



www.sparknet.info

Knowledge network on sustainable household energy
in Southern and Eastern Africa

Scenario Analysis

Mozambique

Lasten Mika
September 2004

An initiative of



Intermediate Technology Development Group – UK, East Africa (Kenya)
and Southern Africa (Zimbabwe/Mozambique)



Eco Ltd – UK



Eco Consulting Group – Germany



Energy and Environmental Concerns for Zambia – Zambia



Makerere University, Women and Gender Studies Department – Uganda



Rural Area Power Solutions (Pty) Ltd – South Africa



Scientific and Industrial Research and Development Centre, Energy
Technology Institute – Zimbabwe



TaTEDO, Tanzania Traditional Energy Development and Environment
Organisation – Tanzania



Universiteit Twente

University of Twente, Technology and Development Group – Netherlands



University of Liverpool, Department of Public Health – UK

In association with



HEDON Household Energy Network – www.hedon.info

Supported by



The European Commission, International Co-operation (INCO), FP5

Executive summary

The Mozambican population stands at 18.3 million and is highly rural with over 70% of the population staying there. Traditional energy resources (fuelwood and charcoal) constitute the major energy consumed in the country accounting for over 90% of it. Electrification rates are very low and are even worse for the rural communities. On the national level 20% of the households have access to electricity whilst 1 – 2% of rural households have access to electricity. Electricity consumption is set to multiply by over 3 times the current consumption levels due to a number of energy intensive investments that the country is embarking upon. The country has made commitments to improve its energy supply by looking at other hydro-power options along the Zambezi River. These include the upgrading of Hydro Cahora Bassa and M'panda-Ncua. In addition the country has started harnessing its natural gas resources at Pande and Temane gas fields. However the gas is wholly exported to neighbouring South Africa.

The country is one of the poorest but with the fastest growing economy. The indicators show that the GDP grew by an above 10% since 1995 while investment levels peaked 27% of the GDP. Inflation went down to single digit figures and is stable. A large majority of the population over 70% lives in absolute poverty. The economy is mainly agrarian and the agriculture sector employs the majority of the work force that is over 80%. On the international level, the country enjoys good relations with international financial institution and donor support is immense.

Despite all the achievements, the country faces many challenges among them, the rising HIV/AIDS, high poverty levels, inadequate basic infrastructure and the high vulnerability to natural disasters (floods and droughts). The government introduced a number of policy initiatives as strategies to combating absolute poverty, increasing access to electricity, improvement in health and environmental management. As we reflect upon these initiatives and given the above background, we hypothetically set three distinct scenarios; the business as usual, worst case and best case scenarios and look into the next ten years (2000 – 2010) and predict what the picture would look like in terms of household energy provision.

Based upon the analysis, the predictions for the business as usual scenario approach to the predictions of the worst-case scenario. The hypothetical best-case scenario would be a far-fetched dream for the Mozambican situation.

Acknowledgements

To all ITDG Southern Africa staff and in particular members of staff of the International Programme Aim 3 (IPA3), I would like to thank you all.

Table of Contents

EXECUTIVE SUMMARY.....	II
ACKNOWLEDGEMENTS.....	II
TABLE OF CONTENTS.....	III
1 INTRODUCTION.....	1
1.1 SCENARIOS – WHAT THEY ARE AND WHY WE HAVE DONE THEM.....	1
1.2 BACKGROUND INFORMATION ON THE SCENARIOS.....	2
MAXIMUM DEMAND.....	4
2 DEVELOPMENT OF THE SCENARIOS.....	5
2.1 BUSINESS-AS-USUAL SCENARIO.....	5
2.1.1 Fuel Access.....	6
2.1.2 Fuel choice.....	6
2.1.3 Gender.....	6
2.1.4 Health.....	7
2.1.5 Forestry.....	7
2.1.6 Policy options.....	7
2.2 WORST-CASE SCENARIO.....	8
2.2.1 Fuel Access.....	8
2.2.2 Fuel choice.....	8
2.2.3 Gender.....	9
2.2.4 Health.....	9
2.2.5 Forestry.....	9
2.2.6 Policy options.....	10
2.3 BEST CASE SCENARIO.....	10
2.3.1 Fuel Access.....	10
2.3.2 Fuel choice.....	11
2.3.3 Gender.....	11
2.3.4 Health.....	11
2.3.5 Forestry.....	11
2.3.6 Policy options.....	12
CLOSURE.....	12
REFERENCES.....	13
APPENDIX A OVERVIEW OF SCENARIOS.....	14

1 Introduction

Sparknet is a multi-stakeholder interactive Knowledge Network focusing on how people, in the context of acute poverty, can gain access to better energy services and improve their livelihoods.

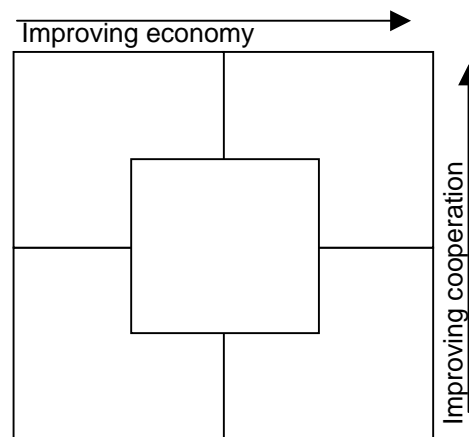
The network aims to make available resources for policy makers, companies, and civil society on energy poverty in Southern and East Africa. These are published through the network website www.sparknet.info. Sparknet focuses on three key themes – Health, Gender and Forestry – and the relationship of these issues with energy poverty. Output include detailed country reports, scenario analyses, and policy assessments. Two e-conferences will be held during the project – one on the scenarios, and another on policies.

Through a network of associates in Africa and Europe, Sparknet brings together 70 organisations and over 110 people from research institutes, NGOs, Governments and private companies.

1.1 Scenarios – what they are and why we have done them

Scenario analysis is simply a way of exploring realistic futures and predicting, based on our knowledge and experience how things could look in the future, how things could develop. As with all predictions we are likely to get it not entirely correct but the exercise is useful to stimulate debate on key issues. Scenario building is a *process* providing a structure for discussion and debate on what is could happen within a timeframe of the next ten to fifteen years. We will explore how things could change and how these changes are likely to impact on access to household energy in each country and across the Sparknet region. From these discussions, we hope to be able to make policy recommendations for poverty alleviation through identifying the key areas where policy action needs to take place. The intention is not to produce definitive studies but to stimulate relevant policy dialogue and serve as a basis for further research. Using management jargon we are looking here for 'blue sky thinking'. To do this we need to know the status quo (work-package 2, the country reports – which are now available on the Sparknet web site) and also to have identified influential organisations and projects and key actors who will shape the future of household energy provision (work-package 3, the draft version also available online).

External influences, such as changes in economic growth and levels of regional cooperation, are circumstances over which we have limited control. By identifying what policies might be effective under varying best and worst scenarios we have a good basis for debating potential policy actions which are pro-poverty alleviation, take into account our three themes – health, gender and natural resources / forestry – and are realistic under a broad range of external circumstances. As defined in the original Sparknet proposal, the intention is to develop a number of scenarios based on levels of economic prosperity and regional cooperation. The five possible scenarios – A to E – are shown in the 'box matrix' figure alongside. We believe it is sufficient to deal only with scenario A (business as usual), C (best case economy and co-operation), and D (worst case economy and co-operation). The other two are variations of these main scenarios. Both variables relate strongly to globalisation and market developments. This is the reason for including regional co-operation, since the Sparknet proposal was submitted to a funding window, which explored impacts of globalisation on energy poverty.



Because of the limited time/funding resources, these analyses are based – to a certain extent – on a subjective interpretation (the opinion of well-informed researchers, organisations and individuals in each country) of the impact of key variables and on findings of earlier studies (if available). It is focused mainly, but not exclusively on the issues identified by the three Northern partners on Health, Gender and Forestry (these papers are available online from the www.sparknet.info website.)

The scenario development follows the following process:

1. The development of peer reviewed scenario analyses for countries including 'business as usual' and alternatives based on levels of 'economic prosperity' and of 'regional co-operation'. This current document is a working version of the scenario.
2. An international e-conference (through the Internet) will be held based on the scenarios for each country. The provisional date for this conference is the end of September, over a 2-week period (see the www.sparknet.info website for additional details).
3. Publishing of conference proceedings from the e-conference on scenarios

The scenario analysis will lead naturally to an analysis of *'what do we think will happen'* and *'what do we want to see happening'* (or *how best we can deal with it if it does happen*) in each country and the region, and leads directly into work-package 5 (how to get from one to the other – i.e. policy recommendations).

1.2 Background information on the Scenarios

With a total surface area of 800,000 km², Mozambique has a total population of 18.3 million people (FAO, 2000) of whom 72% of them live in the rural areas and 28% are in the urban area. The urban population is mainly in the capital Maputo and the other 9 provincial capitals. By 2010, the population is projected to have risen to 21 million representing a compounded growth rate of 29%. The urban population is projected to have increased to 46%. Mozambique is now listed as one of the countries with extremely high levels of HIV/AIDS. Estimates from FAO (2001) put the percentage of adults between 15 – 49 years of age with HIV at 13% and rising. The population density, a key factor to consider when planning extension of electricity supply shows that Maputo city has the highest population density (1 692 people/km²), followed by Nampula (40) and Zambezia (32).

Mozambique is one of the poorest countries in the world. The living conditions of a large majority of Mozambicans are characterised by a situation of poverty. A minority of the population is living in greatest wealth while the majority swim in the pool of poverty. The Household Survey (IAF) of 1996/97 provided a detailed profile of poverty in Mozambique. Nearly 70% of the population lives in absolute poverty, and there are notable urban-rural and regional imbalances. The incidence of poverty at the provincial level is most marked in Sofala (87.92), Inhambane (82.60) and Tete (82.27). The prevalence of destitution (abject poverty) follows the same pattern, being highest in Sofala (65.19), Tete (53.60) and Inhambane (53.73). Maputo city shows the lowest levels of both poverty and abject poverty, while the least poor province in terms of per capita consumption is Cabo Delgado. Besides suffering from acute material poverty, the poor in Mozambique also suffer from a high degree of vulnerability to natural disasters and economic shocks. The tragic floods of 2000 and 2001 as well as the low agricultural product prices on the international markets bear clear testimony to this. The major challenge facing the country is of ensuring that benefits accruing from growth and stability can raise the standard of living of the majority.

The country faces widespread malnutrition, inadequate provision of basic needs in food, shelter, sanitation, water, health, and education. The WFP/FAO crop and food supply assessment mission report (2003) estimated that 788,000 people in 40 districts were highly vulnerable and food insecure. The average rate of malnutrition in children under five is 6.4%. Although this figure is only slightly above the acceptable average rate of 5%, the malnutrition rates are severe in Gaza, Maputo, and Tete. Food production is not enough to feed the growing population. The quality of education is poor, in part because teachers remain poorly paid, despite budget increases towards education. Economic, as well as political and social, factors have contributed to the building of a society, where the educational shortage is extremely acute. Illiteracy rates remain high and especially among females where the rate is 71% against 40% for the male. The school system is characterized by high dropout and failure rates, particularly among girls. Modern health services reach only about 40 per cent of the population. Overall, the health status of the population is lower than the average for African countries, and conditions have been exacerbated by years of flood and drought. The public health system in Mozambique is stretched thin as it attempts to provide coverage for a large, dispersed, and poor rural population. The morbidity and mortality statistics reveal that the health problems of Mozambique are communicable diseases that are mostly attributable to the low-level environmental health conditions. These diseases can easily be prevented/reduced by the application of simple environmental health measures.

Mozambique's economy is mainly agrarian based and women contribute the majority of the labour force. Between 1995 and 2000 Mozambique registered very positive macroeconomic performance. Inflation fell to single digit figures and the annual growth rate of real GDP was above 10%, while investment reached an average of around 27% of GDP. In 2001 the annual GDP growth was 13.8% and in 2002 it went down to 9.9%. The growth was broadly based, including 9% growth in agriculture and animal husbandry (led by the family sector) and 18% in industry (excluding mega-projects).

Traditional biomass energy resources (fuelwood and charcoal) account for more than 90% of the total energy consumption in Mozambique, while petroleum products account for 7–8% and electricity only 1–2 %. In terms of the IAF 96 data, in 1995 the country consumed about 12 million tonnes of fuelwood of which 76% were consumed in rural areas. Of this total, 83% was consumed in the form of fuelwood and 17% as charcoal. The supply of fuelwood in towns is solely performed by private producers who are either full time professionals or sporadic small-scale producers. In rural areas people mostly collect their fuelwood. Reliance of the poor rural and urban population on traditional energy resources is not supportive of the development and income generation needed to take them out of the poverty cycle. The fuelwood is often burnt in poorly ventilated kitchens posing serious health problems for women and children. Also women and children spend long hours per day in the drudgery of collecting Fuelwood often from considerable distances. Because of these demands on their time and physical energy, women and children often have no opportunities for education and other productive activities, while their health suffers. In the next 10 years, biomass will continue to represent the largest share of household energy demand in Mozambique.

The country has one of the lowest electrification rates of 7.2% in Southern Africa, South Africa has 66.1% and Zimbabwe has 39.7%. National electricity consumption has been increasing in quantum leaps as several mega investment projects come on stream. The new aluminium smelter, Mozambique Aluminium (MOZAL) increased the national consumption three fold when it came on stream in 2002. MOZAL will need 400 megawatts of power, more than double current national electricity consumption. Domestic consumption remains low due to the very low per capita incomes for the majority of the population. Only about 5% of Mozambican households (about 220,000 or a population of about 2 million) have access to electricity, and over half of these are in the capital, Maputo, and its surrounding areas. Outside these main urban areas, electricity access is minimal, and there has been practically no increase in the last 25 years. Of the 120 or so "district capitals", over 50 are without any form of public electricity supply, or have sporadic supplies from small diesel-fueled generating sets (gensets) to a handful of customers via old and poorly maintained small grids. Even in these areas, supply reliability is low, the household electricity access rate is only 15-20%, and the implicit cross-subsidies (from the Maputo area to the rest of the country) are heavy. The average rural household income level is low, in the range of USD30 –40 per month. The energy expenditure for rural households is in the area of USD 5 – 6 per month for purchase of kerosene, batteries, charcoal etc. (Rural electrification Strategy Plan for Mozambique – Final Report).

The current electricity generating capacity is 2385 MW. On the supply side 80% of the current energy production (8900 GWh)¹ comes from Hydro Cahora Bassa and the balance from *Electricidade de Mocambique* (EdM) operated hydro and gas power stations. EdM expects to cover demand growth from additional power allocation from the HCB in the coming years with surplus still exported to South Africa, Zimbabwe and Malawi. A number of energy intensive primary extraction industrial projects are on the horizon and at different stages of development. The table below summarizes these projects and their projected electricity demand.

¹ IEA Energy Statistics 2001.

Table 1: Proposed and operational mega investments in Mozambique.

PROJECT	MAXIMUM DEMAND MW	ANNUAL ENERGY GWh/yr
Mozal Phase 1	460	4000
Mozal Phase 1 and 2	895	7500
Maputo Iron and Steel Plant	850	5000
Kaiser Aluminium Smelter, Beira	625	5000
Nacala Titanium Smelter	150	1000
Chibuto Corridor Heavy Sands Project	150	1000

The total demand of these major projects if realised will be some 3000MW with annual energy demand of over 20 000GWh/year. This would outstrip the current installed generation capacity of 2385MW. Feasibility studies are under way for a second power station at Cahora Bassa, and a new dam at M'panda-Ncuca, 70 kilometres downstream from Cahora Bassa. New generating capacity will certainly be required for the mega-projects in the north and centre. Besides the Beira iron plant, these include a second aluminium smelter, also in the Beira area, and a titanium smelter in Nacala. Meanwhile, prospecting for oil continues.

Forests play an important part in the supply of fuelwood and charcoal as an estimated 16,000,000 m³ of wood are burned every year to satisfy the country's energy demand. Mozambique has three major ecological zones: coastal forest mosaic, miombo woodlands, and mopane. There is no up to date forestry data and it is estimated that Mozambique has 62 million hectares of forest cover, which constitutes more than 78% of total land surface. Of these 20 million hectares are commercially viable while 8.5 million hectares are located within National Parks and nature reserves. The forest use pattern in these ecoregions depends on several aspects including proximity to large cities or roads, the economy of local community, among others. In general, the majority of population uses forest products for subsistence (energy, building, and medicines...) as well as for income generation by selling firewood and charcoal and poles for buildings. The Forest Sector review has provided the 1992 per capita consumption in order of 1.0 to 1.7 m³.

Amid such a diverse collection of issues and interactions, a question emerges: **What are the prospects for sustainable development over the next 10 years in Mozambique?** The central objective of the Government is a substantial reduction in the levels of absolute poverty in Mozambique through the adoption of measures to improve the capacities of, and the opportunities available to all Mozambicans, especially the poor. The specific objective is to reduce the incidence of absolute poverty from 70% in 1997 to less than 60% by 2005 and less than 50% by 2010. The Government of Mozambique, in order to provide continuity to its strategy to combat absolute poverty, initiated the Action Plan for the Reduction of Absolute Poverty (PARPA) 2001-2005. This is an important government instrument that should assist in the preparation of the State's medium-term and annual budgets, programmes, and policies. One of the targets is to provide reliable and sustainable electricity supply to administrative centres and all district capitals lacking electricity supply.

The Mozambican Rural Electrification strategy Plan of 2000, establishes that for the next ten years its main objective would be to electrify all district headquarters by 2004 and all administrative centres, isolated health centres, schools and other social and economic important targets by 2012.

The governance processes surrounding land and forests are critical for local communities and the nation as a whole and are fundamental for poverty eradication. The government of Mozambique has taken important steps in promoting development of the forest sector and in establishing the enabling

environment for sustainable forest management. Notable milestones include the formulation of the Policy and Strategy for Forests and Wildlife Development in 1997, the National Forest and Wildlife Programme in 1998, the new Forest and Wildlife Law of 1999 and the new Forest Regulations of 2002. The legal instruments helped steer a new dynamic approach on private investment as well as community participation in forest resource management. The new thinking moves away from the simple licensing system to a concession based system and it involves community participation in forest management. Local and provincial governments license transport operators, loggers, and charcoal traders. Regulations to control forest harvests dictate how many trees can be cut, their minimum diameter, and when reforestation must take place. Those found breaking the rules are usually fined. The general trend in licensing shows an increase in the number of licenses issued and this is an indication of how the state has been able to bring about control over the forest resources. With this trend it is expected that the deforestation will be arrested in the next decade.

Since 1995 the government has been implementing the Health Recovery Programme. It is aimed at reducing mortality, morbidity and suffering among the high risk groups such as women, children and all those displaced during the war and natural disasters. It is also intended to keep the primary health care as the basis for provision of good quality and sustainable health care and make it accessible to the majority of the population. The technical and managerial capacity of the ministry of health will be upgraded to enable them to effectively plan, implement and evaluate health care and support services. The government objective is to increase health coverage from the low 40% to 60%.

2 Development of the scenarios

2.1 Business-as-usual scenario

The underlying assumptions between 2000 and 2010 are; Economic growth will be positive and rapid, with less promising social development. The economy will be characterized by an above 10% growth in GDP, inflation held to 10 % and an average investment of 27% of GDP. The country will continue to advance reforms that facilitate private sector-led and poverty-reducing growth. These gains will be complimented by the high foreign assistance that the country will be receiving. However the majority of the population (70%) will remain below the poverty line. Mozambique's poor infrastructure will support to a limited extent value adding economic activities. Subsistence agriculture will still be the single most employer, with 83% of the labour force.

The energy sector will continue to be one of the biggest recipients of international support through the good relations with the international community and the high levels of investments. Substantial resources will be channelled into extending the reach of the centrally operated grid networks within the urban centres of the country.

Mozambique's high population growth rate will be countered by the increasing HIV/AIDS pandemic and it will undo most of the economic and social development gains made. From the most recent estimates of prevalence rate of 13% and an estimated 84,000 having died of AIDS in 2000, the demographic impact of HIV/AIDS will be a retardation of the growth rate as well as the deformation of the age structure of the population. The present age and sex structure is a wide-based pyramid with many young people and few elderly. This has serious implications on social expenditure, as more resources will be required to meet the needs of a young and elderly population.

2.1.1 Fuel Access

As large-scale investments come on board, the government's priorities will be directed towards ensuring energy security for these investments. Hence the industry/commercial sector shall continue to chew the bulk of energy investments. There is less likelihood that much would be done in terms of improving access to modern energy services to the household sector. In addition, the Rural Electrification Strategy that is aimed at improving the electrification degree in rural areas is very silent on improving access to the rural households. So far the investments in other sources of energy (the gas fields of Pande and Temane) are mostly benefiting South Africa at the expense of the locals.

Blessed with direct access to the Indian Ocean and having a number of ports, which also serve some of the landlocked countries Zimbabwe, Malawi and Zambia. These ports serve as important entry points for petroleum products. Hence in the urban centres the accessibility of petroleum products will not be a problem except for the poorly developed infrastructure in the hinterland. The countryside is sparsely populated serve for the cities and coupled to the above, leaves the majority of the population without good access to modern energy services.

Without major revolutionary changes to the agricultural system, poverty levels will remain unchanged for the majority and this will pose a great challenge in their ability to pay for any form of modern energy service. Fuelwood and charcoal will be the most sought after fuels by the urban poor households and the majority rural populace. For the urban areas accessibility of charcoal would be difficult during the rainy seasons as most of the roads are inaccessible and the vehicles in deplorable states.

2.1.2 Fuel choice

Viable fuel choices of fuel include both conventional and renewable energy sources. Among the common ones are electricity, petroleum, solar, fuelwood, charcoal and LPG. Price and availability will be the limiting factors to the large majority. Rural infrastructure will remain in its poor state posing serious delivery of fuels like LPG and petroleum and thereby limiting the fuel options to traditional energy sources Grid electricity will remain non-viable for the rural population as there are no options for empowering people to move out of their poverty circles. Within the next ten years fuelwood and charcoal will remain the dominant fuel choice for the poor majority population of Mozambique.

The country's low levels of illiteracy and low base of skilled manpower in the energy sector will not improve in the next 10 years. Despite the government's heavy investment in the education sector, the fruits of this effort will be realised well after the next ten years. This will obviously affect the development and promotion of alternative energy sources such as solar, micro-hydro and wind.

2.1.3 Gender

Women both urban and rural dwellers will have little choice over the domestic fuels that they use due to a number of factors among them, high poverty levels, high illiteracy rates and low participation in development projects. Men and women will still have different levels of access to different types of energy. Men will dominate commercial fuelwood production and marketing while women will be active in the collection of fuelwood. Villagers, mostly women and children, will have to spend more time in search of fuelwood as the forests recede and travel more than the 4-8 km per day per household to collect 10 kg of wood. At household level women will be responsible for the daily chores of water collection, fuelwood collection and preparing meals. This will increase

the vulnerability of women and children to a whole range of problems, some of which impact negatively on them for life. These include low women illiteracy rates and poor health.

More women will be involved in gender policy formulation following the positive moves by the government that favours women's emancipation with the objective to elevate women's participation in all activities of the society. More women will respond quite positively as evidenced now by the high number of women occupying high positions in the parliament and government.

2.1.4 Health

Despite positive policy pronouncements to improve the health status of the nation, the levels of environmental health conditions will only slightly improve. This will be worsened by the rising HIV/AIDS pandemic. In addition the poor health infrastructure will remain poorer. It will be affected by lack of health personnel and in rural areas the clinics will remain far away. Improvements in the standard of living of the majority within the next 10 years will be a great challenge to overcome and we foresee these health problems persisting beyond the decade. As the greater majority of the population turn to traditional sources of fuel, the associated problems will also be carried along. These include acute respiratory diseases (ARI), and the physical effort in collecting and transporting the fuels over long distances. There would be less attention paid to those sick (due to the high HIV/AIDS) and people move over long distance in search of the fuel. Meals will unavoidably be poorly prepared as either the families make savings on the little fuel available or save for the next day. With health facilities far away, poorly equipped (staff and medicine) the health situation of a large majority will be compromised.

2.1.5 Forestry

The high poverty levels, low electrification rates and unaffordable prices of gas and electricity will provide a thriving demand for charcoal and fuelwood for domestic purposes. The demand for charcoal that is largely in the main urban cities of the central part of Mozambique will rise. Remote provinces of Nampula and Cabo Delgado, where the percentage of households using charcoal and fuelwood is greater than the national average will also increase and this will overall impart pressure on Mozambique's forests.

Deforestation will be a significant problem in Mozambique, damaging the environment, the economy, and the welfare of Mozambicans. However with the government legal system in place, this will assist in curbing the high deforestation rates. With a growing population, some, greater areas will be severely deforested to provide enough cleared land for crop cultivation and this land will not have enough time to recover after use, making the practice extremely damaging to the environment.

2.1.6 Policy options

Key to achieving the objectives of poverty and sustainable development is improved access to improved quality and an increased quantity of energy services. The overall strategy would be to:

- ❖ Economically empower the rural and urban poor in particular the women.
- ❖ Promote decentralised small-scale technologies, in particular those locally made and operate using available fuels. These can then be a source of jobs, employment and enterprise creation for both rural and urban poor.

- ❖ Manage the population increase and concentration in urban centres, through the provision of more options for the rural people so as to slow migration and reduce pressure on cities and towns.
- ❖ Empower the poor people and include them into the decision making process so as to assist them to influence the selection of affordable, reliable and clean energy services that can most appropriately meet their needs.
- ❖ Improve energy efficiency in particular on household cooking.
- ❖ Reduce the high levels of indoor air through use of improved stoves.
- ❖ Technically capacitate through imparting of knowledge and skills to the highly illiterate society.
- ❖ Main streaming gender into development process.
- ❖ Promote social management of forestry resources.
- ❖ Collect and inventorise data on forest resource management

2.2 Worst-case scenario

The underlying assumptions are that Mozambique will be the poorest and most aid-dependent country in the world, with a GNP per capita standing at levels as was in 1997 at US\$90. The country would have a high foreign debt and without a good track record on economic reform. The government's lack of tight control of spending and the money supply, combined with non-financial sector reform, will not succeed to reduce inflation assumed to be 70%. Devastating floods will continue to disrupt economic growth. Subsistence agriculture will continue to employ the vast majority of the country's workforce. The illiteracy rates will rise to above 90%. Without focused economic development, investments will remain pathetically low and infrastructure poor. Overallly there would be no guarantee to some improvement in the living conditions of the population, and worse still for the rural areas.

The energy sector will suffer from lack of international support over the next decade. The few minority urban population in an economy where wealth distribution is largely skewed will benefit more. The high population growth rates will turn negative as the HIV/AIDS pandemic takes its toll.

2.2.1 Fuel Access

Due to the poor state of the infrastructure, accessing modern energy services for the majority will remain a pipeline dream. High poverty levels pose a great challenge in the ability of the majority to pay for any modern energy service. There would be over dependence by the majority on traditional fuels (charcoal and fuelwood) as a source of energy. Charcoal one of the most sought after fuel by urban households would be preserve of the rich minority as the poor urban households fail to pay for it. Charcoal and firewood which are brought to urban areas by wholesalers, using their own or hired trucks and, in some cases through railway might be difficult due to poor infrastructure and truck breakdowns will be a common feature as owners fail to keep them in good condition. This will also contribute to poor access of charcoal and fuelwood in urban centres. With an economy on the downward trend, lack of foreign currency and bad relations with the international community will create problems in investing in alternative energy resources and the importation of petroleum products. This will lead to widespread shortages creating “a fuel black market”.

2.2.2 Fuel choice

Over 90 – 95% of the population will rely on traditional energy sources (Fuelwood and charcoal) as a fuel of choice. Other alternatives such as electricity, petroleum, solar and LPG will remain a

preserve of the rich minority. Price and availability will be the limiting factors to the large majority. The country's low levels of illiteracy and lack of skilled manpower in the energy sector, compounded by lack of government support in social services, will hinder the development and promotion of alternative energy sources such as solar, micro-hydro and wind.

2.2.3 Gender

With little or no option on alternative energy sources, women both urban and rural dwellers will continue to be responsible for the daily household chores among them water and Fuelwood collection. The different levels of access to energy types will be glaringly become clearer as men would venture into the commercial production and marketing of charcoal while women will be on the non – commercial use of the energy resources. Over reliance on traditional energy sources will see women travelling over longer distances and time looking for Fuelwood. This will inevitable worsen the vulnerability of women and children to a whole range of problems, some of which impact negatively on them for life. This will further compound the lower women illiteracy rates, poor health.

2.2.4 Health

The health problems of the country that are mainly communicable diseases attributed to the low level of environmental health conditions will continue to haunt the country. Waste management would be no better off as indiscriminate disposal will continue in peri-urban and rural areas creating favorable conditions for the propagation and spread of the diseases. The poor health infrastructure will further collapse and not help the situation either. Over dependence on traditional fuels used on inefficient open fires will lead to higher cases of ARI, the leading cause of childhood mortality. Switching completely to cooking with clean fuels, such as LPG or biogas or electricity, will be a preserve of the minority rich.

As the availability of fuel become a problem, cases of malnutrition are often reported as people resort to eating poorly prepared food due to insufficient resources or trying to stretch the limited available sources. Low birth weights a cause of high indoor air pollutants will rise and this will also affect the country's overall health status. There would be less attention paid to those sick (due to the high HIV/AIDS) and people move over long distance sin search of the fuel. Meals will unavoidably be poorly prepared as either the families make savings on the little fuel available or save for the next day.

2.2.5 Forestry

In general, the majority of the population will be relying on forest products for subsistence (energy, building, and medicines...) as well as for income generation by selling fuelwood and charcoal. The high poverty levels, low electrification rates and unaffordable prices of gas and electricity will create a thriving demand for charcoal and fuelwood for domestic purposes. This growing demand for fuelwood and charcoal will place increasing pressure on Mozambique's forests.

Deforestation will be a serious problem in Mozambique, damaging the environment, the economy, and the welfare of Mozambicans. With little government expenditure in the forestry sector, illegal logging of trees will be rampant. It is expected that all trees surrounding major cities will be used for domestic purposes. Some greater areas will be deforested to the extent that it will fail to meet the increased demand in traditional fuels.

The laws and legal instruments that promote sustainable use of forest resources would largely be ignored with corruption taking its peak. The present legal framework which seeks to bring about a new thinking that moves away from the simple licensing system to a concession based system and also brings on board the community participation in forest management. Local and provincial governments responsible for licensing transport operators, loggers, and charcoal traders. Will be bribed forestry resources over exploited. With this trend it is expected that desertification will spread at a high rate in the next decade.

2.2.6 Policy options

To manage the system from the worst case considerable attention should be paid to:

- ❖ Creating a conducive environment for foreign investments
- ❖ Investment into social infrastructure
- ❖ Diversification of the economy and employment creation
- ❖ Mainstreaming HIV/AIDS into development projects
- ❖ Mainstreaming gender into development projects
- ❖ Promotion of locally managed decentralised energy options
- ❖ Promotion of education

2.3 Best case scenario

The underlying assumption is that the economy will rise to become the leading powerhouse in Southern Africa. Economic growth will be positive and rapid, sustained and being able to support social development. The growth in GDP will exceed that of neighbouring countries and inflation will be held to a single digit. The country will continue to advance reforms that facilitate private sector-led and poverty-reducing growth. The country will transform itself from being donor dependence to a donor itself. A minority of the population will remain below the poverty line and the government will channel social resources to this marginalized group. The country's infrastructure will be perfected to support value adding economic activities. As such the country will focus its economic development policy around the value addition to its primary raw materials such as agricultural produce, mining and hydro power development.

The energy sector will be upgraded and the national grid extended to cover over 50% of the country. This will benefit the majority rural and urban. With the availability of modern energy services, commercial agriculture will take over from subsistence agriculture and will pay well. Overall, this should result in increased production and productivity in the various sectors (particularly in agriculture) and this should lead to an increased standard of living

Population growth rates will be maintained at levels that are sustainable with economic growth. The HIV/AIDS pandemic that has hit Mozambique will be contained to preserve the economic gains made by the country.

2.3.1 Fuel Access

Access to modern forms of energy services will be enhanced. There would less reliance on traditional fuels (charcoal and Fuelwood) as a source of energy and these will be relegated to the poorest of the poor. Price and availability will be the key issues to consider for the choice of any fuel.

There would be large investments in the commercial energy sector and there would an abundance of electricity energy that can readily be exported to the region earning the country some foreign

currency. The Rural Electrification Strategy clearly spells the targets for electrification in the next eight years as being local administration, electrification of all district headquarters by 2004 and all administrative centres, isolated health centres, schools and other social and economic important targets by 2012 will extend into the household sector. Gas readily available in Mozambique will be tapped and distribution established in all provincial capitals and extended into houses.

2.3.2 Fuel choice

A diversified array of viable fuels that include both conventional and renewable energy resources will be available. Price, availability and user friendliness will be the key determinants of the choice of any particular fuel. It would be common to have a family making a decision at any particular time on whether to use one type of fuel over the other.

With an improved rural infrastructure delivery of fuels like LPG and petroleum to rural areas is would be easy. This would give the rural population a greater option of choice of modern energy services.

2.3.3 Gender

Under the current scenario, there is observed a shift in the mindset in addressing the energy crisis those women faces. There will be economic empowerment for all and this should result in equal access to energy. This phase should see more women being involved in the commercial production and marketing of energy products and services. This reduces the vulnerability of women and children from a whole range of problems, which then impacts positively on the life of the whole family.

2.3.4 Health

People are more informed about the health implications or hazards of communicable diseases due to high levels of environmental health conditions. Waste management including solid, liquid, hospital, human and animal will be disposed of properly The health infrastructure will be in perfect working order with well trained personnel even in the rural areas. There would be marked improvements in the standard of living of the majority within the next 10 years. People will be more informed and aware about the dangers of ARI the leading cause of childhood mortality. Fuel-efficient technologies and techniques will be readily available even to the remote rural areas. Unfortunately indoor smoke from solid fuels, associated with heating and cooking in the home, will continue to haunt the majority of the population as reliance on traditional fuels will be the order of the day.

Switching to cleaner sources of energy becomes a financial, availability or user desired. The incremental costs of switching to modern and superior fuels will not be prohibitive for many rural households and rural markets of commercial fuels will be fully developed. The economics of say using LPG, with its relatively high operating cost, will be favorable to the rural poor who can will afford to pay for refilling a LPG cylinder periodically.

2.3.5 Forestry

The low poverty levels, high electrification rates and affordable prices of gas and electricity will reduce the demand for charcoal and Fuelwood for domestic purposes. The demand for charcoal would be relegated to social needs like braaing etc as opposed to cooking for families. In contrast charcoal will be well-packaged and available from shops around the country. There would be reduced demand for charcoal and this will put minimum pressure on Mozambique's forests.

The laws and legal instruments that promote sustainable use of forest resources will be respected and observed. There will be more private investment as well as community participation in forest resource management. The revitalisation of a sustainable forestry industry will therefore lead to for the creation of jobs to help eliminate rural poverty.

2.3.6 Policy options

- ❖ Promotion of decentralised and integrated energy service provision
- ❖ Promotion of renewable energy sources
- ❖ Financing mechanisms for energy services
- ❖ Revamp of the health system
- ❖ Gender mainstreaming

Closure

Based upon the analysis, the predictions for the business as usual scenario approach to the predictions of the worst-case scenario. The hypothetical best-case scenario would be a far-fetched dream for the Mozambican situation. Some policy options or key issues that policies might take on board are included.

References

- Annababette Wils et al Mozambique's Future: Modeling Population and Sustainable Development Challenges
- African Energy Data and terminology handbook, Afrepren
- Bruce, N.G., (2002), Household energy & health: an introduction, www.sparknet.info
- Bruce, N.G., (2003), Household energy & health: the global context, www.sparknet.info
- Clancy, J (2002). Household energy & gender: an introduction, www.sparknet.info
- Clancy, J (2003). Household energy & gender: the global context, www.sparknet.info
- Clancy, J, 2004. Gender Issues, working draft, www.sparknet.info
- Dr. Almeida A. Siteo, Impacts of Finnish aid in forestry and rural development Community impacts in
- Dr Stafani Klos, Mainstreaming gender in sector investment programmes, Conference Paper : Forum on Participation in Sector Programmes , Lusaka Zambia September 20 – 23 1999.
- Energy Policy: Special Issue, Africa: improving modern services for the poor, Volume Numbers 11-12, September 2002
- Mozambican forestry Department of Forestry, Faculty of Agronomy and Forestry Eduardo Mondlane University, Mozambique May, 2003
- Human Development Indicators 2003 UNDP*
- International Energy Agency's *World Energy Outlook 2002*
- Maundrate Nakala Oreste, Carla Cristina Cuemba FORESTRY DATA ON MOZAMBIQUE Ministry of Agriculture, Directorate of Forestry and Wildlife Economics and Planning Department Maputo, Mozambique
- MOZAMBIQUE Energy Reform and Access Project Project Appraisal Document
- Norplan newsletter page 1, Oslo September 2003 No. 3
- Rural Electrification Action Plan for Mozambique: Phase II Draft Report, National Directorate of Energy, Mozambique, October 2001
- Statistics on the Web: <http://www.iea.org/statist/index.htm>
- World Energy Assessment Overview 2004 Update, UNDP

Appendix A Overview of scenarios

Please do not be constrained by the space available here. The table will expand as necessary and will probably span a number of pages

Criteria/Issue	A: Business as usual	C: Best case economy and co-operation	D: Worst case economy and co-operation
<p>Current situation – short summary: What are the key issues / constraints which you have identified within your country regarding provision of household energy at the current time – particularly with regard to health, gender and forestry?</p>	<p>The population stands at 18.3 million with an annual growth rate of 1.9% High HIV/AIDS prevalence rates 13% Population highly rural with over 70% of the population living there. Over 70% of the population lives in absolute poverty. The country is one of the poorest but with the fastest growing economy. The GDP grew by an above 10% since 1995 Investment levels peaked 27% of the GDP. Inflation went down to single digit figures and is stable. 90% of energy consumed in country is from traditional energy resources (fuelwood and charcoal) The economy is mainly agrarian and the agriculture sector employs the majority of the work force that is over 80%. On the international level, the country enjoys good relations with international financial institution and donor support is immense. Electrification rates are very low 7.2%. On the national level 20% of the households have access to electricity whilst 1 – 2% of rural households have access to electricity. Electricity consumption is set to multiply by over 3 times the current consumption levels due to a number of energy intensive investments The country has made commitments to improve its energy supply by looking at other hydro-power options along the Zambezi River. These include the upgrading of Hydro Cahora Bassa and M'panda-Ncua. The country has started harnessing its natural gas resources at Pande and Temane gas fields.</p>		
<p>What are the impacts on Fuel Choice for household energy under BAU and worst case / best case scenarios for the economy and regional co-operation over the next 10-15years?</p>	<p>A number of viable fuel choices include both conventional and renewable energy sources. Price and availability will be the limiting factors to the large majority. Serious delivery of fuels like LPG and petroleum and thereby limiting the fuel options to traditional energy sources</p>	<p>A diversified array of viable fuels that include both conventional and renewable energy resources will be available. Price, availability and user friendliness will be the key determinants of the choice of any particular fuel. With an improved rural infrastructure delivery of fuels like LPG and petroleum to</p>	<p>Over 90 – 95% of the population will rely on traditional energy sources as a fuel of choice. Alternatives such as electricity, petroleum, solar and LPG will remain a preserve of the rich minority. Price and availability will be the limiting factors to the large majority. Hindered development and</p>

Criteria/Issue	A: Business as usual	C: Best case economy and co-operation	D: Worst case economy and co-operation
	<p>Grid electricity will remain non-viable for the rural population as</p> <p>Within the next ten years fuelwood and charcoal will remain the dominant fuel choice for the poor majority</p> <p>The country's low levels of illiteracy and low base of skilled manpower in the energy sector will not improve in the next 10 years.</p> <p>The development and promotion of alternative energy sources such as solar, micro-hydro and wind hampered.</p>	<p>rural areas is would be easy. A greater option of choice of modern energy services.</p>	<p>promotion of alternative energy sources such as solar, micro-hydro and wind.</p>
<p>What are the impacts on Fuel Access for household energy under BAU and worst case / best case scenarios for the economy and regional co-operation over the next 10-15years?</p>	<p>Government's priorities will be directed towards ensuring energy security for industry/commercial sector.</p> <p>Improving access to modern energy services to the household sector will receive lip service.</p> <p>Rural Electrification Strategy will not improve access to the rural households.</p> <p>Investments in other sources of energy (the gas fields of Pande and Temane) will be for export market.</p> <p>In the urban centres the accessibility of petroleum products will not be a problem except for the poorly developed infrastructure in the hinterland.</p> <p>The majority of the population</p>	<p>Access to modern forms of energy services will be enhanced.</p> <p>There would less reliance on traditional fuels as a source of energy and these will be relegated to the poorest of the poor.</p> <p>Price and availability will be the key issues to consider for the choice of any fuel.</p> <p>Large investments in the commercial energy sector</p> <p>An abundance of electricity energy that can readily be exported to the region.</p> <p>The Rural Electrification Strategy will extend into the household sector.</p> <p>Gas readily available in Mozambique will be tapped and distribution established in</p>	<p>Accessing of modern energy services for the majority will remain a pipeline dream.</p> <p>High poverty levels pose a great challenge in the ability of the majority to pay for any modern energy service.</p> <p>Over dependence by the majority on traditional fuels as a source of energy.</p> <p>Charcoal one of the most sought after fuel by urban households would be preserve of the rich</p> <p>Charcoal and firewood are brought to urban areas by wholesalers, using their own or hired trucks and, in some cases through railway might be difficult due</p> <p>Poor infrastructure and truck breakdowns will be a common</p>

Criteria/Issue	A: Business as usual	C: Best case economy and co-operation	D: Worst case economy and co-operation
	<p>will be without good access to modern energy services. Poor ability to pay for any form of modern energy service by the majority. For the urban areas accessibility of charcoal would be difficult during the rainy seasons as most of the roads are inaccessible and the vehicles in deplorable states.</p>	<p>all provincial capitals and extended into houses.</p>	<p>challenges With an economy on the downward trend, lack of foreign currency and bad relations with the international community will create problems in investing in alternative energy resources and the importation of petroleum products. This will lead to widespread shortages creating "a fuel black market".</p>
<p>In the left hand side boxes below, review specialist paper and others and identify issues which will be impacted by the changes identified above</p>	<p>In each of the boxes below, jot down points on the relevance, developments, implications of each of the scenarios on the issues raised in the left hand column.</p>		
<p>Health Issues - impacts on health</p>	<p>The levels of environmental health conditions will only slightly improve. Worsened by the rising HIV/AIDS pandemic. The poor health infrastructure will remain poorer. Lack of health personnel and in rural areas the clinics will remain far away. Improvements in the standard of living of the majority within the next 10 years will be a great challenge to overcome As the greater majority of the population turn to traditional sources of fuel, the associated problems will also be carried along. These include acute respiratory diseases (ARI), Physical effort in collecting and transporting the fuels over long distances.</p>	<p>People are more informed about the health implications or hazards of communicable diseases due to high levels of environmental health conditions. Waste management including solid, liquid, hospital, human and animal will be disposed of properly The health infrastructure will be in perfect working order with well-trained personnel even in the rural areas. Marked improvements in the standard of living of the majority within the next 10 years. People will be more informed and aware about the dangers of ARI the leading cause of childhood mortality. Fuel-efficient technologies and</p>	<p>The low level of environmental health conditions will continue to haunt the country. Waste management would be no better off as indiscriminate disposal will continue in peri-urban and rural areas creating favorable conditions for the propagation and spread of the diseases. The poor health infrastructure will further collapse and not help the situation either. Over dependence on traditional fuels used on inefficient open fires will lead to higher cases of ARI, the leading cause of childhood mortality. Switching to cleaner fuels, such as LPG or biogas or electricity, will be a preserve of the minority rich.</p>

Criteria/Issue	A: Business as usual	C: Best case economy and co-operation	D: Worst case economy and co-operation
	<p>Less attention paid to those sick (due to the high HIV/AIDS) as people move over long distance in search of the fuel.</p> <p>Meals will be poorly prepared as either the families make savings on the little fuel available or save for the next day.</p> <p>With health facilities far away, poorly equipped (staff and medicine) the health situation of a large majority will be compromised.</p>	<p>techniques will be readily available even to the remote rural areas.</p> <p>Unfortunately indoor smoke from solid fuels, associated with heating and cooking in the home, will continue to haunt the majority of the population as reliance on traditional fuels will be the order of the day.</p> <p>Switching to cleaner sources of energy becomes a financial, availability or user desired.</p> <p>The incremental costs of switching to modern and superior fuels will not be prohibitive for many rural households and rural markets of commercial fuels will be fully developed.</p>	<p>As the availability of fuel become a problem, cases of malnutrition are often reported as people resort to eating poorly prepared food due to insufficient resources or trying to stretch the limited available sources.</p> <p>Low birth weights a cause of high indoor air pollutants will rise and this will also affect the country's overall health status.</p> <p>There would be less attention paid to those sick (due to the high HIV/AIDS) and people move over long distance in search of the fuel.</p> <p>Meals will unavoidably be poorly prepared as either the families make savings on the little fuel available or save for the next day.</p>
Health Issues - policy options on health	<p>Manage the population increase and concentration in urban centres, through the provision of more options for the rural people so as to slow migration and reduce pressure on cities and towns.</p> <p>Empower the poor people and include them into the decision making process so as to assist them to influence the selection of affordable, reliable and clean energy services that can most appropriately meet their needs.</p> <p>Improve energy efficiency in</p>	Revamp of the health system	<p>Creating a conducive environment for foreign investments</p> <p>Investment into social infrastructure</p> <p>Mainstreaming HIV/AIDS into development projects</p>

Scenario Outlines

Criteria/Issue	A: Business as usual	C: Best case economy and co-operation	D: Worst case economy and co-operation
	<p>particular on household cooking. Reduce the high levels of indoor air through use of improved stoves. Technically capacitate through imparting of knowledge and skills to the highly illiterate society.</p>		
Gender Issues - impacts on gender	<p>Women both urban and rural dwellers will have little choice over the domestic fuels Men and women will still have different levels of access to different types of energy. Men will dominate commercial fuelwood production and marketing while women will be active in the collection of fuelwood. Women and children, will have to spend more time in search of fuelwood as the forests recede Women will be responsible for the daily chores of water collection, fuelwood collection and preparing meals. An increase in the vulnerability of women and children. More women will be involved in gender policy formulation.</p>	<p>A shift in the mindset in addressing the energy crisis those women face. There will be economic empowerment for all and this should result in equal access to energy. More women being involved in the commercial production and marketing of energy products and services. A reduction in the vulnerability of women and children.</p>	<p>Women both urban and rural dwellers will continue to be responsible for the daily household chores among them water and Fuelwood collection. Different levels of access to energy services will be clearer as men would venture into the commercial production and marketing of charcoal while women will be on the non – commercial use of the energy resources. Over reliance on traditional energy sources will see women travelling over longer distances and time looking for fuelwood. Increase the vulnerability of women and children Lower women illiteracy rates, poor health.</p>
Gender Issues - policy options on gender	<p>Main streaming gender into development process. Economically empower the rural and urban poor in particular the women.</p>	<p>Financing mechanisms for energy services Gender mainstreaming</p>	<p>Diversification of the economy and employment creation Mainstreaming gender into development projects Promotion of education</p>

Criteria/Issue	A: Business as usual	C: Best case economy and co-operation	D: Worst case economy and co-operation
	<p>Promote decentralised small-scale technologies, in particular those locally made and operate using available fuels. These can then be a source of jobs, employment and enterprise creation for both rural and urban poor.</p>		
Forestry Issues - impacts on forestry	<p>A thriving demand for charcoal and fuelwood for domestic purposes. The demand for charcoal that is largely in the main urban cities of the central part of Mozambique will rise. Remote provinces where the percentage of households using charcoal and fuelwood is greater will also increase Impart pressure on Mozambique's forests. Deforestation will be a significant damaging the environment, the economy, and the welfare of people. The legal system in place, will assist in curbing the high deforestation rates. Severe deforestation due high population to provide for land for crop cultivation Not enough time to recover after use, damaging to the environment.</p>	<p>Reduced demand for charcoal and Fuelwood for domestic purposes Minimum pressure on Mozambique's forests. The laws and legal instruments will be respected and observed. More private investment as well as community participation in forest resource management. The revitalisation of a sustainable forestry industry will lead to the creation of jobs.</p>	<p>Over reliance on forest products for subsistence (energy, building, and medicines...) as well as for income generation by selling fuelwood A thriving demand for charcoal and fuelwood for domestic purposes. Exerts increasing pressure on Mozambique's forests. Deforestation will be a serious problem, damaging the environment, the economy illegal logging of trees will be rampant. All trees surrounding major cities will be used for domestic purposes. Greater areas will be deforested and fail to meet the increased demand in traditional fuels. The laws and legal instruments largely be ignored with charcoal traders. Increased desertification.</p>
Forestry Issues - policy options on forestry	Promote social management of forestry resources.	Promotion of decentralised and integrated energy service provision	Promotion of locally managed decentralised energy options

Scenario Outlines

Criteria/Issue	A: Business as usual	C: Best case economy and co-operation	D: Worst case economy and co-operation
	Collect and inventorise data on forest resource management	provision Promotion of renewable energy sources	