Age: a☐ <20 years b☐ 20 – 30 years c☐ 30 – 50 years d☐ >50 years

6 Education: a☐ None b☐ Primary school c☐ Secondary school d☐ Tertiary

7 Relation to household head: a☐ Person is head b☐ Spouse of head c☐ Other adult

Household details

8 How many people live here? **a) adults:**..... **b) children?** .....

9 How many structures on this erf? ..... **10 How many rooms in total?** .....

11 What are structures made of? a☐ cement brick b☐ wooden sticks c☐ corrugated iron d☐ mud/clay brick e☐ other: .....

12 Household electrified? a☐ Yes b☐ No

13 If no, would you like to have electricity? a☐ Yes b☐ No

Household income

14 How many household members living here have paid employment? .....

15 How many household members are self-employed? .....

16 What is this household's expenditure/income per month? N$.....

17 Does the household own a car? a☐ Yes b☐ No

Electrified households

18 How long have you had electricity? .....

19 Do you have electricity in all structures? a☐ Yes b☐ No

20 Do you have electricity in all rooms? a☐ Yes b☐ No

21 Is the house wired or do you have a ready board? A☐ Wired b☐ Readyboard

What fuel do you use for:

		Electricity	Wood	Gas	Paraffin	Dung	Candles
22 Cooking	First	a☐	b☐	c☐	d☐	e☐	
	Second	a☐	b☐	c☐	d☐	e☐	
23 Water heating	First	a☐	b☐	c☐	d☐	e☐	
	Second	a☐	b☐	c☐	d☐	e☐	
24 Space heating	First	a☐	b☐	c☐	d☐	e☐	
	Second	a☐	b☐	c☐	d☐	e☐	
25 Refrigeration	First	a☐	b☐	c☐	d☐	e☐	
	Second	a☐	b☐	c☐	d☐	e☐	
26 Lighting	First	a☐	b☐	c☐	d☐	e☐	f☐
	Second	a☐	b☐	c☐	d☐	e☐	f☐

27 HiFi/TV a☐ Electricity b☐ Batteries

Appliances

28 What electrical appliances do you own?

a☐ Lights
b☐ Electric iron
c☐ Hotplate
d☐ Stove
e☐ Radio/HiFi
f ☐ Television
g☐ Refrigerator
h☐ Electric fan
i ☐ Others/specify .....

29 What others do you own?

a☐ Paraffin refrigerator
b☐ Gas refrigerator
c☐ Wood/coal stove
d☐ Paraffin stove
e☐ Gas stove
f ☐ Solar stove
g☐ Paraffin lamp
h☐ 3 stone fire place
i ☐ Non-electric iron

30 How do you usually acquire your more expensive appliances (like TV, refrigerator, etc)?

a☐ Buy them second hand b☐ Buy them with cash
c☐ Buy them on lay-bye d☐ Buy them on hire-purchase (HP)
e☐ Given by a friend or relative

31 What appliances do you plan to buy in the next 2 years?

.....

Wood use

32 Does your household collect wood from this area for cooking? a☐ Yes b☐ No
33 If so, how often does your household collect wood? Every..... days
34 How long does each trip take? ..... (indicate time)
35 Do you use less wood now that you have electricity? a☐ Yes b☐ No
36 Does your household ever buy wood? a☐ Yes b☐ No

Expenditure on energy:

37 How often do you buy a) wood? ..... b) electricity? .....
c) paraffin? ..... d) gas? .....
e) candles? ..... f) batteries? .....

38 How many bundles of wood to you buy at a time? .....
39 How much do you pay per bundle of wood? N$ .....
40 What amount of electricity do you buy at a time? N$..... max N$..... min
41 Do you think that having electricity has made your life easy/convenient? a☐ Yes b☐ No
42 Do you think that having electricity has saved you money? a☐ Yes b☐ No
43 If so, can you estimate how much money it saves you per month? N$ .....
44 How much of the following do you buy at a time (size of container/packet)?
a) paraffin: ..... b) gas: ..... e) candles? ..... f) batteries? .....

Likes and dislikes

45 What three things do you like most about electricity? (number in order)

- a☐ Cheap
- b☐ Safe
- c☐ Clean
- d☐ Easy to use
- e☐ Allows you to do more things
- f ☐ Saves you time
- g☐ Streetlights

46 What three things do you not like about electricity? (number in order)

- a☐ Expensive to use
- b☐ Dangerous to use
- c☐ Expensive to buy appliances
- d☐ Difficult to use
- e☐ Difficult to buy tokens
- f ☐ Electricity is unreliable

47 Is it convenient to buy pre-paid electricity in this area? a☐ Yes b☐ No

48 If not, what would you prefer? .....

.....

49 How important are streetlights/area lights for you? a☐ Not b☐ Fairly c☐ Very

Safety

50 Have you ever had a fire in your house? a☐ Yes b☐ No

51 What was the cause of the fire? .....

52 Was this before or after you got electricity? .....

53 Has anyone ever been burnt by paraffin or gas? a☐ Yes b☐ No

54 Was this before or after you got electricity? .....

55 Have any of your children ever been poisoned by paraffin? a☐ Yes b☐ No

56 Have such hazardous incidences motivated you to acquire electricity? a☐ Yes b☐ No

57 Has electricity improved the safety of your home and children? a☐ Yes b☐ No

58 Have you ever had an accident with electricity? a☐ Yes b☐ No

59 If yes, what was the cause of the accident? .....

.....

60 What three things are most important to you and your community? (in priority order)

a) .....

b) .....

c) .....

61 Notes

KEY INFORMANT QUESTIONNNAIRE
CATEGORY A: COMMUNITY FOCUS

To be used for the following respondents:

- ✓ *Regional Governors*
- ✓ *Town/Village Council leaders*
- ✓ *Traditional leaders*
- ✓ *Mission Station heads*
- ✓ *Church ministers/pastors*
- ✓ *Community organizations (CBOs)*
- ✓ *Development aid workers (NGOs)*

ENUMERATOR: ……

Settlement: …… **Questionnaire #:** …… **Date:** ……/……/2007

RESPONDENT NAME AND POSITION: ……

1 How has electrification influenced community development in your area?

……

……

……

2 What other factors have influenced community development in your area?

……

……

……

3 What were the main challenges and opportunities for communities before electrification?

……

……

……

4 What are the main challenges and opportunities for communities now?

……

……

……

5 What are people's perceptions of electricity in relation to other energy sources?

……

……

……

6 Are people switching to electricity from other fuels (wood, paraffin, gas, candles, etc) and why/why not?

……

……

……

7 What percentage of households and businesses do you estimate to be electrified in your area?

a. Households: …… b. Businesses: ……..

8 What are the main electricity-related problems encountered in your area?

……

……

Micro-economic indicators

9 Has electrification improved people's income generation potential? (yes or no) ……..

In what way? ……

……

10 Has electrification improved productivity? (yes or no) ……. What new processes/businesses have been introduced as a result of electricity, that couldn't be done without electricity?

……

……

……

11 How has employment improved as a direct or indirect result of electricity?

……

……

……

12 Is electricity affordable in relation to other energy sources?

……

……

……

13 Other comments on income/productivity/employment/affordability?

……

……

……

……

KEY INFORMANT QUESTIONNNAIRE
CATEGORY B: INSTITUTIONAL FOCUS

To be used for the following respondents:

- ✓ *School principals*
- ✓ *Heads of school hostels*
- ✓ *Clinic nurses*
- ✓ *Hospital superintendents*
- ✓ *Agricultural extension officers*
- ✓ *Department of Water Affairs staff*
- ✓ *Police station staff*
- ✓ *Department of Works staff*

ENUMERATOR: ……

Settlement: …… **Questionnaire #:** …… **Date:** ……/……/2007

RESPONDENT NAME AND POSITION: ……

1 How has electrification influenced development of your institution?

……

……

……

2 What other factors have influenced development of your institution?

……

……

……

3 What were the main challenges and opportunities for your institution before electrification?

……

……

……

4 What are the main challenges and opportunities for your institution now?

……

……

……

5 Does your institution have a☐ Prepaid metering? b☐ credit metering?
c☐ a single-phase connection? d☐ a three-phase connection? e☐ a maximum demand meter?

6 What are the main uses of electricity in your institution (list appliances/equipment/machinery)?

……

……

……

7 What other energy sources/fuels does your institution use, and for what applications/uses?

……

……

8 Did electrification bring about money savings for your institution? Can you quantify these?

……

……

9 What electricity-related problems are encountered by your institution? (quality of supply and safety issues)

……

……

Micro-economic indicators

10 Has electrification improved your institution's efficiency (doing the same things with fewer expenses and/or staff?
a☐ Yes b☐ no

In what way? ……

……

11 Has electrification improved effectiveness/productivity? (yes or no) ……. What new processes have been introduced as a result of electrification, that couldn't be done without electricity?

……

……

……

12 Has your institution employed additional or less staff as a direct or indirect result of electrification?

……

……

……

13 Is electricity affordable in relation to other energy sources?

……

14 What is your institution's average monthly expenditure on electricity? (check electricity bill if possible)

……

15 What percentage of your institutions total overheads is for electricity?

……

KEY INFORMANT QUESTIONNNAIRE
CATEGORY C: BUSINESS FOCUS

To be used for the following respondents:

✓ *Large businesses* ✓ *Small businesses* ✓ *Cuca shops*

ENUMERATOR: ……

Settlement: …… **Questionnaire #:** …… **Date:** ……/……/2007

RESPONDENT NAME AND POSITION: ……

1 How has electrification influenced development of your business?

……

……

……

2 What other factors have influenced development of your business?

……

……

……

3 What were the main challenges and opportunities for your business before electrification?

……

……

……

4 What are the main challenges and opportunities for your business now?

……

……

……

5 Does your business have a☐ Prepaid metering? b☐ credit metering?
c☐ a single-phase connection? d☐ a three-phase connection? e☐ a maximum demand meter?

6 What are the main uses of electricity in your business (list appliances/equipment/machinery)?

……

……

……

7 What other energy sources/fuels does your business use, and for what applications/uses?

……

……

……

8 Did electrification bring about money savings for your business? Can you quantify these?

……

……

9 What electricity-related problems do you encounter in your business? (quality of supply and safety issues)

……

……

Micro-economic indicators

10 Has electrification improved your business' net income (profit)? (yes or no) ……..

In what way? ……

……

11 Has electrification improved productivity? (yes or no) ……. What new processes have been introduced as a result of electrification, that couldn't be done without electricity?

……

……

……

12 Has your business employed additional or less staff as a direct or indirect result of electrification?

……

……

……

13 Is electricity affordable in relation to other energy sources?

……

14 What is your business' average monthly expenditure on electricity? (check electricity bill if possible)

……

15 What percentage of your business' total overheads is for electricity?

……

KEY INFORMANT QUESTIONNNAIRE
CATEGORY D: ELECTRICITY FOCUS

NORED local office or agent

ENUMERATOR: ……

Settlement: …… **Questionnaire #:** …… **Date:** ……/……/2007

RESPONDENT NAME AND POSITION: ……

1 What services is this office responsible for (pre-paid sales/maintenance/connections)?

……

2 How many staff are stationed at this office? ……

3 How many settlements, including this one, are served by this office? ……
4 How many electricity customers are there in these settlements?

4.1 Pre-paid: a) single phase …… b) three phase ……

4.2 Credit: a) single phase …… b) three phase …… c) max demand ……

5 How many customers does this office serve per week on average? ……

6 How much pre-paid electricity does this office sell per week on average? ……

7 What is the average pre-paid purchase per customer (in N$ or kWh)? ……

8 How many power outages are experienced in this area per month on average? ……

9 What are the primary reasons for these outages? ……

……

10 How long does it take on average to restore the power supply after an outage? ……
11 How does the office respond to calls for repairs and maintenance (response time, staff availability)?

……

……

12 How could quality of supply be improved? ……

……

……

13 How many unelectrified households are there in this area? ……

14 How many applications for connection does this office receive per month on average? ……

15 How many new customers are connected in this area per month, on average? ……

16 What are the main electricity-related problems encountered in this area?

……..

……..

……..

Focus Group Discussions Guidelines

Questions

(1) How has electrification influenced the development of your community ?

(2) What other factors have influenced the development of your community ?

(3) What were the main challenges (and opportunities) for your community before electrification ?

(4) What are the main challenges (and opportunities) for your community now ?

(5) How has electrification influenced the growth and urbanization of your community – and of North-Central Namibia more generally ?

(6) Has electrification helped to reduce poverty (and improve the standard of living/ quality of life) in your community ? If so, how ? If not, why not ?

(7) Has electrification helped to improve the standard of living/ quality of life in the community ? If so, how ? If not, why ?

(8) In what ways has electrification affected the lives of men, women and children ?

(9) Has electrification enabled productive uses of electricity ?

(10) Has electrification helped to create employment and income in the community? If so, how ? If not, why not ?

(11) Has electrification helped to improve education and health services in your community ? If so, how ? If not, why not ?

(12) Has electrification contributed to safety in your community ? If so, how ? If not, why not ?

(13) What are the main aspects that you like about electricity ?

(14) What are the main aspects you don't like about electricity ?