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Power sector reforms, rural electrification and gender – related issues

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Executive summary

Introduction

The rural electrification programme in **Namibia** commenced in the densely populated central northern regions of the country, covering the Omusati, Ohangwena, Oshana and Oshikoto Regions between 1991 and 1993. In 1992 and 1993 the western Kavango Region was electrified, 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 Omaheke Regions in 1994 and 1995, and most main cenres 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 Omusati, Oshikoto Ohangwena and Oshana Regions benefiting from a second phase during 1997. Larger settlements in the Erongo and Kunene Regions were electrified in 1998 and 1999.

It was the first large-scale rural electrification project to be implemented in the country, and in fact is one of the first of similar kind in the Southern African region. Since the starting of the rural electrification programme in the country about 15% of the rural people have through the programme got access to electricity. An estimated 9700 rural households have been connected, 400 rural towns, villages and settlements areas supplied with electricity.

The rural electrification programme has, to date, been grant-financed by the **Namibian government,** the **Norwegian government**, and **NamPower.** To improve electricity supply services, a privately owned company, Northern Electricity, was contracted in 1996 to operate and manage electricity supply in the densely populated regions of the country. Northern Electricity services a total of 7500 customers, of which approximately 5500 use prepayment meters. The total number of households in the Omusati, Oshana, Ohangwena and Oshikoto Regions is estimated to be 90 000.

In 1998 the total number of **Swaziland Electricity Board (SEB)** customers was 33 739. About 26 725 households, both urban and rural were connected to the grid. However only 3000 rural households out of an estimated total of 108 000 were connected. Both Namibia and Swaziland, the energy supply situation in rural areas is still unsatisfactory. The overview this background paper work was a deskwork, which, was conducted from April 2001 until the end of May 2001. This background paper will focus on power sector reforms, rural electrification and gender – related issues of **Namibia** and **Swaziland.**

Namibia and Swaziland were selected as case studies and can be viewed as just a contribution to a wider-case study programme of SAGEN. Namibia and Swaziland represent typical Southern African Countries but are at the same time different in economy size and level of development. Thus why the report is not giving examples of countries at the extremes, it serves as a good picture of the typical situation in this region.

The principle objectives of this background paper, as outlined in the terms of reference, are to provide an overview of existing approaches and projects in areas of gender and energy, including where possible, practical experiences with gender and energy policy formulation and implementation. The paper is written with a view to deepen our analysis of gender mainstreaming in energy policy formulation and implementation for sustainable development. The paper is also solution oriented and generates recommendations for policy makers and project implementers. The second objective requires providing case studies impact of rural electrification projects towards gender, and identify strategies for promoting more gender responsive energy policies.

The overall objective of electricity policy reforms are to commercialize state utilities to allow competition, encourage private involvement, establish regulatory agencies and accelerate electrification of rural areas. The effects of these reforms will be improved financial performance of power utilities. Besides increased managerial and technical efficiencies, utilities will benefit from not having to shoulder the burden of rural electrification. Governments established also affirmative action committees in all public and private sector (ESI is not exempted), to empower women in energy sector. Governments will be responsible for sourcing finance for rural electrification. Governments have electrification programmes can then be implemented by the utilities on a commercial basis and increased investment in the Electricity Supply Industry (ESI). This is very much needed particularly to finance capacity expansion and refurbishment of old systems. Allowing more players into the ESI will bring into the ESI much needed finance, new technology and skills. Hopefully, it will also improve the efficiency of service to consumers.

Semi-autonomous regulatory agencies will ensure fair play in the ESI by all parties. The regulators will also be responsible for pricing and licensing. Being semi-independent the regulators will execute their role more efficiently than if housed directly within governments have portfolios. Decisions and rulings by the regulators can also expect to be judged as fair and impartial by all players.

Major use energy patterns and their use:

The largest fuel source for Namibia's, Swaziland's and SADC rural households is wood. All rural households depend on wood for their cooking, lighting, ironing and water heating. It is estimated that 93% Namibia's rural households depend on wood fuel. In the case of **Swaziland**, 30% of rural households depend on wood fuel, 23% on biogas and 23% petroleum products.

Electricity is mainly used in urban households for lighting, cooking, ironing, water heating, refrigeration, TV, radio and other household purposes. Electricity is also used in rural areas mainly at centers and large settlements. Nonetheless, electricity remains a preferred energy carries for most households.
Petroleum product is used mainly at transport sector. Lamp oil is used for lighting and some times cooking. Liquefied petroleum gas (LPG) is also used for cooking especially in Swaziland 30% of rural households. Candles are used for lighting.

Coal in Namibia is imported from South Africa for electricity generation. The coal power generation capacity by power plant, Van Eck in Windhoek is 120 MW. Solar, Diesel, Wind, Biogas, these are the off-grid source of energy, which are often the only option for the electrification of small and remote settlements. These sources of energy services such as lighting, TV, radio and refrigeration. The methane gas (biogas) can be used for cooking, lighting and for the generation of electricity.

About 100 technicians from all the target regions have been trained on how to install and maintain solar home system with assistance from the GTZ. Only 10 of these are women, mainly due to the general belief that technical work is the domain of men. Until mid-February 2001, 456 systems have been installed in Namibia. Parallel to this initiative, government has installed large solar energy systems in more than 30 schools and clinics across Namibia.
About 1000 residential PV systems have been installed in Swaziland. Recent survey commissioned by the MNRE (1998) of 120 PV residential end-users, 86% of the respondents were happy with their systems and 64% had the desire to expand their system.

Women problems in Energy

As a result of economic and traditional circumstances both Namibia and Swaziland, women constitute the largest percentage of the population in rural areas. They remained the suppliers and end-users of energy for household and community consumption of wood fuel. Though they are end-users of energy there is limited involvement of women at planning and implementation levels of most of the projects in the energy sector in Namibia. Women do not have access to information on appropriate technologies in the sector. They are not often in a position to make or influence decisions concerning energy use.

Women are expose with a number of health and environmental impacts, such as indoor smoke pollution, which is major cause of lung disease among poor women and children. The long distance women have to walk to collect firewood is a serious strain on their productivity. Another problem is land allocation is often in the hands of men, therefore women have problems to fetch firewood.

On rural electrification, lack of micro-financing scheme to promote the use of electricity at household level makes it difficult for the majority of households to access electricity. The high present electricity tariffs in Namibia, coupled by the high initial capital requirement in acquiring household electrical appliances makes it difficult for households to use this particular energy especially women.

Gender impacts in rural electrification

Electrification generally improves household's welfare. Women are no longer disadvantaged and do not need to walk a long distances to collect wood fuel. Having electricity in remote areas, eases girls and boys to read and do their homework at night due to the better lighting provided compared to candles and paraffin lamp. Both men and women in rural areas can have access to computers, which are common in urban areas. Electricity may benefit women and children, improving opportunities for access to information and giving a feeling of being part of the process of modernization etc. Electricity has replaced diesel generators, which were not reliable especially at secondary schools during study time. Most of the secondary schools held now evening classes. Criminal activities are reduced due to the streetlights; women and children are now protected. Because of the electricity, incubators are used in the maternity wards for premature babies. Clinics and hospitals make use of refrigeration equipment, with refrigerators for cooling medicine.
In Namibia the rural electrification programme has contributed to improved rural water supply, electric water pumps eases the work of women and children who were drawing water from far in difficult circumstances.

Policy issues

The white paper on energy policy in Namibia was developed in May 1998. Energy policy does not address gender related issues at both national and local level. The Energy White Paper has 83 policy statements. Out of this only one statement has an explicit gender component. The fact that women are the main suppliers and end-users of wood fuel, it is paramount that the policy should include issues to enable women to fully participate in the sector. Women are often unable to participate in development meetings and activities due to lack of time. This would include their

participation in the policy and programme formulation implementation and that would create an enabling environment for their sustainable livelihood particularly for the rural women.

Swaziland National Energy Policy Project (SNEPP), was started in August 1999 and will be completed in June 2002 considers gender to be a crosscutting issues, which is discussed by the Working Group on overall governance of the energy sector.

The Power Sector and Reforms

Power System

NamPower is the publicly owned utility in Namibia, responsible for generation, transmission, and some distribution, mostly to commercial farmers and mining. Mining in the country accounts for some 50% of local consumption. The growth in the non-mining sector has been an average rate of 7% per annum. Rural electricity consumption only accounts for some 7% of the total. As much as 70% of urban electricity consumption is located in Windhoek (World Bank 1992).

Installed capacity in the main grid is 384 MW, of which two-third is the run-of-river hydropower plant on the Kunene river. A further 150-200 MW is provided by a double circuit 220 KV transmission line provides to South Africa, which is currently being upgraded. Approximately one third of Namibia's power requirement is provided from South Africa.

In the case of Swaziland, SEB electricity production comes from four hydro power plants with capacities of 15 MW. In 1995 hydro production was only 109 GWh but in year 2000 was 192.3 GWh. It depends on annual rainfall. The highest system maximum demand was recorded at 153.8 MW in 1999. SEB's customers are industry 54%, followed by households 22%, irrigation 13%, commercial 10% and other 1% (SEB, 2000).

Electricity Sector Reform

Like many countries in the region, Namibia and Swaziland are undergoing reform that intends to liberalize the industry and allow more effective private sector participation. In Namibia, Municipal electricity departments largely undertake distribution of electricity in proclaimed towns. Distribution to rural areas of Namibia is the responsibility of the Ministry of Regional, Local Government and Housing (MRLGH). Government involvement in the electricity supply industry is focused within the Ministry of Mines and Energy (MME), which is ultimately responsible for policy formulation and regulation.

Northern Electricity is a private company established to distribute electricity in Oshikoto, Ohangwena, Oshana and Omusati regions and in the Kavango region. The company is responsible for revenue collection, maintenance, operation, payment of NamPower charges and new connections are transferred to the new entity. Assets are still owned by the state.

Premier Electric was established as part of NamPower commitment to extend electricity to smaller rural consumers and is considering both grid and off-grid, especially solar options. This company is responsible for providing distribution services and assistance to small municipalities, towns and villages.

Electricity Control Board (ECB) has been created in July 2000 as an independent electricity regulator, which controls and regulates all aspects concerning the generation, transmission,

supply and distribution of electricity. The company provides licenses; guarantees fair pricing and ensure overall transparency of the electricity supply industry.

In Swaziland, the legal and regulatory framework has to be updated to support the reform process. Three new Bills have already been drafted and will be tabled before parliament soon. Currently, the main players in the Electricity Supply Industry (ESI) in Swaziland are the Government (through the Ministry of Natural Resources and Energy (MNRE) and the Public Enterprises Unit of the Ministry of Finance), the Swaziland Electricity Board (SEB) and private self-generators and distributors.

Conclusions and Recommendations

Conclusions

Electrification has had most influence on substitution of lighting fuels, has not influenced cooking fuels beyond a minority of households. Access to electricity, solar or grid, has primarily had an impact on fuel choice for lighting, operating radio and television sets. Solar home systems can only provide low-load energy services and not meet cooking.
The regions power sector has been in previous years characterized by monopolistic, vertically integrated power utilities. However, the regionis currently undertaking major reforms, which aim at encouraging and allowing competition in this sector, commercializing (and not necessarily privatizing) state utilities, encouraging private sector involvement, establishing (semi) independent regulatory agencies and promoting access to electricity mainly to households.

There is limited involvement of women at project conception and implementation levels of most of the projects in the energy sector in Namibia, Swaziland as well as in SADC countries. Many women do not have access to information on appropriate technologies in the sector. The majority of women in Namibia and Swaziland do not have access to credit facilities like men.

Recommendation

The efforts of Governments in encouraging enrollment of women for technical courses and programmes should be sustained. This will in the long term ensure that women benefit in more than just being end-users from the electricity reforms. There is a need to review the policy and projects to incorporate the gender dimensions. A study is needed to provide the information that could be taken into account in the review process of the policy and energy programmes.

In most cases women are end-users of energy, therefore they need to be trained in order for them to be in charge of maintaining the new technology as men. There is a need to create micro-financing fund/credit facilities for energy activities that could contribute to sustainable livelihoods of rural women.

There is a need for closer and enhanced collaboration between project engineers and end-users in developing alternative ways of meeting domestic energy requirements. The end-users should be encouraged to participate in the design phase of the technology. It is recommended that implementation of the energy policy should include analysis and implementation of gender specific activities; capacity building on gender need analysis in the energy sector should be vigorously undertaken.

There is a need for the government, private sector and parastatal to subsidized off-grid electrification in order to assist the low in-come especially women in rural areas to acquire easily the technologies.

There is a need for enhancing regional networking on appropriate technology development, demonstration and application.

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Acronyms and Abbreviations

MME	Ministry of Mines and Energy
LPG	Liquified Petroleum Gas
MRLGH	Ministry of Regional and Local Government and Housing
NDC	Namibia Development Corporation
DoW	Department of Works
WCS	World Conference on Science
MRCC	Multidisciplinary Research Center and consultancy
ECB	Electricity Control Board
SWAWEK	South West African Water and Electricity Corporation
NORAD	Norwegian Agency for Development Cooperation
UNAM	University of Namibia
MNRE	Ministry of Natural Resources and Energy
SEB	Swaziland Electricity Board
NDS	National Development Strategy
ESI	Electricity Supply Industry
SCORE	Select Committee on Rural Electrification
DANCED	Danish Co-operation for Environment and Development
MoHA	Ministry of Home Affairs

1. Introduction by Selma-Penna Utonih (UNAM, MRCC)

Country background (Namibia):

Namibia is a country with population estimated at 1.9 million people, with an estimated average population of about 2.3 persons per square kilometers (km^2) in 2000 scattered over the entire land mass surface of 823 988 square kilometers (km^2). Of Namibia's population only 28% is considered urban and 72% of the population live in the rural areas. Out of this population, women and children constitute the majority.

The energy sector is one of the key sectors in Namibia. It has been identified as a key link between poverty and environment. In the households energy is mainly used for lighting, cooking, ironing, TV, radio, refrigeration and water heating.

The electricity supply industry in Namibia in the past has developed mainly in response to demand in urban centers in the country. Shortly after independence from South Africa in 1990, the new Namibian Government embarked on a comprehensive rural electrification programme aimed at increasing access to electricity among the rural population in order to enhance economic development, equitable distribution of resources, and social upliftment. The goal was to reduce the daily household chores performed by rural women, especially by reducing the time spent on collecting firewood.

Rural development, particularly in the communal areas where the majority of the country's population resides, had been grossly neglected in the past. The rural electrification program is being implemented in phases, starting with the most densely populated northern regions and moving clockwise around the country.

1.1. Objectives of the background paper

The objectives of this paper are to:

- Provide an overview of the energy status in Namibia
- Present existing approaches and projects in areas of gender and energy.
- Women's roles in energy planning and implementation
- Present power sector reform
- Provide some case studies impact of rural electrification projects towards gender
- Identify strategies for promoting more gender responsive energy policies.
- Give recommendations.

1.2. Major use energy patterns and their importance

1.2.1. Wood fuel:

Energy is used for a variety of services in different sectors including transport, mining, agriculture, and household sectors. The main form of energy used in the communal agriculture sector is human labour. The actual contribution of women to agricultural production is substantial.

The single largest fuel source for Namibia's rural households is wood. It is estimated that 93% of all rural households depend on wood for their cooking, lighting, ironing and water heating.
In **rural areas** wood fuel is also used at "Olupale", a place where men sit and tell stories while waiting for dinner from the kitchen prepared by women and girls. Wood fuel is very vital energy source at the household level where women are managers. Traditionally, fire wood are collected by women and girls only if there is a big dead tree, boys come in to cut the tree and later on women and girls are responsible to transport them home.
In **cities** wood fuel are used for "braai" and cultural purposes e.g. In the Oshiwabo and Otjiherero culture, people stay up the whole night around the fire before the funeral.

1.2.2 Electricity

At present, Namibia's total power generation capacity amount to some 400 MW. In 1997 electricity imports accounted for nearly 70% of Namibia's total consumption. The mining industry is the major consumer of electricity, accounting for 70% of consumption. In Namibia a significantly larger share of urban households use electricity for lighting, cooking, ironing, water heating, refrigeration, TV, radio and other household purposes. Electricity is also used in rural areas mainly at centers and large settlements. These focused on connected government and public facilities including schools, clinics, hospitals, government offices, police stations, military bases and water pumping schemes. Electricity is a more convenient energy form compared to wood**.**

1.2.3. Petroleum

Liquid fuels, mainly petrol and diesel, are the principal fuels used in the transport sectors. Men own majority of the vehicles.
Nearly all petroleum products are imported. About 70% come from South Africa. The transport sector consumes about 55% of the petroleum products. Lamp oil /Paraffin/Kerosene is used mainly for lighting and some times cooking. Some households are used candles for lighting purposes. Liquified petroleum gas (LPG) is also used for cooking.

1.2.4. Coal

In Namibia coal is imported from South Africa for electricity generation. The coal power generation capacity by Power Plant, Van Eck in Windhoek is 120MW.

People who are electrified by grid do not switch to electricity for all the desired energy services. They are still using candles for lighting and wood fuel for cooking. The solar electrified group are mainly using LPG, which be attributed to their higher incomes. People who are without grid or solar do use low quality fuels such as dung and crop waste for cooking as well as lighting.

1.2.5 Solar, Diesel, Wind, Biogas etc.

Off-grid technologies are often the only option for the electrification of small and remote settlements. The power generation capacity by power plant (Generators, Photovoltaic, etc.) of off-grid (from diesel, wind, solar, etc.) nationwide is 2 MW. These sources of energy are currently insignificant. These provide low-load energy services such as lighting, TV, radio and refrigeration. The methane gas (biogas) can be used for cooking, lighting and for the generation of electricity.

1.3. Existing approaches on women and energy in Namibia

Energy has been identified as a key link between poverty and environment. Of all sources of energy stated above, wood fuel is very vital energy source at household level where women are managers. The current energy use patterns are probably the most environmentally damaging form of resource exploitation. The continued use of wood fuel is associated with a number of health and environmental impacts.

The issues for the urban woman may differ from those of the rural woman but there are some commonalties between urban woman in the low-income brackets of society and rural woman. Both are dependent on biomass fuels. Despite the fact that women are the major users of this important energy source, (wood fuel) their participation in the policy formulation, design of wood fuel based programme/projects and implementation still remains low.

The situation analysis of women in the energy sector especially in rural electrification projects in Namibia is not different from the overall performance of women in any sectors. There have been projects initiated and implemented on wood fuel in Namibia but did not address specific needs, concerns and priorities of women. This initiative supposed to empower women in managing wood fuel, but rather address the problems of environmental degradation particularly deforestation and generally to improve the efficiency of wood fuel consumption.
The analysis of women's participation in decision-making, access to and control our key resources including energy, is therefore very crucial in assessing the responsiveness of the sector in meeting women's needs and priorities.

1.4. Rural Electrification in Namibia

1.4.1 the grid extension programme

The overall objective of the rural electrification programme is to connect socio-economic centers to the grid. This programme does not necessarily target women or gender consideration. Instead aiming at poverty alleviation, development and empowerment of remote and rural communities without mentioning that women are also end-users as well as industry and commerce.

The program in its first phase aimed to cover all main rural centers and large settlements. Typically, these main centers and settlements comprise institutional, commercial and domestic infrastructure, including at least some of the schools, clinics, hospitals, government building, community halls, missions, churches, police stations, agricultural development centers, post offices, telecommunication infrastructure, supermarkets, cuca shops, workshops, fuel stations, water supply infrastructure as well as formal and informal housing.

Consumers located within a radius of 500m from the distribution transformers were also offered connections at **no** charge.
Prioritization of centers is done in consultation with regional officers. Women were involved in the consultation only where they are members of the regional council. Women also worked on construction of power lines.

The programmes commenced in the most densely populated central northern regions of the country, covering the Omusati, Oshana, Ohangwena and Oshikoto Regions between 1991 and 1993. In 1992 and 1993 the western Kavango Region was electrified, followed by the eastern Kavango Region in 1993 and 1994.
The electrification programme covered parts of the Otjozondjupa and Omaheke Regions in 1994 and 1995, and most main centers in the Hardap and Karas Regions were electrified between 1995 and 1998, refer (Appendix 1) the map of Namibia; Existing Electricity Distribution.

The first phase of rural electrification in the Caprivi Region took place in 1995 and 1996, with Oshikoto, Ohangwena, Oshana and Omusati Regions benefiting from a second phase during 1997. Larger settlements in Erongo and Kunene Regions were electrified in 1998 and 1999, during which period the third phase of rural electrification in Oshikoto, Ohangwena, Oshana and Omusati Regions was implemented.

Since the starting of the rural electrification projects in the country about 15% of the rural people have access to electricity. That has covered an estimated 9700 rural households connected, 400 rural towns, villages and settlements areas supplied with electricity. The rural electrification programme has, to date, been grant-financed by the Namibian government, the Norwegian government, and NamPower.

Estimates from NamPower, the Namibian only electricity utility long-term planning confirm that within the next ten years, it aims to reach at least 25% of the Namibian rural population. This means that within the next 10 years, 75% of the rural population will still be out of reach by the electricity grid. 75% of the rural population will have to be supplied with energy from fossil and other non-renewable energy sources as they do now.

In an effort to improve electricity supply services, a privately owned company, Northern Electricity, was contracted in 1996 to operate and manage electricity supply in the densely populated northern regions of the country. Northern Electricity services a total of 7500 customers, of which approximately 5500 use prepayment meters. The total number of households in the four "O" regions is estimated to be 90 000. Northern Electricity, by virtue of a contract with government, has relieved the Ministry of Regional and Local Government and Housing (MRLGH) of its electricity supply commitments in those regions.
Outside municipal areas, of the rest of the country, MRLGH is responsible for management, operation, maintenance and extension of the rural and peri-urban electricity from NamPower, the only utility (for electricity generation and transmission and bulk electricity to municipalities) and supplies this to end consumers.

1.4.2 Electrification by Solar Home System

In parallel with the grid electrification efforts, the Ministry of Mines and Energy (MME) instituted a revolving credit fund for solar home systems in an effort to afford remote rural households the opportunity to acquire basic electrification of their homes. This facility, initiated

in 1996 under the management of the Namibia Development Corporation (NDC), provides loans at low interest rates to purchasers of solar home systems. This project, called "Home Power". The approach that has been used so far is based on system ownership.

During the pilot phase of the project, the aim was to provide loans at 5% interest rate, payable over a maximum period of 5 years. A down payment of 20% of total system cost and minimum annual income of N$15 000.00, exchange rate currently is 1 US$ = N$8.05, were part of the requirements for qualifying for the loan.
About 100 technicians from all the target regions have been trained on how to install and maintain solar home system with assistance from the GTZ (Gesellschaft fur technische Zusammenarbeit). Only 10 of these are women, mainly due to the general belief that technical work is the domain of men.

The third phase of the "Home Power" Project is underway and allows its beneficiaries to purchase high quality solar home systems of various sizes at a reduced deposit of 10% with the same interest and payback rates. The larger systems now include an inverter for 220V applications. A major advantage is the fact that the price includes installation, transport and insurance over 5 years and the systems are thus devoid of any further hidden costs and correct installation is ensured.

Customers are buying the system and have the responsibility of maintaining them. Until mid-February 2001, 456 systems have been installed in Namibia. 70 in Caprivi, 5 in Erongo, 6 in Hardap, 15 in Karas, 26 in Khomas, 8 in Kunene, 37 in Ohangwena, 7 in Kavango, 40 in Omaheke, 81 in Omusati, 90 in Oshana, 39 in Oshikoto and 32 in Otjozondjupa. Two villages in the Caprivi and Erongo Regions were electrified by solar panels in 2000, with 80% of the equipment donated by the Indian government. Parallel to this initiative, government has installed large solar energy systems in more than 30 schools and clinics across Namibia. The success of this programme depends on high repayment rates, which in turn depend on people's satisfaction with the systems.

To enhance access to suitable fuels for thermal energy needs, liquefied petroleum gas (LPG) cooking appliances are also promoted through the project. However, the cost of LPG devices is not accounted for in the loan and households must pay for them in cash.

In 2000 the Ministry of Mines and Energy initiated two further off-grid projects with financial assistance and expertise from the Indian Government. The National Biomass Program investigates the suitability of using biogas digesters for household thermal energy production. Biogas digesters produce and capture flammable methane gas from cow dung and other organic waste. The methane gas can be used for cooking, lighting and for the generation of electricity. Ten biogas digesters have been installed across the country and are closely monitored (MME 2000 an information brochure). This project is not gender consideration.

In year 2000 MME commissioned a project "Developing implementation guidelines for off-grid policies for sustainable electrification in Namibia" in collaboration with the United Nations Environmental Programme, Collaborating Center on Energy and Environment. The project of this nature enables the Ministry to identify options, which would optimize electrification in all areas in Namibia in a sustainable manner.

The University of Namibia through the sponsorship of the MME and in line with the principles of private-public-partnership developed the technology called "Power Can".

The objective of this technology is to contribute to the social upliftment of the poor in Namibia, particularly in the rural and peri-urban areas and supply a source of minimum electricity (for lighting, radio, low-power TV and other appliances) in the market, which is sustainable and affordable to the poor. The Power Can is the focal point in the concept of rural Power Contracting.

Under this concept any private and business minded person in Namibia can set up a charging power point from where he/she can supply the customer households with electricity through the power can. His/Her customer shall pay a price of electricity unit depending on the household requirements.
It is known that women are also end-users of this technology but the pilot project does not emphasis how women will be involved.

1.4.3 The funding of rural electrification

The bulk of the funding for rural electrification has come from Government. The figure includes grant funding, which has contributed substantially to the electrification drive, particularly during the early years.
NamPower contributed significantly from 1995 and, with the completion of the Rural Electricity Distribution Master Plan in August 2000, is contributing substantial amounts of funds annually for the next 20 years.

Table 1:

Funding Received since 1991

Funding Agency	Time Frame	Total Funds
NORAD (Norwegian Agencyfor Development)	1991 - 1998	N$84 millions
GRN (Government of the Rep. Of Namibia)	1991 - 1999	N$102 millions
NamPower (Namibian utility)	1995 - 1999	N$42.5 millions
Annual Average	1991 - 1999	N$25.4 millions

1.4.4 The Rural Electricity Distribution Master Plan

The next phase of rural electrification in Namibia is to cater for substantially smaller and more remote settlements and farms. Cost effectiveness as well as financial and economic feasibility is critical factors in allocating available funds in an equitable manner among the unelectrified localities. It is in this context that NamPower in conjunction with the MME has embarked upon the **Master-Planning Project**, which considers the country's 13 regions. Due to the vast distance and low population densities in Namibia this master plan considers both grid and off-grid electrification options.

The objective of the Master Plan is to provide guidelines and establish priorities for the upgrading and extensions of the existing electrical distribution networks in Namibia which will enable NamPower in conjunction with the MME to establish the networks to meet the demands of development in an orderly and cost effective manner. The time frame of the master plan is a

period of 20 years, and the availability of a fixed annual electrification budget of N$46 million for the whole country has been assumed.

2. Participation of Women in the Energy sub-sectors

2.1 Problems

Women are more affected by the conditions of poverty than men because poverty among women is linked to inequality situations in the society, in the world of employment, unfair treatment under social welfare and their cultural and home environment status. Women, particularly in the rural areas have remained the suppliers and end-users of energy for household and community consumption of wood fuel. This is not only a serious constraint on their productive time, but depending on the volume of fire wood collected, a heavy strain on their health. There is limited involvement of women at projection and implementation levels of most of the projects in the energy sector in Namibia.
Women are not often in a position to make or influence decisions concerning energy use. Many women do not have ready access to information on appropriate technologies in the sector.

Namibia has many single mothers who often have to support their children without the assistance of the fathers to these children. These mothers are most affected in one way or another. The 1991 census reported a profile of children born by married and never married mothers by age groups. Table 4, the ratio of children born within legal marriages to those born to never married women is 28.5: 19.9. That is 29: 20. Approximately, this implies a ratio of 30:20, meaning that for every three children born to legally married women, two are born to 'never married women' as shown in **Table 2.**

Table 2: Female population by number of children born

Age group	Women Legally Married	Average # of Children ever Born Live	Women never Married	Average # of Children ever Born Live
15 – 19	2 210	0.8	51 349	1.1
20 – 24	6 577	1.8	27 162	0.8
25 – 29	10 670	2.8	14 823	1.7
30 – 34	11 781	4.3	7 014	2.9
35 – 39	10 412	5.4	3 891	3.9
40 – 44	9 835	6.5	2497	4.6
45 - 49	8 233	6.9	1 816	4.9

Source: *1991 Census*

- *# - Number*

This high ratio, coupled with a high number of female-headed households, increases the rate of food insecurity, which is believed to be more common in female-headed than male-headed households. In addition to the above, and even though there are more females than males in Namibia, statistics about the labour force have shown that less females than males are in labour force. **Table 3** serves to illustrate this point

Table 3: Proportion of Males and Females in the Labour Market

	Urban %	Rural %	Total %
Males	75	65	69
Females	53	48	49
Both	64	56	58

Source: *reprinted from Department of Women Affairs (DWA), 1995a:90*

This indicate that, women's role in the economy has been extremely undervalued, because economic studies and policy review normally focus on formal sector rather than the informal sector in which women are mainly involved.

The continued use of wood fuel is associated with a number of health and environmental impacts. First, the indoor smoke pollution exposes women, who are the principal end-users of firewood and charcoal to serious health hazards. Available evidence indicates that indoor smoke pollution is major cause of lung disease among poor women and children (Energy sector and Women in Zambia paper; Women Democracy Center of Zambia). Second, the long distance women have to walk to collect firewood is a serious strain on their productivity.

In areas where forests have been depleted, women and children are made to walk long distances to fetch firewood. This aspect exposes women to health hazards of carrying heavy loads on their heads. Matters relating to the community such as land allocation are often in the hands of men. Lack of effective control over communal land has resulted in illegal fencing of some areas where wood was previously obtained from, thus aggravating the fuel wood problem.
Another problem, in rural areas, homes are burned down because of firewood, candles, paraffin oil and mostly women are to be blamed.

On the environmental imperative, the United Nations Conference on Environment and Development, UNCED, as the Earth Summit, which was held in Rio de Janeiro in 1992 was called to focus on the most fundamental and important challenges to the preservation of the natural human environment. At the Earth Summit, it was considered essential to develop environmentally sound technologies and industrial practices.

In Chapter 9 of Agenda 21, it as agreed that: *"Energy is essential to economic and social development and improved quality of life. Much of the world's energy however is currently produced and consumed in ways that could not be sustained if technology were to remain constant substantially. The need to control atmospheric emissions of greenhouse and other gases and substances will increasingly need to be based on efficiency in energy production, transmission and consumption and on growing reliance on environmentally sound energy systems, particularly renewable sources of energy".*

Referring to Chapter 9 of Agenda 21 it shows that the use of renewable energy (Esp. by women who are mainly exposed in day today's household activities) is highly recommended because of its environment friendly and systems have been proven to be more cost effective than conventional alternatives in thousands of applications worldwide under a broad range of diverse operating conditions.

Despite the fact that women are the major users of this important energy source, (Wood fuel) their participation in the policy formulation, design of wood fuel-based programmes/projects and implementation still remains low. The situation analysis of women in the energy sector in Namibia is not different from the overall performance of women in any other sectors.

The Government and private sector interventions in this sub-sector, promote projects and activities that are improve the efficiency of cooking stoves. There are few activities that are addressing health hazards and economically empowering women.
When firewood and charcoal are sold, then they become men business ventures.

Attempts towards rural electrification have not yielded positive results. This is because of the following:

- The sparse settlement patterns in rural areas and the absence of specific demand for electricity, due to poverty, make the venture economically unviable and technically less feasible. As the major of poor people use wood in Namibia, this approach has not very well responded to women's needs and priorities.
- Lack of micro-financing scheme to promote the use of electricity at household level makes it difficult for the majority of households in rural areas to access electricity.
- The high present electricity tariffs in Namibia, coupled by the high initial capital requirement in acquiring household electrical appliances makes it difficult for households to use this particular energy especially women.
- Lack of scientific know how and enough information how, where, when to get technologies. If there is adequate public awareness on appropriate technology or energy related issues, women would not have been faced a lot of problems.

As it is stated that women are managers of energy source at the household level they are not consulted especially in rural electrification projects. Projects are 'para-shooted' in rural areas without gender consideration. In some cases the number of women and men involved in energy projects has been indicated, but the settlement projects fail to show how many of the projects are managed by females.

Overall, the share of female-headed rural households owning radio, TV, and refrigerators is lower than male-headed households (CSO 1996). The CSO (1996) reports that the share of female-headed urban households without electricity for lighting is 36% compare to 26% of male-headed households (Wamukonya). This is an indicator of gender-based disparities in access to electricity**.**

2.2 <u>Common concerns about energy projects in the region:</u>

Common concerns are centralized energy planning and exclusion of women in project planning and policy formulation, unavailability of energy information at end-user level, reliance on donor funding, and ineffective financing mechanisms.

Centralized energy planning: Energy issues pertaining to women who are the main gatherers managers of fuels at the household level are left out during policy formulation and project planning. This is due to the limited involvement of communities in energy related issues.
The practice of planning energy projects at central level also impacts on the retention of technical support. The failure of energy projects in some countries including Namibia, Angola and Botswana is partly due to the resignation from the projects for higher salary or transfer of technical officers who were working on the projects**.**

Donor funding: Reliance on donor funding has led to the collapse of some of energy projects. For instance in Angola, the withdrawal of funding from donors contributed to the collapse of the fish-drying project. In Zimbabwe, the UNDP GEF solar electrification programme received criticism from local people for failing to ensure women's participation (MEPC, UNDP Project, Draft report 1999). In South Africa and Angola, solar energy projects identified during the first phase of the UNDP FINESSE failed to take off because of promised donor funding which never arrived (UNDP Project, Southern African Regional Workshop Report, 1999) on "Energy and Women."

Energy information: Generally, information about available energy options and how to access resources is not available to communities and women.

3. Gender impacts in rural electrification

Fuel wood appears to be less accessible and increasingly commercialized. Access to adequate fuel wood resources is by far the most important energy issues currently faced by the majority of households. Electrification generally improves household's welfare. Some women in rural areas are no longer disadvantaged and do not need to walk a long distances to collect wood fuel. New technology will ease their work and they can use the time for other productive activities.

Due to the fact that women are marginalized for long, education is needed to understand new technologies especially maintenance, operation, etc. for both men and women. In most cases women are end-users of energy, therefore they need to be trained in order for them to be in charge of maintaining the new technology as the men.

In rural areas girls are overloaded by work until late in the evening and have no time to study or do their homework. Having electricity in remote areas, eases girls and boys to read and do their homework at night due to the better lighting provided compared to candles and paraffin lamp. Some school classrooms, which are electrified, are used for evening study. Evening lights also help household members to stay up later, mainly to watch TV and socialize. As it is mentioned earlier that most households in Namibia in rural areas are burned down and blames are always on women and girls who are mainly using candles, lamp oil and wood fuel for lighting in household chores, after electrification these blames are minimal. Men in Namibia use candles and lamp oil only when they light their rooms.

Women initiate projects such as sewing business, hair salon, bakery, and brick making business to empower themselves and make living. Among these projects it is noted that females head 98% of hair salons and sewing businesses, while 98% of males head brick making businesses. They are buying less candles and paraffin, though it is not quantified how much exactly they save. Candles, lamp oil and other fuels are used as contingencies during electricity blackouts or solar battery failures. Both men and women in rural areas have now access to computers, which are common in urban areas.

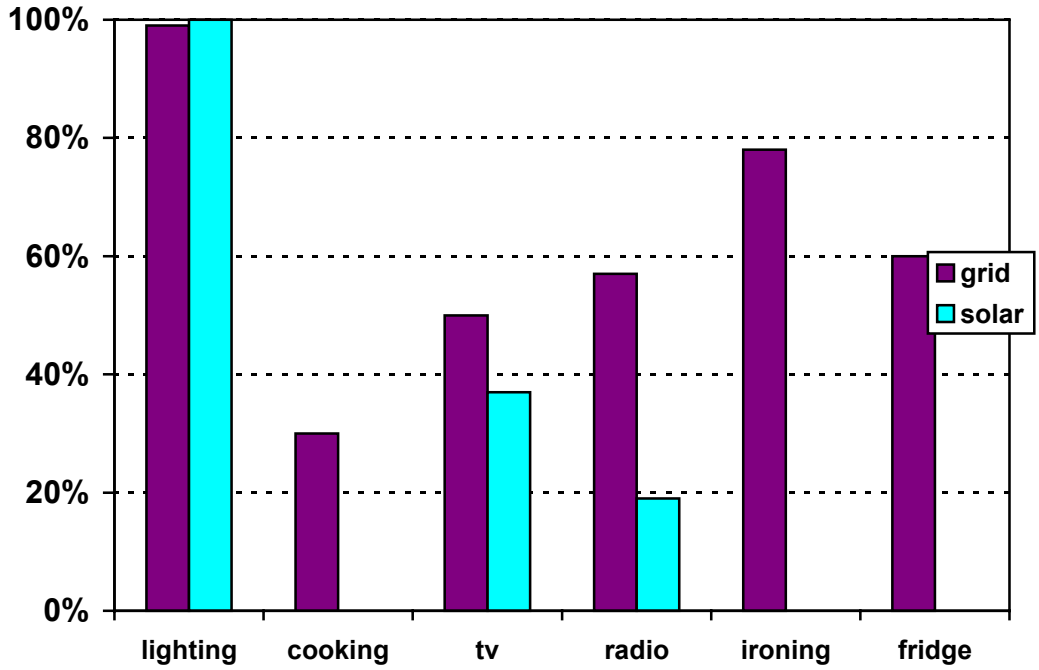


Figure 1: Electricity end-uses: Source: Wamukonya & Davis (Electricity use)

Figure 1 illustrates how electricity is used in various services including cooking, lighting, TV, refrigeration and ironing. It is also illustrate how solar is mainly used for including lighting, TV and radio. Women are mostly using these services.

4. Regional Cooperation

Namibia as a member of SADC has benefited from a number of regional initiatives.
A 66 KV line from Zambia, securing a power supply of 3 MW, supplies the eastern Caprivi Region, which includes the town of Katima Mulilo. Oranjemund in the extreme southwest and Ariamsvlei in the extreme south east of the country are presently supplied by South Africa. 200 MW is provided by a double circuit 220 KV transmission line from South Africa, which is currently being upgraded 400 KV for 400 MW (see table 2).

The draft agreement on cross border gas trade with South African has been concluded. The Oranjemund power plant and the possible landing of gas for the Oranjemund power plant is envisaged by midyear 2005.

This cooperation has assisted Namibia to lessen duplication of efforts on basic research but to concentrate efforts on adopting the technologies. However, there is need for Namibia to translate this international and regional cooperation into more activities that would meet the needs of women in the sector. On electricity and petroleum, the current regional cooperation efforts are towards meeting energy requirements of commerce and industry. However, there is need for these sub-sectors at the regional level to integrate gender concerns so that women's needs can be met.

For New and Renewable Energy for example, "Power Can" will be sold in SADC as well as in African countries. Networking is the major activity of this sub-sector in the regional cooperation.

5. Findings

5.1 Women needs in energy

Often, women's needs remain hidden from those institutions involved in the implementation of energy projects and programmes. In some cases, women may experience these interventions negatively, as workloads increase, for example, or stress on household budgets is felt. Women are often not in position to make or influence decisions concerning energy use, such as those concerning the acquisition of appliances.

It has been found that, where men understand the potential benefits of particular interventions aimed at assisting women; they are less likely to oppose the allocation of household resources, either in the form of cash or labour, towards these interventions. Thus, government believes that by working with both women and men there is a better chance of helping women to meet their needs.

Women's need in the energy sector in Namibia include:

- Access to micro-credit to enable them access new and renewable sources of energy as well as initiate wood fuel-based income generation activities that would contribute to their economic empowerment.

- Access education & training in skills that would contribute to women's confidence, and enhance their participation in decision-making processes in the energy sector.

- Ease access to improve and efficient wood fuel-based cooking stoves that reduce the time spent on food preparation as well as manage energy related health and environmental impacts.

- Ease access to appropriate technologies that would enable women use other sources of energy.

5.2 Policy Issues

The white paper on energy policy was developed by energy policy committee and approved by the cabinet in May 1998. During the policy planning formulation process, relevant stakeholders as well as few women working on projects targeting women were consulted.

Energy policy does not address gender related issues at both national and local level. These issues have been considered with less attention. It can be due to the fact that there is less initiative from relevant government bodies such as the MME and Ministry of Women Affairs and Child Welfare to implement policies and take action.

WCS/5/Draft emphasized women to actively participate in the design of policies. Clause 57 of WCS/5/Draft read*: "Science and Technology policies should be implemented that explicitly consider social relevance, cultural diversity and gender differences. Adequate participatory mechanisms should be instituted to facilitate democratic debate on scientific policy choices. Women should actively participate in the design of these policies."*

The Energy White Paper has 83 policy statements. Out of this only one statement has an explicit gender component. This statement is within a section on "Rural Energy Needs" under the sub-section entitled "Women Energy Needs".
This policy statement reads:
"The Government undertakes to ensure that energy projects impact positively on rural women, the principal users of energy and energy appliances, by ensuring that they participate in the design of energy projects and programmes, as well as by educating the public about the potential impact of these energy interventions" (Page 17).

National Gender Policy consists of 13 chapters. Chapter 3.0, Gender, Poverty and Rural Development deals with poverty eradication, allocation of financial, technical and human resources to in-cooperate women in the development of agricultural, mining and fishing sectors; engage in purposeful training for women and men and intermediary institutions with a view to mobilizing capital for those institutions and increasing the availability of credit to women. In this policy there is no specific clause deals with gender and energy or women and energy.

The policy does not address issues of improving women in wood fuel sector and contribute to sustainable human development. The fact that women are the main suppliers and end-users of wood fuel, it is paramount that the policy should include issues to enable women fully participate in the sector.

The main problem associated with wood is unavailability within close proximity to the dwellings. Hence women have to spend a lot of time and physical energy at the expense of other beneficial activities to procure fuel wood. Women are often unable to participate in development meetings and activities due to lack of time. This would include their participation in the policy and programme formulation implementation and that would create an enabling environment for their sustainable livelihood particularly for the rural women.

Women have to rely on poor quality lighting fuels, candles and wood, due to lack of alternatives. Women headed households, being generally poorer than male-headed households, are disadvantaged in the acquisition of solar home systems.

The other sources of energy in the policy document do not capture the fact that women are also end-users as well as industry and commerce. The focus for interventions for this source of energy addresses the energy needs of industry and commercial sectors such as transport and mining.

5.3 Institutional Issues

In Namibia, the Directorate of Energy under the Ministry of Mines and Energy (MME) is the main government body regulating the energy sector, formulating and implementing energy policy. This Directorate has three main divisions; electricity, petroleum and gas (upstream), and petroleum and gas (downstream).

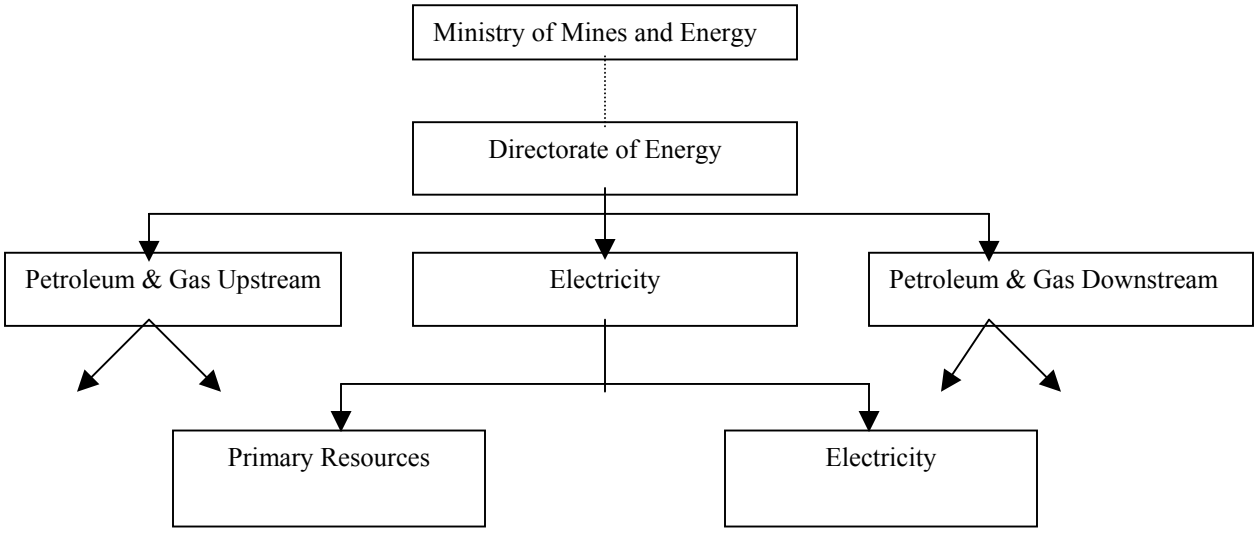
Each of these divisions is comprised of two sub-divisions. The primary resources development sub-division, which encompasses renewable energy, falls under the Electricity Division. The other sub-division in the Electricity Division is Electricity, which is responsible for rural electrification. The new structure of the Directorate is pending. The Directorate is still using the old structure. The Director of Energy, two Deputy Directors of Petroleum & Gas (Upstream) and Down Stream are all males. Deputy Director for Electricity Division position is currently vacant.

In the Department of Energy there are few women and these are at technical and clerical level. In the private sector, women are found at much lower levels beyond technical positions.

Namibia has one main electricity utility, NamPower, responsible for electricity generation, transmission and bulk supply. NamPower is a state owned enterprise. Distribution of electricity is the responsibility of municipalities, NamPower, the (MRLGH) and Northern Electricity a private company that caters the Oshikoto, Ohangwena, Oshana, Omusati Regions and Kavango region.

Liquid Petroleum fuels are supplied in bulk by five oil companies: Shell, BP, Eugen, Total and Caltex, and distributed through approximately 226 service stations (Energy White Paper, 1998). AFROX and Easigas supply liquid petroleum gas and distribute it through various entrepreneurs. Biomass fuel sources vary ranging from communal woodlands, and private land to government owned forests.

Structure of the Energy Sector within Ministry of Mines and Energy



Source: *Ministry of Mines and Energy; Directorate of Energy*

6. Background to the Namibian power sector

At independence Namibia inherited a reasonably well-developed and financially viable electricity supply industry. Key problems relating to the industry included:

1. A low level of household access to electricity, particularly in rural areas;
2. A fragmented distribution industry; and
3. An inadequate regulatory regime and an under-resourced government ministry.

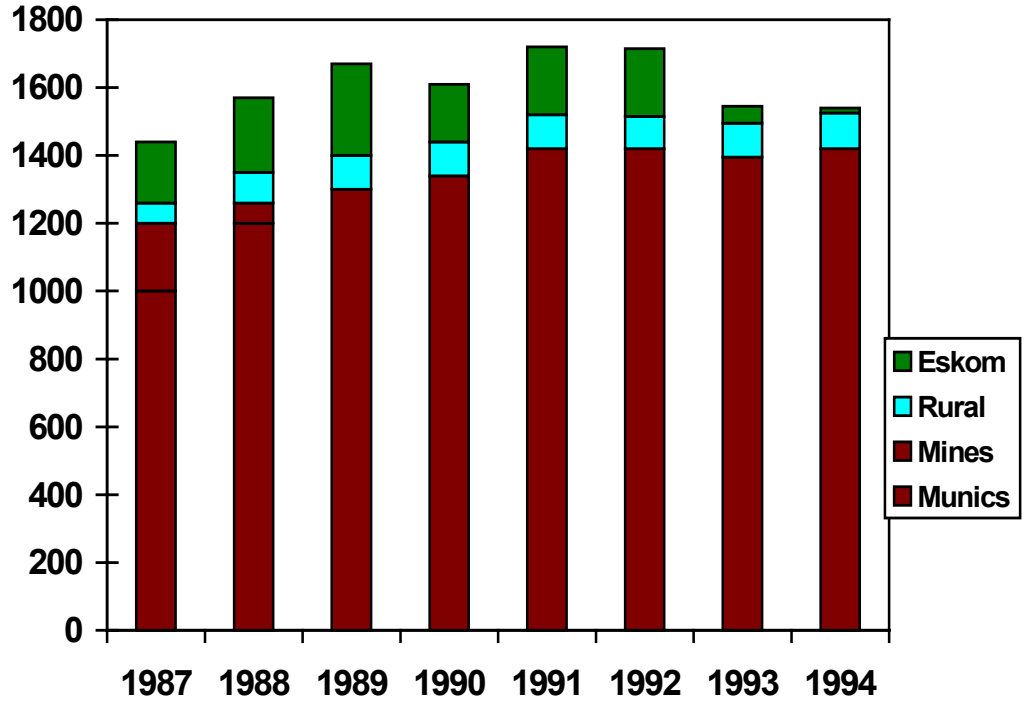
6.1 <u>Current status of the power sector</u>

Mining in Namibia accounts for some 50% of local consumption, although electricity consumption by mines has actually declined over the past seven years, whereas the growth in the non-mining sector has been an average rate of 7% per annum. Despite these trends, rural electricity consumption only accounts for some 7% of the total. As much as 70% of urban

electricity consumption is located in Windhoek (World Bank 1992, Davis and Nghikembwa, Review of the Owambo Rural Electrification Programme, 1995).

SWAWEK (NamPower) electricity sales (GWh/year)

Figure:2 Electricity consumption by sector
Sources: World Bank 1992; SWAWEK now NamPower 1994, (Davis & Nghikembwa)



Installed capacity in the main grid is 384 MW, of which two-third is the run-of-river hydropower plant on the Kunene river. A further 150-200 MW is provided by a double circuit 220 KV transmission line provides to South Africa, which is currently being, upgraded. Due to water availability, capacity at Ruacana varies through the year and is reduced to half its rated capacity 130 MW for much of typical hydrological year, and as low as 65 MW during the driest quarter (World Bank 1992). During August 1995 an unexpectedly large fall in the Kunene water flow from 102 cubic meter/sec. to 40 cubic meter/sec. meant that Ruacana's maximum output was reduced from 50% of its full capacity to around 20% (The Namibian News Paper, 18 August 1995, Davis & Nghikembwa).

Approximately one third of Namibia's power requirement is imported from South Africa. Thermal plants owned by NamPower are primarily used for back-up purposes, although drought conditions in 1993/4 and its effect on the Ruacana hydropower station meant that generation at the coal-fired Van Eck plant was more than the total generated by this plant during the previous four years (M. Davis & S Nghikembwa, 1995).

6.2. Electricity infrastructure

At present, Namibia's total power generation capacity amounts to some 387 MW, which includes a large number of small diesel generating units through out the country (mainly on commercial farms). Local electricity generation accounts for about 30% – 50% of the total consumption. In 1997 electricity imports accounted for nearly 70% of Namibia's total consumption.

Two grid supply areas are not connected to Namibia's national grid: The Eastern Caprivi Region, which includes the town of Katima Mulilo, is supplied by a 66KV line from Zambia, securing a power supply of 3 MW. Oranjemund in the extreme southwest and Ariamsvlei in the extreme south east of the country are presently supplied from South Africa.

Table 4:

Namibia' Electricity Sources

Power Plant	**Location**	**Plant Type**	**Energy Carrier**	**Capacity**
Ruacana	Kunene River	Hydro	Water	240MW
Van Eck	Windhoek	Thermal	Coal	120MW
Paratus	Walvisbay	Thermal	Diesel	24MW
Katima Mulilo	Katima Mulilo	Thermal	Diesel	3MW
220KV	From South Africa	Interconnector	Power Lines	200MW
400KV	From South Africa	Interconnector	Power Lines	400MW
Off-Grid Technologies	Nationwide	Generators, Photovoltaics,etc.	Diesel, solar, wind etc.	2MW
PROPOSED				
Kudu	**Off the Oranjemund Coast**	**Thermal**	**Gas**	**350-750MW**
Lower Kunene	**Kunene River**	**Hydro**	**Water**	**300-500MW**
Wind Park	**Luderitz**	**Turbine**	**Wind**	**3-20MW**
Divundu	**Okavango River**	**Hydro**	**Water**	**20MW**

Source: *MME an information brochure for Rural Electrification in Namibia*

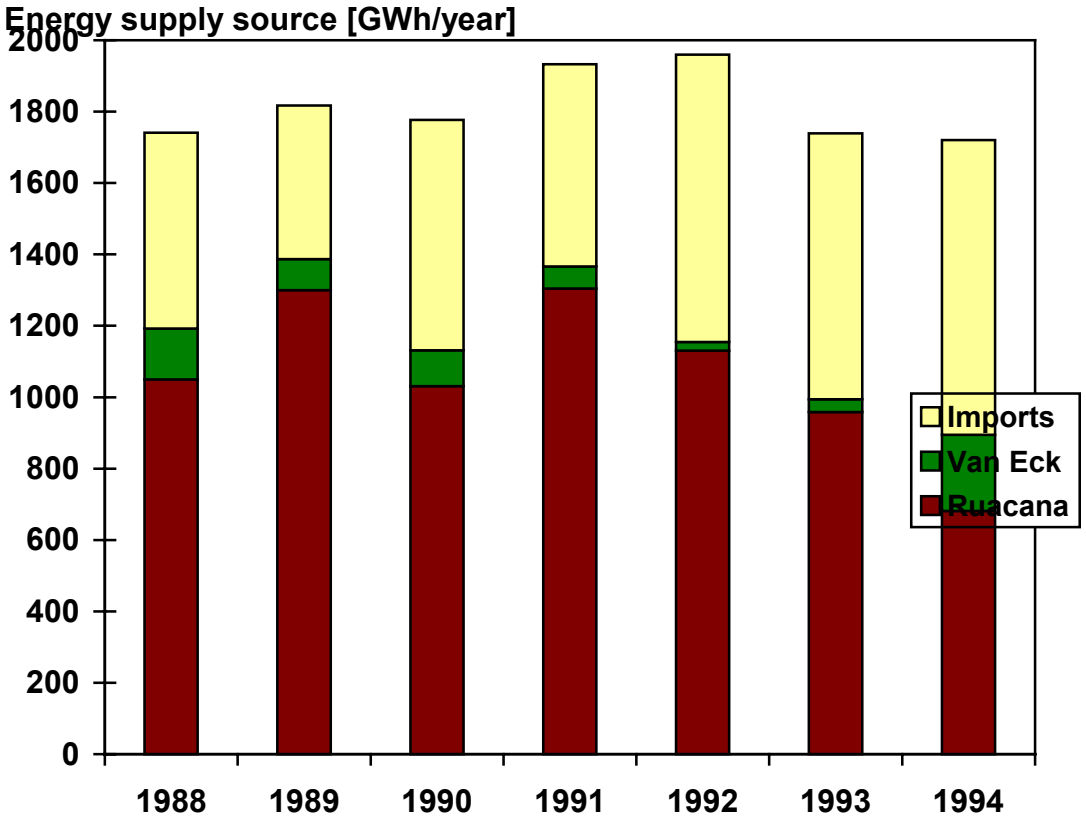


Figure 3: Energy production and imports: 1988-1994
Sources: World Bank 1992; (SWAWEK) NamPower 1993; 1994

6.3 Current and proposed institutional arrangements

NamPower is the publicly owned utility responsible for generation, transmission and some distribution, mostly to commercial farmers. It was called SWAWEK. This utility was established in 1972 by the South African Industrial Development Corporation and purchased for the Namibian government from its own accumulated reserves.

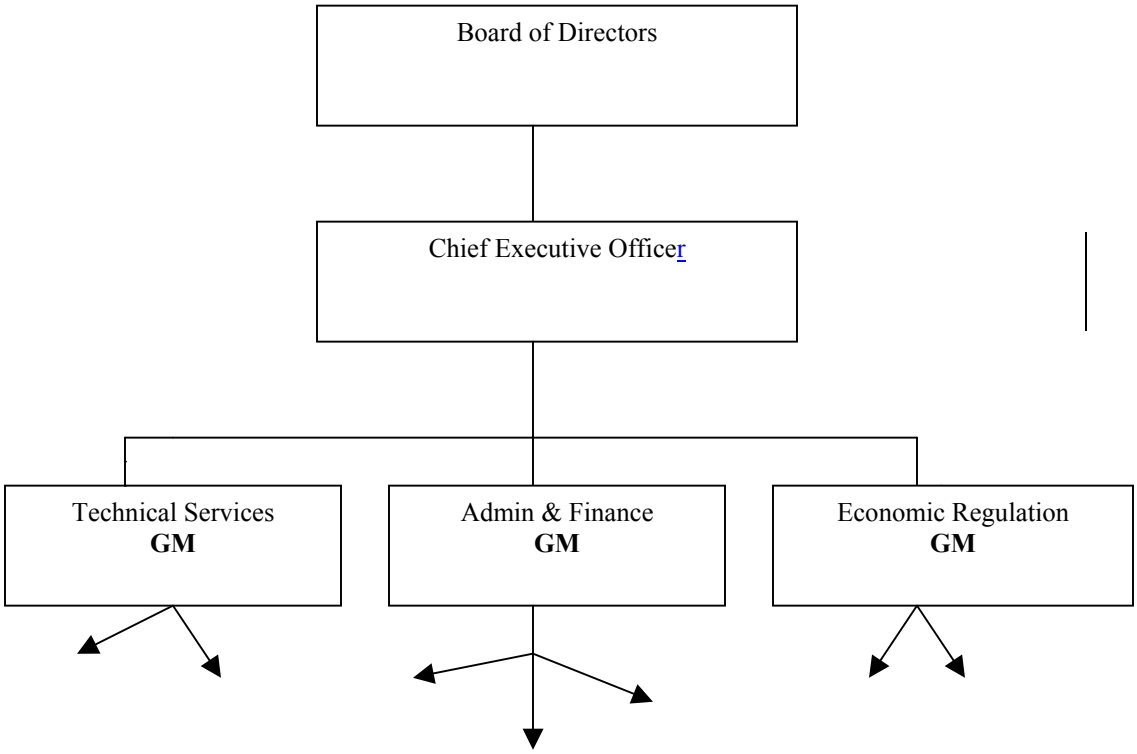
Municipal electricity departments largely undertake distribution of electricity in proclaimed towns. Distribution to rural areas of the country is the responsibility of the MRLGH. Government involvement in the electricity supply industry is focused within the MME, which is ultimately responsible for policy formulation and regulation.
Apart from the MRLGH, other government department involvement in the electricity supply industry is principally as users. Water Affairs is a large customer, especially in rural areas, and the Department of Works (DoW) has had the responsibility of paying energy bills, operating diesel generators and maintaining all fixed and movable property in government buildings. Recently individual government departments have had to take budgetary responsibility for many of the DoW's functions.

Premier Electric was established as part of NamPower commitment to extend electricity to smaller rural consumers and is considering both grid and off-grid, especially solar options. Premier Electric, a Nampower subsidiary company, is responsible for providing distribution services and assistance to small municipalities, towns and villages.

Electricity Control Board (ECB) has been created in July 2000 as an independent electricity regulator, which controls and regulates all aspects concerning the generation, transmission, supply and distribution of electricity. The ECB provides licenses; guarantees fair pricing and ensure overall transparency of the electricity supply industry. Only one woman on General Manager's position (GM. Admin & Finance) in ECB structure.

Northern Electricity is a private company distributes electricity in Oshikoto, Ohangwena, Oshana, Omusati regions and Kavango region. Although assets are still be owned by the state, responsibility for revenue collection, maintenance, operation, payment of NamPower charges and new connections are transferred to the new entity.
Implementation of this arrangement is effectively curtailing MRLGH's direct participation in electricity distribution in the area, reducing its involvement to monitoring the new entity.

ECB Organization Chart:



7. Energy Projects Benefiting Women: case studies:

The following are some case studies of energy projects that aim at improving women's energy situation.

7.1 Sihetekera Bakery

Agency: Ministry of Regional Local Government and Housing; Division of Community Development and NGO African Development Foundation.

Objectives: To provide skills to women in bread baking; create job opportunities; get profit for school and hospital fees; provide fresh bread to the community and improve living standard.

The project is situated at Bunya +60km West of Rundu, Kavango.

Women involvement: This is a project for women and there are 24 women in the project. They are baking bread for profit to sustain this project and make their own living. They are able to pay for the school and hospital fees as well as transport fare.

Beneficiaries: The 24 women and their families.

School children and communities in the village.

Energy use: The project is using electricity, which is provided by Northern Electricity Company. Namwater Company provides water.

Funding: The government and NGO African Development Foundation provide the funding.

External assistance: The government provides the financial, training and technical support, and hardware. So far the community has not contributed anything.

Difficulties: Lack of proper business management training, transport to and from the project to the different places for sale bread. Public transport is too expensive to transport their stock.

Strength and weaknesses The group is serious with their work. They are working very hard. They also participate in different activities such as Church group etc. Apart from baking, they attend short courses of how to run business of that nature.
Sometimes there is conflict among the project participants because some believe in witchcraft.

7.2 Solar Home System, Rural Power Contracting and Battery Manufacturing "Power Can"

Agency: Ministry of Mines and Energy

Through the sponsorship of the MME, the University of Namibia in line with the principles of private-public-patnership (UNAM and SunTechnics) developed this technology, the Power Can.

Objectives: Supply a source of minimum electricity (for lighting, radio, low-power TV and other appliances) in the market which is sustainable and affordable to the poor; contribute to the social upliftment of the poor in Namibia, particularly in the rural and peri-urban areas; establish a manufacturing facility for solar accumulators and regulators; provide mechanism for engineering training and technology transfer; introduce sustainable schemes for de-central power supply by small power contractors.

Power Can: The Power Can is a state of the art photovoltaic system supporting the sustainable electrification program in Namibia affordability, easy access and resources renewal. The battery is charged in the Central Power Point and transported to the remote house. As the battery is used it discharges power in electrical form. Once the battery charge falls to the depth of Discharge, it is returned to the Central Power Point for recharging.

Women involvement: The Programmer Leader of this pilot project is a woman. Both men and women will directly benefit from this pilot project. As women are the principal users of energy and energy appliances in rural and peri-urban households, they will benefit from the access to an affordable source of a minimum power supply. One women technician also identified to work at central power point. A lot of women in the country especially in rural areas are interested in the project. They want to have the product in their household.

Beneficiaries: Disadvantaged people living in rural areas benefit, as they now have access to appropriate energy supplies, especially those too poor to purchase Solar Home Systems. Rural power point entrepreneurs also benefit, as they now have the opportunity to start business activities in rural areas. The Engineering Department students at the University of Namibia will benefit as they building their capacity through the solar laboratory, which is already established at the University.
The laboratory was inaugurated as well as the power can launch by the President of the Republic of Namibia on 19th March 2001 at the UNAM.

Energy: The source of power at the central power point is mainly photovoltaic (PV).

Sustainability: Due to financial constraints, the projects focuses only one pilot site in the North of the country. The actual sustainability of the project will be proven once the pilot phase is completed. As the majority of the population is very poor, they would be potential customers of the project in a big way.

8. Swaziland Case Study: By Sibusiso Dlamini (MNRE)

8.1 Country background

The Kingdom of Swaziland, with an area of only 17,364 km^2 and a population of just over 1 million, is one of the smallest countries in Africa. The country is landlocked by South Africa and Mozambique and divided into four geographical zones. The Highveld is at an average altitude of 1,300m and has a temperate climate. The Middleveld is subtropical and lies at an average altitude of 700m. This region is the most densely populated and harbours the major industrial centre. The Lowveld lies at an average latitude of about 200m and is harbours the main agro-industries. The Lubombo Plateau rises to an altitude of just 600m and is near the border to Mozambique.

The Swaziland economy, like most of its neighbours, depends significantly on the Republic of South Africa for its economic sustenance. Some of the major forms of dependence are the areas of trade (over 75 % of imports and about 45 % of exports), transport and communications, energy (electricity –70%, petroleum products 100%) and investment.

Swaziland, with a per capita income of US$1,100 (1997 figure) per annum, is ranked among the lower middle income developing countries.

8.2 Outline of the Energy Sector

Biomass energy in the form of bagasse and woodfuel constitutes the greatest component of Swaziland's energy balance. The total forest cover in Swaziland is estimated to be about 625,400 ha i.e. 162,400 ha commercial plantations and 463,000 ha indigenous forests (Hess,1990).The area of indigenous forests is decreasing due to among other factors overgrazing and general exploitation of the resource without strict control. In 1995, the estimated annual production increment was 317,000 tonnes while the estimated demand was 475,000 tonnes.

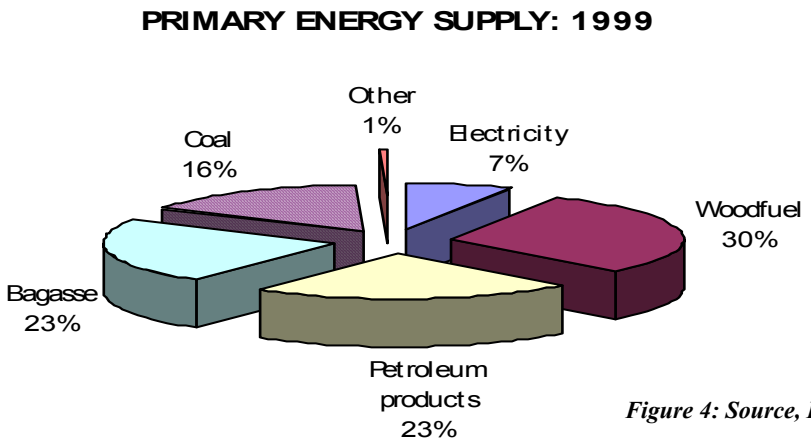


Figure 4: Source, Energy Balance 1999

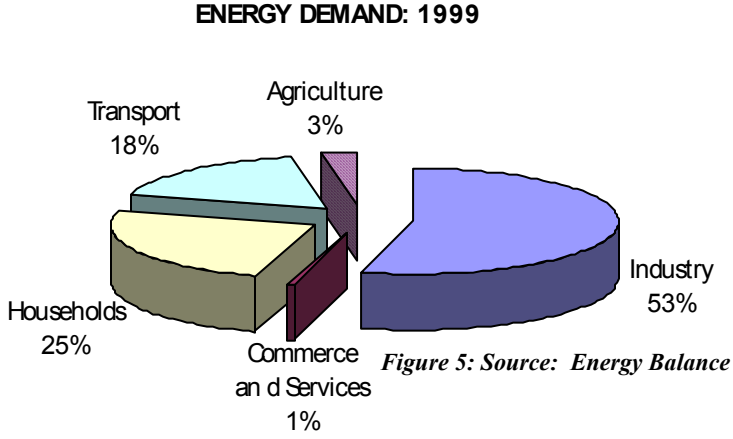


Figure 5: Source: Energy Balance 1999

Substantial amounts of bagasse are produced by the sugar industry annually. A large fraction of this is used for industrial process heat and the balance for electricity generation. In general, there exists extensive excess bagasse in all three mills in Swaziland.

Commercial fuels such as electricity, petroleum products and coal are imported from the Republic of South Africa. The commercial supply of electricity through the national grid is the sole responsibility of the government owned utility, Swaziland Electricity Board (SEB), which delivers about 70% of the electricity for final consumption. Of this 70%, approximately 30% is generated by SEB's hydro and diesel plants. The remainder is imported from the South African electricity utility (ESKOM). Besides the SEB's commercial supply, co-generation plants in the sugar and pulp industries contribute as much as 30% of the total electricity supply in the country.

Petroleum products are imported from South Africa by five international oil companies. The Ministry of Natural Resources and Energy (MNRE) regulates pump prices of petrol, diesel and illuminating paraffin.

Swaziland possesses large reserves of low-volatile and low sulphur anthracite coal of medium to high quality. However, this coal is not suitable for the local industrial equipment and is thus exported to the Republic of South Africa.

8.3 National Energy Policy

The Government in co-operation with the Danish Co-operation for Environment and Development (DANCED) is undertaking a project known as the Swaziland National Energy Policy Project (SNEPP), which is executed by the Ministry of Natural Resources and Energy (MNRE). This project began in August 1999 and will be completed in June 2002.

The development objective of the project is that the energy needs in Swaziland are increasingly covered in a sustainable and efficient manner, taking into account indigenous resources, social, economic and environmental factors.

The immediate objective of the project is that at the end of the project period the Government of Swaziland (GoS) will have an implementable national energy policy, approved by the Cabinet, following sustainable, social and economically sound planning principles.

SNEPP established various working groups in order to effectively address issues from the different energy sub-sectors. The reports from the working groups are now being finalised and will be presented and debated in the next national stakeholder workshop of SNEPP. Gender is considered to be a crosscutting issue and is discussed by the Working Group on overall governance of the energy sector.

8.4 Rural household energy patterns

Unlike in urban centres, traditional fuels are still the dominant cooking and heating fuel in rural areas. LPG and paraffin are used for cooking by about 10% and 30% respectively of rural households. The pattern of energy use in rural areas is shown figure 6. Nonetheless, electricity remains a preferred energy carrier for most households.

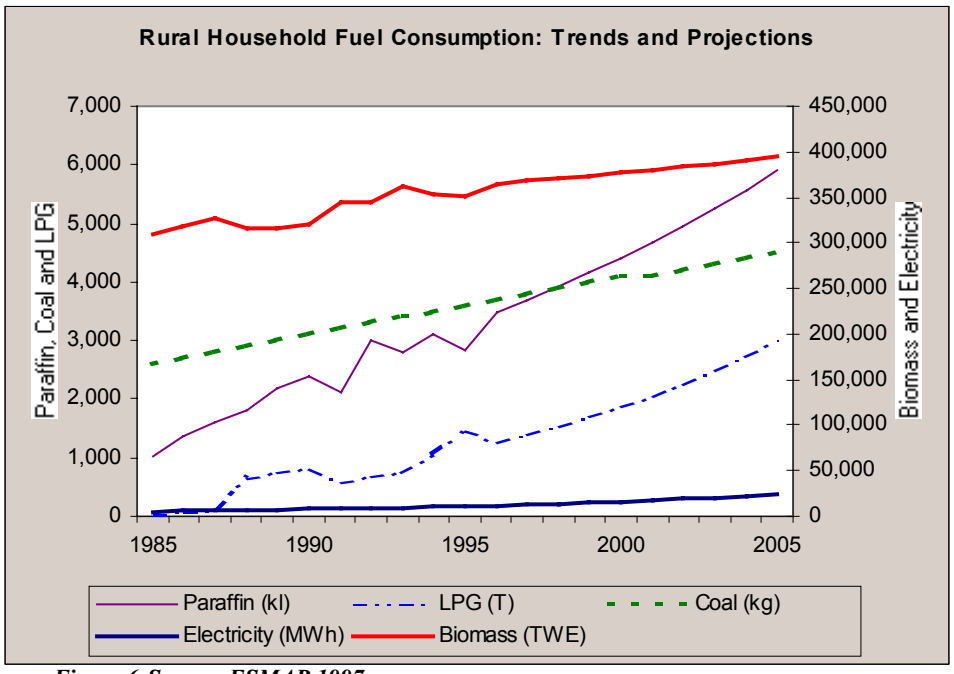


Figure 6:Source, ESMAP 1997

Woodfuel will continue being the most important energy source in rural areas in the foreseeable future. However, the forest resource base has not been maintained sustainably, and this has resulted in decreased availability of firewood.

TWE: Tons of Wood Equivalent – this is a unit for all biomass resources used, which compares the weight to an equivalent of wood only.

9. The Power Sector and Reforms

9.1 The SEB power system

SEB electricity production comes from four hydro plants with capacities of 15MW, 20MW, 6MW and 1MW and from two diesel units with a total capacity of 9.5 MW. Actual electricity production from the hydro plants varies depending on annual rainfall e.g hydro production was only 109 GWh in 1995 but 192.3 GWh in 2000. The highest system maximum demand was recorded at 153.8 MW in 1999.

The balance of SEB's power requirements are imported though three 132 kV transmission lines and a new 400kV transmission system. From 132/66 kV substation, 66 kV transmission lines distribute the power to 66/11 kV substations. Except for the high power lines steel pylons, most of the lines are built with wooden poles.

SEB's customers are industry (54%), followed by households (22%), irrigation (13%), commercial (10%) and other (1%)(SEB, 2000).

9.2 Electricity Sector Reforms

Like many countries in the region, the ESI in Swaziland is undergoing major reform that intends to liberalise the industry and allow more effective private sector participation. Government's main objectives for the ESI are among others to:

- *Improve quality and reliability of supply*: any future structure of the ESI must lead to a better quality and reliability of supply.
- *Facilitate economic development by increasing access*: access to electricity is a key element to achieving economic development particularly in rural areas.
- *Attract/facilitate private sector involvement in the ESI*: the increased participation of private sector in the ESI will bring new skills, finance and technology.
- *Mobilise finance*: the new ESI structure should reduce the burden on public finances, which currently are shouldered by the Government and SEB, but should encourage finance raising through private sector means.
- *Improve the customer orientation of SEB*: in order to improve efficiency, offer competitive customer service and enhance profitability, the utility's operations have to be improved.
- *Reform of legal and regulatory framework*: the current legal and regulatory framework has to be updated to support the reform process. This will ensure clearer oversight of SEB's operations, allow new players in the ESI while at the same time ensure that no new undue obligations are imposed on the Government. Three new Bills have already been drafted and will be tabled before parliament soon.

Currently, the main players in the Electricity Supply Industry (ESI) in Swaziland are:

- the Government (particularly through the MNRE and the Public Enterprises Unit (PEU) of the Ministry of Finance)
- the Swaziland Electricity Board (SEB); and
- private self-generators and distributors.

10. Rural electrification

10.1 Overview

In 1998 the total number of SEB customers was 33,739. About 26,725 households, both urban and rural were connected to the grid. However only 3,000 rural households out of an estimated total of 108,000 were connected. This means the energy supply situation in rural areas is still very unsatisfactory. The general objectives of the Government with regard to rural electrification are:

- Promotion of the productive use of electricity in rural areas in order to facilitate economic development;
- Improving the living conditions by satisfying the basic need for electricity supply
- To contribute towards poverty alleviation;
- Facilitating the provision of electricity to as many homesteads as possible so as to retard the rate of fuelwood consumption; and
- Reducing the social gap between rural and urban communities in order to reduce migration.

A significant landmark in rural electrification in Swaziland was the establishment of a Select Committee on Rural Electrification (SCORE) in 1992. Thereafter, pilot projects were carried out to assess the impacts of rural electrification. These were followed by a three-phased Rural Electrification Study (1996-1998) aimed at assessing the problems and opportunities of rural electrification in Swaziland. The study consisted of technical and financial analysis, cost-benefit analysis and analysis of policy options. The study identified 160 rural areas for electrification and also prioritised them according to the most viable areas in terms of connection cost and electricity consumption.

The study also showed that extending the national grid to rural areas of Swaziland requires substantive investments as settlements are characterized by dispersed homesteads instead of villages. Indicative costs for grid extension are around “E 60 000 - E 80 000 per km, exchange rate, 1US$ = E7.9. In order to encourage connection by rural households, the utility has set connection fees to “E 3, 500 per metered point within a radius of 1km from an existing distributor line. Latest estimates from SEB are that 40% of rural households consume less than 250kWh per month, corresponding to a cash flow of around “E81.45 per month. This makes grid rural electrification financially unviable in most rural areas.

10.2 Rural Electrification Policy

The current status is that only an estimated 5% of rural households have access to electricity. This is despite the fact that 66% of all households are in rural areas. Based on the rural electrification study and on consultation with stakeholders, a draft Rural Electrification Policy has been prepared by the MNRE. The vision enshrined in the policy is that “*access to energy is made available for all by 2010*” and that “*access to electricity is made available for all by 2020*”. The draft policy prioritises the electrification of schools, health care facilities and other essential public services. It is envisaged that when the policy has been approved by the Cabinet, an implementation programme will be drawn up to indicate targets and resource requirements for electrification in the country. The programme is also expected to include off-grid options where viable.

11 Solar electrification

The solar irradiation in Swaziland is estimated to be around 4kWh/m^2·day to 6kWh/m^2·day in some areas. Given this abundance in sunshine, the stable political setting and the relatively high GDP per capita, the potential for solar energy is reckoned to be high. In spite of these favourable conditions, the country's experience with solar PV is rather modest due to high investment costs and lack of awareness.

The PV market has been growing steadily over the past decade and about 1000 residential PV systems have been installed. There is one major supplier of PV systems and several others who sell systems as a marginal activity in their shops. In a recent survey commissioned by the MNRE (1998) of 120 PV residential end-users, 86% of the respondents were happy with their systems and 64% had the desire to expand their systems.

Other users of PV systems have been private corporations like the Swaziland Posts and Telecommunication Corporation and Swaziland Railways. The use of PV systems is however been slowly phased out due to PV module theft and due to the advancement of the grid extension programme.

On the other hand, the MNRE implemented a PV demonstration project from 1992 to 1995. The main objectives of the demonstration programme were to create awareness of solar energy among the rural population as well as to meet the basic electricity needs. The Ministry also intended to learn from the demonstration experience and hence help clarify the role of the Government in future activities. The programme included the provision of electricity to schools, clinics and water pumping schemes. The installed capacity of the PV programme was about 12.2 kWp. The overall lesson learnt from this project was that PV systems are a technically feasible option for provision of electricity in rural areas but that proper awareness raising and promotion of solar energy was required.

12 An overview of the gender scene

Swaziland like most African countries is a patriarchal society that is essentially male dominated. It is also a society with strong cultural and religious practices.

Married women are minors in relation to their husbands. This is historic and deeply embedded in the cultural traditions and religions belief. The concept of equality between men and women has thus been discouraged, as this would be against the ideals of culture and religion. This imposes limits to their independent access to family and community resources. Examples of this could be in ownership of property, inheritance and credit.

The illiteracy rate in the country is very similar for both men and women (see Table 1). Swaziland has also achieved with relative success, equal access for both girls and boys in primary education. However, fewer girls are retained at higher levels of the education system. The number of female-headed households in the rural areas is significant and is mainly due to the migration of workers for employment in the cities. In urban areas this is partly due to the changing face of society whereby single parenthood is now becoming more acceptable than it used to be.

Table 5: Brief statistics on population, employment and illiteracy

	MALE	FEMALE
POPULATION	473 520	507 202
ILLITERACY (AGE 5+)	23%	24%
PAID EMPLOYEES (AGED 12+)	106 439	65 949
HEADS OF HOUSEHOLDS*		
RURAL	57 531	56 264
URBAN	40 329	18 290

Source: CSO,1997

*NB: This includes both true heads and defacto heads.

Swaziland is currently facing challenges posed by sluggish economic growth, decreasing levels of "fresh" Foreign Direct Investment, relatively high population growth and rising unemployment. This significantly impacts on households, in particular those headed by women due to their lower job opportunities.

While women constitute about 52% of the population, their representation in politics and decision-making is approximated at only 2%(MoHA).

The Government has acknowledged the need to address gender inequalities. The National Development Strategy (NDS), which is a guiding framework for the country's development, articulates a number of priorities "aimed at eliminating gaps and offering equal opportunities to all citizens irrespective of their sex".

A Gender Unit, within the Ministry of Home Affairs was established in 1996 and gender policy is being formulated. The long term objective of this policy is to contribute to the process of mainstreaming gender in plans and programmes of various ministerial sectors, NGOs, the private sector and other agencies involved in national development.

13 Gender and electrification

As a result of economic and traditional circumstances, women constitute the largest percentage of the population in rural areas. This means that the rural energy situation affects women disproportionately more, merely by virtue of being living there and because of their role as family caretakers and farmers. Thus, energy plays a key role in development of rural areas and improvements in terms of cleaner and convenient energy carriers will most likely benefit women.

13.1 Impact on households

Cooking

There are many positive benefits of electrification in rural areas. Electricity may benefit women and children by easing the drudgery of household tasks, improving health conditions, improving opportunities for access to information and giving a feeling of being part of the process of modernisation etc. Previous studies (Lasschuit, 1994, for example) have shown that on average women spend about 5 to 6 hours to collect firewood for a week's requirement. This time is envisaged to extend as the firewood resource get farther and farther away. In some areas the scarcity of firewood has meant that even men are obliged to provide for firewood for their families normally by buying and transporting it from remote areas. Under these circumstances, fuel switching to electricity could offer a solution. However, the minimum connection costs of E3,500 are still prohibitive to many households. Furthermore, even for those households that have

access to electricity the choice of cooking with an electric stove is dependant among other factors household income, the household head and the current cooking device.

As discussed earlier, a typical rural household consumes about 250 kWh of electricity per month which corresponds to about E 81.45. Certainly, lower income households would still rely substantially on firewood for cooking purposes in order to reduce their electricity bills.

Lasschuit, 1996, also observed that the choice of cooking fuels also depended on whether a man or a woman headed the household. It was found that electric cooking was more prevalent among female-headed households possibly due to their higher influence in decision-making. In male households the responsibility for major financial and investment matters rests upon the man, while women are responsible for cooking. On the other hand, in female-headed households women are not only responsible for cooking but also have decision-making power. This integration of decision making with responsibilities makes the possibility of electric cooking having a higher priority higher in female head households.

Another factor that may impede a cooking fuel switch from firewood to electricity is the type of stove that is being used. A number of rural households have already invested in a cast iron coal/wood stove with cost ranging from E 2,500 to over E4, 000. With such a high investment and the long lifetime of these stoves, the decision to buy an electric stove may be delayed. This means that firewood collection would remain an important chore for some time even after electrification.

Lighting

Electric lighting provides safer, higher quality and more reliable output as compared to candles or paraffin. The higher quality of electric lighting may also have positive health consequences. Proper lighting reduces eyestrain, especially for eye intensive activities such as reading and kitchen work. Consequently, it may prevent headaches and tiredness and in the long run loss of eyesight. This is even more important for women, who in most cases stay awake for extra work and preparations for the next day, even after other family members have gone to bed.

Electric lighting also contributes to the feeling of safety and security as it enables outside lighting during the night. This has grown to be an important feature due to the rising levels of crime in the country. Female-headed households are more susceptible to criminal in-breaks than male-headed households since the former are often perceived to be “weak” and unable to sufficiently defend themselves. The installation of an outside light is generally one of the first things that households do when they get connected (for Lasschuit, 1996, this was 87%). Table 6 depicts the differences in lighting times, observed during a survey, for households with electric lighting and those without.

Table 6: Comparison on lighting times for different fuels

Time lights switched off	% of respondents		
	Electric lighting	**Candle**	**Paraffin lamp**
< 8 PM	20	22	28
< 9 PM	48	72	74
< 10 PM	84	91	92
< 11 PM	99	99	100
AVERAGE LIGHTING TIME (HRS/DAY)	4.1	3.0	2.9
NUMBER OF CASES	89	262	198

Source: Lasschuit, 1996

13.2 Impact on economic development

One of the reasons for Government's involvement in rural electrification is that electrification is expected to stimulate growth of the rural economy. There has been a debate on whether electrification should be the primer for economic activity or whether electrification will be truly beneficial if there already exists some economic activity in an area. While this dilemma is still an issue for further research, what seems to be clear that electricity does play a facilitatory role in economic development. Electricity facilitates increased production and sales opportunities. There are other factors of importance for establishment and operation of businesses such as supply of raw materials, transport and communication infrastructure, and nature of the market for the goods and services provided.

Women in rural areas are largely involved in informal sector activities such as gardening, vending and sewing. Operating a vending business has little, if at all to do with electricity. The supply and availability of product and the market are the crucial elements in successful operation.

For small to moderate gardens, water pumping can be carried out efficiently with petrol (or solar) pumps. Grid electrification would not necessarily benefit women.

Electric sewing machines can boost production levels as compared to manual machines. Women in electrified household's benefit from the ease and convenience of electric machines. Community sewing schemes also stand to benefit from electrification since production and sales levels can be significantly increased as compare to manual sewing.

A significant proportion of the products of the rural informal sector are bought by intermediaries and resold in the urban centers. Since these intermediaries are usually men, it can be argued that the benefits that accrue to men are higher than for women.

13.3 Opportunities in the electricity sector

Many employers in Swaziland now offer equal opportunities for employment for both men and women. However, even though there have been significant increases over the years in the numbers of women in formal sector employment, women in general, continue to occupy positions at lower levels of the employment ladder. A study by the Federation of Swaziland Employers on the general situation of women in the private sector (1997) revealed that the employment of women in the private sector still lags behind that of men. In particular, women are under-represented in management positions and in skilled/semi-skilled jobs in the country.

The numbers of women enrolling for engineering or technical courses are still glaringly lower than those of men (see Table 3). Therefore unless a direct intervention is made, the representation of women in higher echelons of management of electricity firms/utilities will remain low. This also means that the benefits of the electricity reforms and electrification will only benefit women as end users of electricity but their opportunities for employment within the sector are still poor.

Table 7: Population aged 10+ by highest vocational educational level completed

Qualification		MALES	FEMALES
ELECTRICAL	certificate	551	31
ENGINEERING	diploma	344	18
MECHANICAL	certificate	1 052	38
ENGINEERING	diploma	563	17
AUTOMOTIVE	certificate	200	15
ENGINEERING	diploma	134	13

Source: CSO, 1997

However, on another level the ongoing ESI restructuring process once completed, could offer increased opportunities for participation by women if SEB is public listed in the stock exchange as is being proposed

14. Conclusions and Recommendations for Namibia:

14.1 Conclusions*:*

Planning and implementation of the rural electrification programme in Namibia commenced in 1991 and it is now possible, 10 years later, to make an assessment of gender differences, achievements and failings of the programme.

Overall, electrification has had most influence on substitution of lighting fuels, but has not influenced cooking fuels beyond a minority of households. Only the grid-electrified households can utilize ironing and cooking, since the solar systems can only be used for low-load energy services. Higher priority receives TVs and refrigerators, at least partly due to gender-based decision making regarding household expenditure.

Access to electricity, solar or grid, has primarily had an impact on fuel choice for lighting, operating a radio and television sets. However, many solar-electrified households cannot use the systems to power their radios or televisions because of incompatibility between the standard appliance and the voltage output of the solar system (M Davis & Wamukonya). Access to solar electricity has no impact on fuel wood use or choice of cooking fuel.

Women, particularly in the rural areas have remained the suppliers and end-users of energy for household and community consumption of wood fuel. This is not only a serious constraint on their productive time, but depending on the volume of fire wood collected, a heavy strain on their health. Women are not often in a position to make or influence decisions concerning energy use. Most SADC countries do not subsidized the off-grid electrification.

There is limited involvement of women at project conception and implementation levels of most of the projects in the energy sector in Namibia, as well as in SADC countries.

Many women do not have access to information on appropriate technologies in the sector. There are more energy-based projects in urban than rural areas in some of African countries. This has further marginalized the rural women's involvement in the sector. The majority of women especially in Southern African Countries like in Namibia and Swaziland do not have access to credit facilities like men.

14.2 Recommendations:

There is a need to develop an adequate programme for gender training for the sector. Gender analysis models should be used as a tool of stock of women's needs and priorities in the sector. As such, there is need to review the policy and projects to incorporate the gender dimensions.

Participatory approach should be used to gather, define and quantify women's needs, priorities and potentials in the sector. In this regard, a study is needed to provide the information that could be taken into account in the review process of the policy and energy programmes. It is further recommended that attempts be made to incorporate needs assessments and community level participation in the electrification planning process. In particular the needs of women need to be taken into account and their participation and representation encouraged. These objectives can be achieved through the establishment of consultative forums and information dissemination programmes.

There is a need for development of a programme on functional literacy, entrepreneurship and leadership training skills for women in rural areas to equip them with the challenges of the sector. There is a need to create micro-financing fund/credit facilities for energy activities that could contribute to sustainable livelihoods of rural women.

To comply with UNESCO World Conference on Science, WCS/5/Draft, clause 45 as stated above, there is a need to develop an adequate programme on awareness on energy and women.
There is a need for closer and enhanced collaboration between project engineers and end-users in developing alternative ways of meeting domestic energy requirements.

There is a need for enhancing regional networking on appropriate technology development, demonstration and application. Collaboration of all stakeholders should be enhanced to minimize duplication of efforts. The end users should be encouraged to participate in the design phase of the technology.

There is a need for the SADC and other African governments and parastatals to subsidized off-grid electrification in one-way or another so that the rural women who do not have access to grid electricity to benefit.

14.3. Conclusion and Recommendation for Swaziland

The general problems faced concerning gender inequalities in Swaziland are also true in the energy sector. Different levels of achievements have been realized and a Gender Unit has been established. Awareness rising on gender issues has also raised some level of understanding and acceptance of gender equality and women's advancement. As a further step forward, a recommendation of general nature could be the establishment of a consultative mechanism constituted by a broad representation from society. This permanent gender consultative forum would then steer the gender programme in Swaziland.

Since women constitute the largest percentage of the proportion in rural areas, any improvement in the rural energy supply situation will also be of benefit to them. Electrification of rural areas may help to relieve women of the burden of fuel wood collection. Electrification of rural also enable higher quality lighting, which in turn allows women to undertake extra work and relieves and has positive health impacts. Electrification may also stimulate development of small businesses, which in turn could raise the standard of living in rural areas. However, the specific energy needs assessment of women in rural areas has not been adequately investigated. Therefore it is recommended that the implementation strategy of the energy policy should include analysis and implementation of gender specific activities. As a step further, capacity building on gender needs analysis in the energy sector should be vigorously undertaken.

On the other hand, the efforts of the Government in encouraging enrollment of women for technical courses and programmes should be sustained. This will in the long term ensure that women benefit in more than just being end-users from the electricity reforms.

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