

DANIDA

**February
1990**

MOZAMBIQUE

URBAN HOUSEHOLD ENERGY PROJECT

**APPRAISAL MISSION REPORT
ON
PROPOSED DANIDA INVOLVEMENT
IN
URBAN ELECTRIFICATION COMPONENT**

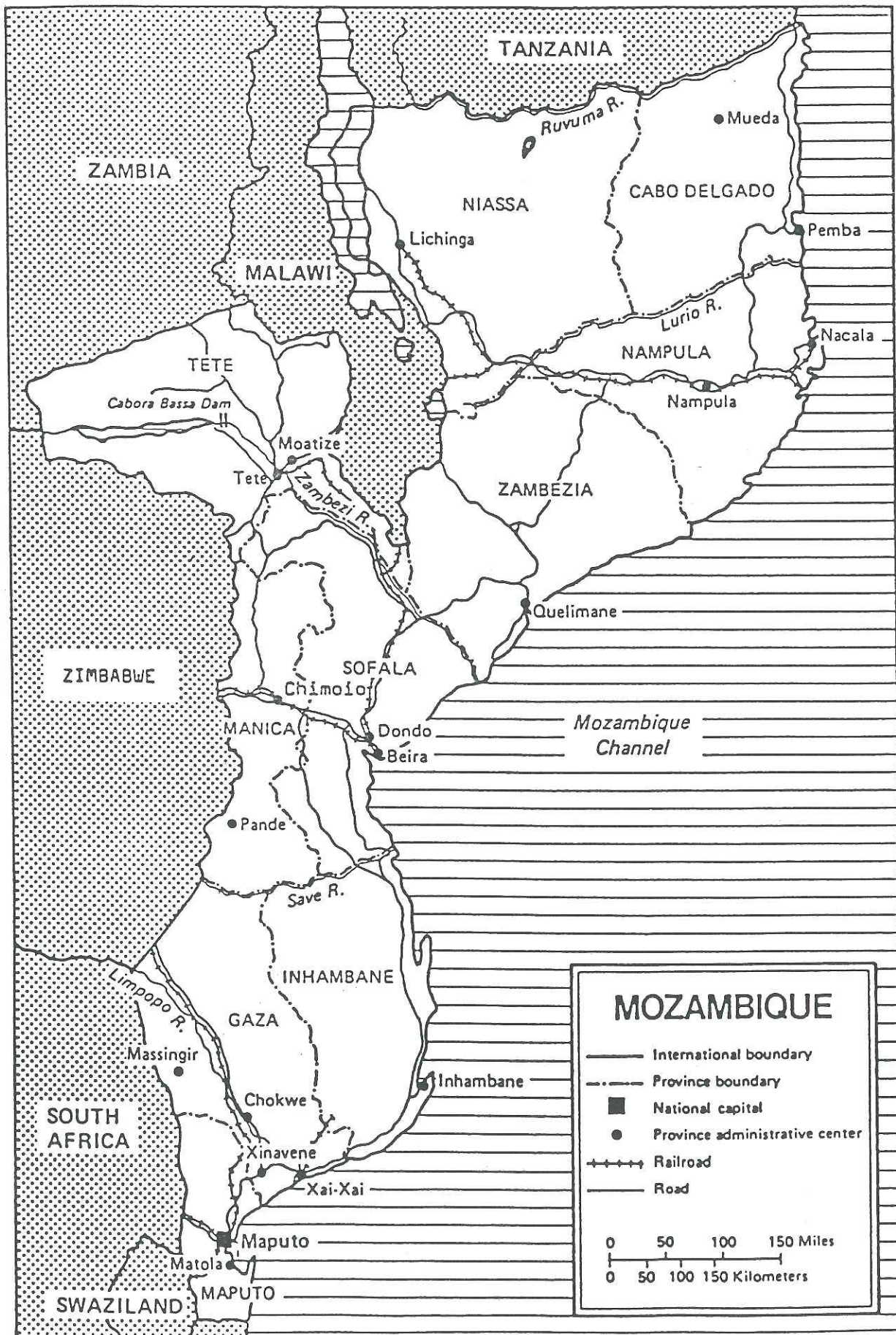
**VOLUME I
SYNTHESIS**

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FOREWORD

This report provides a synthesis of the findings and recommendations of a mission to appraise the potential involvement of Danida in the Urban Household Energy Project being promoted by the Mozambique Government in collaboration with the World Bank.

The detailed working papers prepared by the mission members are presented, for record purposes, in Volume II. They have been not been subjected to a final edit and do not necessarily represent the conclusions of the mission. It is, nevertheless, hoped that they will contribute to the general build-up of information on Mozambique which is taking place in Danida and, in particular, that they will help in the creation of a basis for informed interventions in the energy sector in the future.

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9 February 1989

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CURRENCY

Metical (plural, meticaís) MT

Official exchange rate (September 1989) \$1.0 = 800 MT

ABBREVIATIONS AND ACRONYMS

BEU	Biomass Energy Unit
BPD	Banco Popular de Desenvolvimento
EDM	Electricidade de Moçambique
ERP	Economic Recovery Programme (PRE in Portuguese)
ESKOM	Electricity Supply Commission (South Africa)
ESMAP	Energy Sector Management Assistance Program
ETAR	Energy Technical Assistance and Rehabilitation Project
IDA	International Development Association (concessionary funding arm of the World Bank)
IMF	International Monetary Fund
MIE	Ministry of Industry and Energy
PETROMOC	Impresa National de Petroleos de Moçambique

EXECUTIVE SUMMARY

1 . 0

BACKGROUND

EXECUTIVE SUMMARY

The purpose of the mission was to appraise the proposed Danida contribution to the Urban Household Energy Project which is being promoted by the Government of Mozambique with the support of the World Bank.

The project was strongly supported at the Consultative Group meeting in Paris in 1988. Its aim is to reduce the social impact of the Government's Economic Rehabilitation Programme by increasing the availability of electricity, kerosene, LPG and coal to lower and middle income urban families thereby reducing their expenditure on woodfuel for cooking.

The intention is that the poor will benefit indirectly as a result of lower fuelwood prices because of the switch to alternative commercial fuels. The project is also expected to bring additional environmental benefits in the form of reduced deforestation around the main urban centres.

The electrification component will cost about \$26 million. The proposed Danida funding of \$3-5 million is for strengthening and extending the distribution system and connecting some 7 500 new domestic consumers in the provincial towns of Tete, Chimoio and Quelimane.

The mission feels that, as it is presently envisaged, the project is unlikely to realise its objectives. In the mission's view, the new electricity consumers will primarily be among the middle and upper income families presently unable to obtain a supply. These are not a priority group for Danida assistance.

The mission also feels that the project will have an adverse effect on the economic and technical performance of the electricity utility, EDM. The mission is also concerned that almost half the new consumers are planned for the Maputo area where there are already supply constraints and where, until the Cahora Bassa high voltage link is restored, all the electricity will have to be generated in South Africa or from imported fossil fuels.

The mission queries whether the projected rates of return for the project are realistic. It also doubts whether the expected reduction in woodfuel prices will be realised in practice.

Despite these reservations, the mission recommends that Danida accept the World Bank invitation to participate in a constructive dialogue on the future development of the project. It also suggests that bilateral discussions with the electricity utility should be continued with the aim of identifying projects which could be funded directly or within the framework of the Urban Household Energy Project.

Among its other recommendations the mission points out the need and potential for increased donor collaboration, particularly with other Nordic agencies active in Mozambique. It suggests further internal Danida discussion to clarify policies in the energy sector and particularly their relationship with the overall objective of poverty-alleviation. It also expresses concern about certain aspects of the ERP and suggests that Danida should monitor its progress as independently as possible.

1.0 BACKGROUND

The purpose of the Urban Household Energy Project is to reduce the social impact of the Economic Rehabilitation Programme currently being implemented in Mozambique.

The project was developed by the Government of Mozambique in collaboration with the World Bank and was presented at a meeting of the Consultative Group in Paris in November 1988. It was pointed out that the expected beneficiaries would primarily be lower and middle income families. These could look forward to a reduction of about a third in their fuel budgets. Additional environmental benefits were anticipated in the form of a reduction in deforestation around the main urban areas.

At the meeting, the Danida delegation expressed interest in supporting the project by means of a grant channelled through a parallel financing arrangement with the World Bank. Danida suggested and it was agreed that its support would be focused upon the electrification component of the project in the three provincial towns of Tete, Quelimane, and Chimoio. The World Bank subsequently included a Danish contribution of \$3 million in its proposed financing plan for the project.

The Danida appraisal mission was fielded to review the Urban Household Energy Project in general and to examine in detail the potential involvement in the electrification component in the three provincial towns. The terms of reference of the mission included an assessment of how the project related to the overall objectives of Danish development cooperation as well as a detailed social, technical and economic review of the electrification component.

1.1 Mission programme

On arrival in Maputo, the mission found that the planning for the electrification component of the project was at a far less advanced state than anticipated. The consultants, Swedpower, who had been engaged to prepare cost estimates of various elements in the electrification programme had found the documentation available to them was extremely poor. The maps of the existing network had not been revised for many years and there was no information on the location of many consumers.

Swedpower therefore had to undertake new surveys in collaboration with the electricity utility Electricidade de Moçambique (EDM). At the time of the mission's visit, all the available information from these surveys had been sent to Stockholm for further processing. From the sample documentation available, however, the impression gained was that the full results, which will be available by March 1990, will be very detailed and extremely useful in future planning by EDM. But the immediate consequence was that there were no project proposals, even in draft form, for the electrification component in the Tete, Quelimane and Chimoio which the mission could examine.

It was, nevertheless, decided that the mission could usefully visit the three towns to gain a broad impression of what was intended. This was done in company with senior representatives from EDM and Swedpower who provided

every possible help. Meetings were held with regional EDM officials, local government authorities, planning officers, and manufacturing companies. EDM generating plant, substations, switchgear, transmission lines and distribution systems were inspected. Visits were paid to charcoal and woodfuel markets. Spot interviews were carried out with families already connected to the electricity supply and in areas proposed for electrification.

During this tour, which lasted a week, the mission began to have certain reservations about the orientation and detailed proposals of the project. An outline of these reservations was conveyed in a memo to EDM and the Department of Energy on the mission's return to Maputo to see if they could be resolved.

Meetings were held with EDM, the Department of Energy, the Banco Popular de Mozambique, the National Planning Commission, the National Forestry and Wildlife Directorate, the World Bank and other organisations. The resident Danida mission was fully involved in all these discussions. Further background information was collected and visits were made to areas proposed for electrification under the project in Maputo. The result was a continued reinforcement of the mission's doubts about the project on social, economic and technical grounds.

Before leaving Maputo, the mission held a number of meetings with EDM to discuss possible collaboration outside the framework of the Urban Household Energy Project. On its return to Copenhagen, the mission prepared a detailed description and critique of the project which was sent to the World Bank for its comments. The response of the World Bank has been carefully taken into account in the preparation of this report.

In assessing the Urban Household Energy Project, the mission had to consider the broader contextual issues which the project was attempting to address. In some cases this raised questions relevant to the overall programme of Danish Development Cooperation with Mozambique and that in the energy sector in particular. These questions are addressed briefly in the Recommendations at the end of this report.

2 . 0

THE MOZAMBIKAN CONTEXT

2.0 THE MOZAMBICAN CONTEXT

The People's Republic of Mozambique lies to the southeast of Africa. It is a large country with an area of 783 000 sq km. It is elongated in form and has a coastline of 2470 km with the Indian Ocean.

It is bordered by Tanzania, Malawi which cuts into the northwest of the country like a wedge, Zambia, Zimbabwe, South Africa and Swaziland. The border with South Africa is particularly important in the extreme south where it narrows the country to a strip about 50 km wide. This is where the capital Maputo is located.

Most of the country is a relatively low-lying plateau, sloping gently towards the coastal plain; almost half the country is at an elevation of 200 metres or less above sea level. In the east, the land tends to rise and meets the central African plateau along the borders with Malawi, Zimbabwe and Zambia. The coastal plain is narrow towards the north but widens considerably towards the south. The country is crossed by numerous rivers, among them the Zambezi in the centre and the Limpopo in the south.

The total population is estimated to be about 15 million with a growth rate of 2.7% per year. There are virtually no reliable statistics on the numbers of people in the cities and towns. Maputo is generally reckoned to have 1.2-1.5 million people and is by far the largest city.

The climate is generally dry tropical or subtropical with a rainy season from October to April. The influence of the southern summer monsoon and the warm Agulhas Current mean that the country generally has a rainfall of 400 mm or more per year. In the north and the mountain areas it can reach 100-1500 mm but is considerably less in the southern lowlands. The drier savanna areas are subject to drought. That which lasted from 1981 to 1983 and brought famine to many areas, was the worst recorded in the country.

2.1 Historical and political background

Mozambique is a former colony of Portugal. The basic colonial policy in the decades before independence was to turn the country into a supplier of cheap primary commodities and a market for Portuguese goods. This left the economy with a number of severe structural weaknesses which still inhibit its efforts to achieve balanced economic development. Another feature of colonial rule was that virtually all the skilled and semi-skilled jobs, even to the level of bus and taxi drivers, were filled by Portuguese.

The last fifteen years of colonial rule were characterised by an armed liberation struggle led by Frelimo. Following the revolution in Portugal, independence was granted in June 1975. A new constitution came into force with the President as Head of State and Chairman of Frelimo.

Political direction rests with Frelimo which is governed by a quadrennial Congress, a Central Committee and a Politburo. Frelimo held its Third Congress in 1977 and proclaimed itself a Marxist-Leninist vanguard party of workers and peasants. The Fourth Congress was held in 1983 and the Fifth



Huge baobab trees are a feature of the savanna landscape

in July 1989. References to Marxist-Leninist ideology are now avoided.

Legislation, including the approval of the annual budget and economic plan, is enacted by the People's Assembly during its sessions and otherwise by its Permanent Commission composed of high-ranking Party and Government officials. Daily administration and the preparation of legislation are the responsibility of the Council of Ministers, chaired until July 1986 by the President and since then by the Prime Minister. The official language is Portuguese.

Mozambique is divided into 10 provinces, some 115 districts and 850 localities. The provinces each have a provincial government headed by a governor appointed by the President. The governor is also provincial Party chairman and is responsible to Frelimo, the Council of Ministers and the President.

Immediately after independence, an exodus of some 90% of Portuguese workers and administrators took place over a period of just a few months. Projects and businesses were abandoned and there was a considerable amount of administrative and, indeed, physical sabotage. Many urban businesses and the whole rural trading, transport, and farming credit system collapsed completely. The Government was forced to take over the running of a large number of enterprises simply because they had been abandoned by their owners. Few enterprises were, however, formally nationalised.

2.2 War and economic destabilisation

Independent Mozambique has never enjoyed freedom from externally fomented terrorism. Rhodesian raids and the creation of groups of armed bandits in the rural areas marked the first five years of independence. These were in retaliation for the support given by Mozambique to the Rhodesian independence movement and for cutting off supplies of goods through Beira in accordance with the UN policy of sanctions on the Smith regime.

The armed bands were taken over and relaunched on a larger scale by South Africa in 1981. They operate under the name of the MNR or RENAMO. The aim is to maintain a state of instability in Mozambique mainly as a means of ensuring that Malawi, Zambia, Zimbabwe and Botswana remain dependent upon their trade routes through South Africa. In 1984, the governments of South Africa and Mozambique signed the Nkomati Accord under which Mozambique undertook to withdraw support for the ANC in return for South Africa ending its promotion of the armed bands.

In spite of Mozambique's adherence to its side of the bargain, South Africa has continued to provide arms and training for the bandits. All regions of the country have been severely affected by sabotage and terrorism of a peculiarly brutal and sadistic kind. The number of displaced and severely affected people is estimated at 4.6 million. Social and economic infrastructure has been destroyed on a massive scale. War related deaths in the period 1980-81 are estimated at 1 million. The costs of the direct and indirect losses and damage are calculated at \$15 billion, well over twice the country's total external debt.

Despite the efforts of Mozambican religious leaders and the heads of several other African states to promote peace talks, little progress has been made. To a considerable extent this reflects the lack of any significant political programme on the part of the MNR. The leaders are primarily drawn from outside the country and their principal objective is to maintain the current state of instability in Mozambique.

2.3 Infrastructure and communications

The transport infrastructure clearly reflects the country's colonial role as a service economy for its neighbours. Provision for traffic in transit to Mozambique's inland neighbours is far superior to that linking the different regions of the country itself.

Mozambique has a total of 4 500 km of asphalt roads, 500 km of gravel roads and a further 20 000 km of earth roads. Most of these suffer from lack of maintenance and are in poor condition. The fleet of buses and lorries is small and in bad repair and there are major problems in obtaining spare parts. Transport of crops and fuelwood from the rural areas is consequently difficult and expensive. The journey to work is a serious problem for a large number of urban dwellers.

There are three railway systems. In the south there is a line from Maputo along the Limpopo river to Zimbabwe; in the centre, there is a line from Beira to Zimbabwe; and in the north there is a line from Nacala to Malawi. There are also links between Maputo and South Africa and Swaziland. Services on the Beira line are protected from attack by Mozambique and Zimbabwe army troops; these also provide protection for the oil pipeline running in the same corridor. The rail systems are not interconnected and there is no north-south line.

Coastal shipping could, in principle, play an important role in goods and passenger movement. But poor maintenance, lack of vessels, and inadequate port facilities mean that the existing services, principally provided by the parastatal shipping company, Navique, are severely strained and unable to cope adequately with the demand upon them.

The only safe and effective means of transport, for those who can afford it, is by air. There are services connecting Maputo with six of the major provincial cities. These are provided by the state airline, Air Mozambique, and a variety of private companies.

2.4 Urban living conditions

The urban population has been expanding rapidly in recent years. Large numbers of people have been coming to the towns and cities to escape the violence and insecurity of the rural areas. It is likely that 25-30% of the national population are now living in or close to the principal towns and cities.

The urban areas basically consist of three zones: the inner "cement city" as it is referred to in Mozambique; a zone of "shanty" housing; and peripheral squatter settlements. It should be noted that the term "shanty"



The country's isolated farming villages have no defences against the brutal attacks of the armed bands in the rural areas

housing, as it used in the Household Energy Project documents, does not refer to squatter settlements but to more formal and prosperous urban areas. These are characterised by relatively good quality traditional housing with a certain amount of cement block and corrugated iron roof construction also taking place.

Electricity connections are only made to "shanty" dwellings provided they meet construction standards laid down by the electricity utility. They must also be positioned in accordance with the road lines and plot locations in the local authority urban plans.

The housing and living conditions of refugees from the rural areas and the urban poor conform much more to the conventional notion of a shanty settlement. Dwellings are of poor quality and often temporary. There is little employment and many families live in extreme poverty.

In general, the urban areas are poorly serviced. In Maputo, it is estimated that about 20% of the population are served by piped water and a further 10-12% have access to stand pipes. The remainder must rely on wells, open sources and water sellers.

Farming plays a very important part in the lives of many urban families. Even though they may have to walk for several hours to get there, families try to have a plot of land where they can grow at least some of their basic food requirements. Survival strategies for those without permanent employment also include collecting wood, delivering water, cooking and selling food, brewing, petty trading, and selling produce from their farms.

2.5 The economy

According to official statistics, there are about 6 million economically active people in the country. Formal sector employment provides only about 500 000 jobs and there are an estimated 850 000 jobs in the informal sector. A further 100 000 have jobs abroad, mainly in the mines in South Africa and Zimbabwe.

Agriculture is the main economic activity. It accounts for half of GDP, and some 85% of employment. The main crops are cassava, maize, groundnuts, beans, sorghum, rice and vegetables. The main export crops are cashew nuts, cotton, sugar, copra and fruit.

Only about 20-30% of the arable land is under cultivation of which 90% is in the family sector. There are some 2.0-2.5 million small family farms which account for about 75% of the total agricultural production. The output levels are generally low, poverty is endemic in the rural areas, and the country is not able to meet its own food needs.

Fishing accounts for about 10% of industrial output. Prawns provide about 40% of the country's total exports. These are mainly harvested by a number of joint venture companies with foreign partners.

There are only a few hundred manufacturing enterprises in the country. The majority are in the public sector and around 85% are in the Maputo region. About two thirds are light industry such as food, drinks, soap, candles and

clothing. The remainder are relatively heavy industries such as metals and paper. There is little intermediate industry. Heavy industry has to import 60-75% of its inputs and even producers of clothing, shoes and other products have to import 30-40% of their requirements. In all, manufacturing accounts for about 14% of the total GDP.

One of the most serious obstacles to the economic development of the country is the lack of skilled workers. At independence, the illiteracy rate was 93% but this had been brought down to 72% by 1980. The impact of the war has slowed and, indeed, reversed this trend. In 1986, the proportion of the population who had completed primary school was 6.5% for men and only 1.8% for women; for secondary school the corresponding figures were 1.2% and 0.4%.

The number of students enrolled in the final two years of secondary school in 1985 was just 2 000. Of these, only about 330 graduated or passed their exams. It is a cripplingly small pool from which to draw the managers, administrators, and skilled workers which the country needs.

2.6 Widespread poverty

Mozambique has an annual GDP per head of \$170 in 1987 according to World Bank figures, making it one of the poorest countries in the world. There are few statistics on the distribution of wealth or family income and expenditure patterns. It is, nonetheless, abundantly clear that a high proportion of the population live in extreme poverty.

A recent study carried out for UNICEF defined "absolute poverty" as the income level at which growth faltering in children is very common or the cost of a monthly ration supplying 60-70% of basic calorific requirements is 50% of income. Using this definition the study identified four groups living in absolute poverty.

The first includes families where the income is less than 4000 MT per month. A family of six, for example, with one member earning the minimum wage of 21 000 MT would fall into this category. The second group consists of families living in the peri-urban areas with limited access to land for growing food and lacking secure employment. A third very large group consists of farming families displaced or prevented from growing their crops by the war; it is estimated that this includes at least 2.5 million people. In addition, there are the extremely poor rural families who do not have seeds, tools, access to markets, or goods to buy.

It is estimated that about 10 million people, or two thirds of the total population, fall into one or other of the above categories of absolute poverty. In the urban areas, the proportion is estimated to be in the range 30-50%.

Health indicators reflect the poverty of the country. The mortality rate for children under five is 325-375 per thousand, one of the highest in the world. The destruction of health posts by bandits has more or less put a stop to efforts to improve rural health standards. Scarcities of drugs and medicines, and the lack of hospital beds and out-patient facilities are further obstacles to improved health care.

2.7 Background to the Economic Recovery Programme (ERP)

Despite the difficulties encountered by the new state, the economy showed hopeful signs of recovery in the period 1977-81. An ambitious 10 year development programme was launched for the 1980s with a focus on "socialisation of the countryside." Under this, the rural population was to be encouraged to move into communal villages and efficient agricultural production was to be promoted through producer cooperatives and state farms.

Economic conditions, however, began to deteriorate after 1981 and, in 1983, the Fourth Frelimo Congress reassessed the country's development policies. There was much criticism of the neglect of peasant production and of "giantism" on the part of the state farms. Renewed emphasis was therefore placed on the peasant sector and land was distributed to smallholders; prices of agricultural crops were also raised significantly. There was a move to promote private initiative in all sectors of the economy; and reforms were instituted in the regulation of foreign investment.

Mozambique joined the IMF and the World Bank in 1984. In the same year its arrears of foreign debt were re-scheduled. Economic conditions, however, continued to deteriorate. By 1985, total economic production, measured by the Gross Social Product, had fallen by 40% from 1981; food production was also down on 1981 by 20-40%. The trade deficit in 1986 reached \$600 million, almost ten times its level in 1981; and the Government budget from showing a small surplus in 1981 had a deficit of 48%. There were widespread shortages, inflation rapidly increased, the exchange rate became grossly over-valued, and the economy descended into crisis.

Discussion were held with the IMF and the World Bank and in January 1987, a programme of structural adjustment and economic recovery was launched. It is referred to as the Economic Recovery Programme (ERP) or in Mozambique by its Portuguese initials PRE. Its broad aims are to reverse the decline in production; ensure a minimum level of consumption and income, especially of the rural population; strengthen the balance of payments; and lay the foundations for economic growth.

Among the measures to reach such objectives the Government undertook to reduce centralised administrative controls; rely on the use of price and credit policies rather than administrative intervention; relate income more directly to economic performance; reduce subsidies; and improve planning to ensure that public expenditure is related to the priorities of the economy. The Government also undertook to reintegrate the parallel and official exchange rates.

2.8 Impact and negative effects of the ERP

The ERP has now been running for almost three years. Mozambique has so far implemented the planned programme measures to the full satisfaction of the IMF and the World Bank.

The metical has been devalued massively. At the beginning of the ERP the rate against the dollar was 39 MT; at the time of the mission it was 800 MT. The number of imported products which must be traded through a single

designated trading corporation has been reduced from 14 to six and the number not subject to any controls is being increased. The amount of external loans taken on under non-concessional terms has been restricted to \$50 million and budget deficits have been limited.

Subsidies have been removed from a variety of goods and the wage increases paid to state and government employees have been restricted. Incentives for production have been increased by removing price controls on a variety of goods and substantially increasing the prices of others. The number of products subject to administrative allocation has been reduced from 43 to 11. Private traders have been introduced as competitors with a variety of state enterprises.

The ERP has generally been judged a success and the Frelimo Congress in July 1989 focussed principally upon its favourable impacts. The Government, IMF and World Bank have attributed a number of specific benefits to it. Among these is the fact that economic collapse has been replaced by a degree of recovery and the economy is now growing at a rate of 4% per year.

There has also been a significant increase of marketed output in the agricultural sector and an increase in rural incomes in areas where security is not a constraint. The most promising results were obtained in the private commercial sector and in areas where price adjustments had been most marked. Growth has also occurred in the industry and fishing sectors. The overall Government budget deficit has been reduced to 14% and the level of borrowing has been brought sharply down. A significant improvement has also been registered in the balance of payments.

A certain degree of caution is required, however, in interpreting any such assessment of the impact of the ERP. The fact is that there are very few reliable statistics of any kind available in the country. Data on total agricultural production as opposed to marketed production, for example, are non-existent. Nor is there any information to back the claim that rural incomes have increased.

Moreover, it is impossible to separate the effects of increased availability of resources from those of policy changes under the ERP. Recovery in light industry, for example, is heavily dependent on the availability of imported raw materials and spare parts. A delay in the disbursement of foreign assistance halted the expansion of the sector in 1988, but the availability of finance for the necessary supplies allowed growth to be resumed in 1989.

In contrast with such uncertainty about some of its benefits, it is quite clear that many families have been negatively affected by the ERP because of increases in the prices of food and other necessities. Health and education services have also been badly affected by cuts in Government allocations. Recurrent expenditure on health has fallen from 7% of the Government budget in 1986 to 5% in 1989. The fall in recurrent expenditure on education over the same period is down from 18% to less than 10%.

Consultation fees have been introduced for visits to doctors. School fees have also been increased and there has been a significant fall in enrolments. There have also been major cuts in the availability of books

and educational materials.

A less tangible, but possibly more important result of the ERP is upon wider public attitudes in Mozambique. Despite its difficulties, the country has been remarkably free of official corruption and petty crime. The shift towards a liberal growth-oriented market economy implicit in the ERP runs the risk of eroding many of these attitudes. It is already noticeable that land grabbing, corruption, and crime are on the increase. Such trends could have serious longer term implications for the social consensus on which the ERP and, indeed, the longer term development of the country depend.

3.0

THE ENERGY SECTOR

3.0 THE ENERGY SECTOR

Mozambique is comparatively well endowed with conventional energy resources. For the vast majority of people, however, energy simply means wood. It provides virtually the whole of the energy consumed in the rural areas and a high proportion of that in the towns.

3.1 Energy resources

The numerous large rivers flowing across the country into the Indian Ocean provide an abundance of hydro electric potential. Over 100 possible hydro power station sites have so far been identified. The potential installed capacity of these amounts to about 14 000MW with an estimated annual output of 75 000 GWh/year. To date, about 15% of this capacity has been developed, principally at Cahora Bassa.

There are extensive coal deposits in the centre-west of the country. Proven reserves amount to 850 million tonnes. The only coalfield in operation is at Moatize in the Zambezi valley some 100 km from Cahora Bassa and close to the town of Tete.

There has been a considerable amount of oil and gas exploration over the past few decades and the Government has signed exploration contracts with a number of the major international oil companies. The only commercial discovery to date is of natural gas at the Pande field, about 550 km north of Maputo and some 30 km inland from the coast. Although this was discovered in 1961, the field remains to be developed. Estimates of recoverable reserves range from 0.4 to 1.3 trillion cubic feet.

The country is reasonably well wooded. The natural vegetation varies from relatively sparse savanna woodlands in the drier zones through to dense forests in some of the wetter mountainous areas. In many parts of the country, the natural forests have been cleared for agriculture; this is particularly so around the cities and major towns where wood is also cut to meet urban household energy demands.

3.2 Energy supply and consumption

Quantitatively, woodfuels dominate the national energy supply picture. It is estimated that they provide about 80% of the total energy consumption in Mozambique. Conventional energy needs are met by hydro electricity, petroleum products and coal.

3.2.1 Woodfuels

Most of the woodfuel consumed is in the form of firewood. Charcoal is also used in the cities. It is estimated that it provides about 20% of the woodfuel consumed in Maputo.

A survey of woodfuel consumption carried out in July 1988 for the Urban Household Energy Project found an average consumption in Maputo of 294 kg per month for households not linked to the electricity grid and 275 kg per

month for those linked to the grid. The figures for Quelimane were surprisingly lower: households not linked to the grid used 146 kg per month and those linked to it used 111 kg per month.

Apart from this survey, there appear to be virtually no other statistics on woodfuel consumption at the household level. A Ministry of Industry and Energy estimate that the total woodfuel demand in Maputo is 360 000 tonnes per year was based upon figures from similar cities in other countries and an assumed population of 820 000 people.

There do not appear to be any data on the sources from which the woodfuel is obtained. It is thus impossible to estimate the level of the available supply. Some figures have, apparently, been derived from aerial survey of forest resources in 1981 but, in the absence of confirmatory ground surveys, little reliance can be placed upon them as a source of information on potential woodfuel supplies.

Woodfuel plantations have been established by the National Forestry and Wildlife Directorate, with the support of FAO, for the supply of Maputo, Beira and Nampula. The Maputo plantation, started in 1977, now has an area of 3 700 ha; that in Beira, started in 1981, has an area of 3 200 ha; and that in Nampula, also started in 1981, has an area of 965 ha. These have suffered from lack of funds, attacks by armed bandits, and forest fires. Soil and climatic conditions have also proved difficult for tree growth. They are not able to break-even at present woodfuel prices.

3.2.2 Electricity

Total electricity consumption has fluctuated around 600 GWh for the past ten years. In 1988 it was 644 GWh, of which 53% was imported from South Africa, 41% was produced by the national power company Electricidade de Moçambique (EDM), and the remainder was bought from other producers in Mozambique. Of the total EDM production, 35% was from hydro; coal provided 37%; diesel provided 24%; and the remainder was from fuel oil.

Indigenous hydro electricity thus accounted for about 14% of the total consumption of electricity in Mozambique in 1988. The remaining 86% was directly imported or generated from imported fossil fuels. About 70% of the consumption was in Maputo.

Overall losses were about 18%, leaving a total billed consumption of 526.4 GWh. Of this, 34% was for domestic consumption, 50% was for medium and high voltage industrial consumers and the remainder was for low voltage commercial and industrial uses.

3.2.3 Petroleum products

The total petroleum consumption in 1988 was 300 000 tonnes. The whole of the country's needs are imported as refined products since the only refinery, at Matola near Maputo, was closed in 1984. There have been severe shortages of kerosene, LPG and gasoline in recent years. Price rises have, however, reduced the demand for gasoline and its rationing was ended in 1988.

The annual consumption of kerosene was around 45 million litres (36 000 tonnes) during the early 1980s. It fell to about 4 million litres per year after the closure of the refinery but has now increased to around 6 million litres per year. It is used almost entirely for lighting. About 60% of kerosene consumers are in the Maputo area.

Kerosene was formerly distributed in bulk to about 8 000 retailers and cooperatives in Maputo each supplying about 25 families. This network has disappeared and kerosene is now sold through 12 motor service stations.

LPG consumption in the early 1980s was about 13 000 tonnes per year but fell to some 3 000 tonnes per year. Supplies are now around 7 000 tonnes per year. A total of 33 000 customers are registered to receive supplies; virtually all are in the Maputo area. In general, they are in the upper income group as the available LPG appliances are sophisticated and expensive. LPG is principally used for cooking.

3.2.4 Coal

The sole operating coal mine at present is at Moatize near Tete. Annual production peaked in 1975 at 575 000 tonnes but declined to only 3000 tonnes in 1986 as a result of sabotage of the road and rail systems by which the coal was transported. This has meant a loss of about \$10 million in foreign exchange earnings for coal exports.

Since 1983, most of the coal used in Mozambique has been imported by rail from South Africa. It is used in the Maputo region for power generation, railway locomotives and cement manufacture. Coal is not used to any significant scale for domestic cooking.

A pilot programme to introduce coal stoves has been under way in Maputo for a number of years. It is being run by two Mozambican companies Carboval and Carbolard with assistance from the Beijer Institute in Stockholm. The stoves have been designed with a tall steel chimney to increase the draught, give good fuel combustion and draw the smoke and fumes from the house. It is anticipated that it will be possible to manufacture the stoves in bulk at about \$30-40 each, of which about \$20 will be in foreign currency. About 800 stoves have been distributed free to families in Maputo and their performance and use is being monitored.

The cost of coal from South Africa at Maputo was \$23 per tonne in October 1988. The estimated cost of coal from Moatize, after rehabilitation and at a production level of 500 000 tonnes per year, is about \$20 per tonne. Transport and handling charges are, however, high and the estimated ex-Beira cost is about \$48 per tonne.

3.3 Energy prices

Wood is normally sold in bundles of three sticks or in larger bundles measured by filling up an area between two poles in the ground. A survey in 1985 found an average price to the consumer of 21.8 MT/kg with a variation of $\pm 35\%$. The price of charcoal in 15 litre tins was found to be 86 MT/kg with a variation of $\pm 23\%$ and in 4 litre tins was 83 MT/kg.

The prices of wood and charcoal were freed of government control at an early stage in the ERP. This does not appear to have any major impact on prices. The World Bank project appraisal report quotes a price of 22 MT/kg for firewood and 107 MT/kg for charcoal in 1988. Spot checks and interviews by the mission in 1989 indicated that little change had taken place in the ensuing year.

Domestic electricity tariffs are based on a fixed fee plus an energy charge per kWh. In September 1989, the fixed fee was 1050 MT/month for consumption up to 300 kWh/month and the energy charge was 19.3 MT/kWh, equivalent to 2.4 US cents at the official rate of 800 MT to the dollar.

The ex-distributor retail price of kerosene in May 1989 was 175 MT/litre and that of LPG was 344 MT/kg. The Government has decided to implement a system of regular revisions of petroleum product prices. The intention is that this will ensure that prices reflect inflation and the devaluation of the metical. The distribution and retail margins applicable to LPG and kerosene have also been reviewed in order to encourage distributors and retailers to handle these fuels.

3.4 Energy institutions

The Ministry of Industry and Energy (MIE) has overall responsibility for the energy sector. A Department of Energy was set up inside the MIE in 1985. The Department is responsible for coordination and monitoring the energy sector, collecting data, initiating cross-sectoral activities, and advising on energy policy.

Electricidade de Moçambique (EDM) has exclusive responsibility for the supply, generation and distribution of electricity in the country.

The Impresa Nacional de Petroleos de Moçambique (PETROMOC) has responsibility for supervising the petroleum sector. It purchases the country's imports and also collects government taxes on all petroleum products. In carrying out its coordinating role it works with the MIE, the Ministry of Finance and the Banco de Moçambique. Major multinational oil companies such as BP, Caltex, Mobil, Exxon and Shell also have roles as distributors or in petroleum exploration.

Mocacor is responsible for the storage, bottling and distribution of LPG. It is owned by PETROMOC (24%) and PETROGAL (76%) the Portuguese national oil company.

A Biomass Energy Unit has been established at the National Forestry and Wildlife Directorate for an initial period of five years. The aim of the Unit is to undertake, in collaboration with the MIE, research, planning and project development activities related to the utilisation of biomass energy in the urban household sector. It is also charged with promoting the protection and further development of energy-oriented forestry plantations in the country.

3.4.1 Financial and managerial problems

Prior to the ERP, the Government emphasis was on the stability of prices rather than the financial viability of energy institutions. Electricity prices, for example, were not changed between the mid-1960s and January 1986; petroleum prices were not changed between 1979 and January 1987. There was also a major reluctance on the part of government agencies to pay their energy bills. In consequence, financial discipline among the energy institutions was extremely poor.

One of the key objectives of the ERP has been to bring the various energy institutions into a financially viable state. The prices of petroleum products have been raised and higher electricity tariffs have been introduced in the past few years. The problem the Government faces is to do this without undermining the demand for energy and with it the fragile structure of the energy institutions and the economy in general.

One of the major obstacles to be overcome in all these efforts is the scarcity of skilled managers. Added to this is the inability of the energy institutions to retain skilled staff because of the low salaries they pay.

3.5 Energy Technical Assistance and Rehabilitation Project (ETAR)

The World Bank has launched an Energy Technical Assistance and Rehabilitation Project (ETAR) which is scheduled to run from 1988 to 1991. It is funded by a \$20 million IDA credit and \$5 million from the Government of Norway.

Extensive technical assistance is being provided to the energy institutions, in particular EDM. The project is also providing funds for the rehabilitation of EDM and PETROMOC facilities, including Maputo power station, power transmission and distribution networks, and petroleum product handling equipment. Some 4 150 new domestic consumers will be connected to the electricity networks in Maputo, Beira, Nampula and Nacala.

A household energy strategy is also being prepared under this project. It is expected to be complete at the end of March 1990.

4 . 0

**ELECTRICIDADE DE MOÇAMBIQUE
(EDM)**

4.0 ELECTRICIDADE DE MOÇAMBIQUE (EDM)

Electricidade de Moçambique (EDM) was established in 1977 and gradually took over the operations of numerous regional and municipal suppliers.

It now has a staff of about 3 800. Of these, about 1 000 are semi-skilled; a further 120 are skilled workers and staff in engineering, professional, managerial and technical grades. The number of senior staff is thus extremely low given the scale of operations. There are a further 80 expatriate staff, mainly from Portugal.

4.1 The supply system

The EDM supply system is divided into three regions, Northern, Central and Southern. The Northern system covers such towns as Tete, Songo, Nampula, Nacala, Quelimane and Pemba; the Central Region includes Beira and Chimoio; and the Southern Region covers Maputo, Xai-Xai and Chokwe.

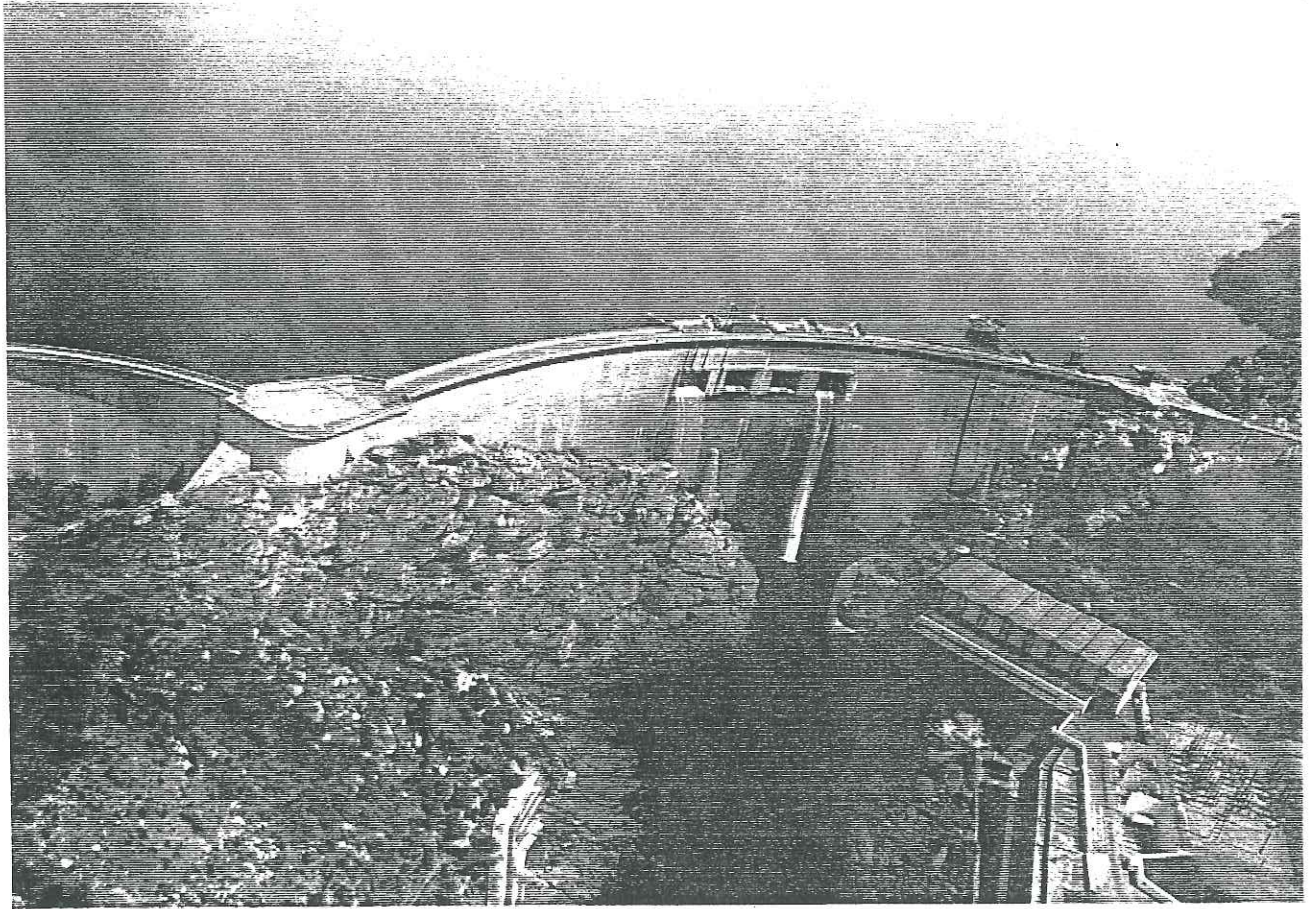
Towns in the south of the Northern Region, including Tete, Quelimane, Nampula and Nacala are connected into a grid served by Cahora Bassa; the remainder rely on isolated stations. The Central Region grid serves Beira and Chimoio and draws its power from hydro stations at Chicamba and Mavuzi; a connection with Cahora Bassa has been built but the substation serving it has not yet been commissioned.

The Southern grid is supplied by a 275 kV line from the East Transvaal system of the Electricity Supply Commission (ESKOM) in South Africa. The capacity of the line is about 120 MW but the maximum off-take is limited to 80 MW by the capacity of the transformer at Maputo. In practice, EDM takes electricity up to the agreed maximum from the ESKOM grid and uses the Maputo power station for peak loads.

The total nominal installed supply capacity under the control of EDM, excluding Cahora Bassa, is about 250 MW. The principal stations are Maputo, powered by coal-fired steam units and gas turbines with a total output of 94 MW, and the hydro stations at Chicamba (38MW) and Mavuzi (52MW). There are about a dozen thermal stations ranging in size from 15 MW down to 0.4 MW. In addition, there is a total of about 88 MW of thermal plant under private ownership.

The maximum simultaneous demand on the EDM system is around 115 MW. The Southern Region is, however, close to capacity while there is a considerable surplus in the other regions. The position in Maputo is particularly insecure. Its only sources of supply are the connection to South Africa and the Maputo power station. The latter is in extremely poor condition but has to be kept on spinning reserve to meet peak loads.

In general, the quality of the supply is poor. Much of the network is overloaded and there are frequent breakdowns, high system losses and excessive voltage drops. Surveys and the every-day experience of EDM indicate that there is a large suppressed demand for connections. The system, however, needs to be rehabilitated and upgraded if it is to meet existing demands satisfactorily let alone take on new consumers.



The Chicamba hydro electric station provides power to the country's Central Region

4.1.1 Cahora Bassa

The Cahora Bassa hydro electric station has a maximum output of 2075 MW from five 415 MW turbines. Its firm capacity is 14 000 GWh per year. The construction contract was let in 1969 and the station was commissioned in stages between 1977 and 1979. It is owned and run by Hidroeléctrica de Cahora Bassa (HCB), in which the Portuguese Government has an 82% share and the Mozambique Government 18%. The outstanding debt on the project is \$1.2 billion.

The station was built to provide cheap electricity to South Africa. Power is sent by means of two monopolar 535 kV DC lines with earth return over a distance of 1360 km to the Apollo substation in South Africa.

The contractual arrangement is that the electricity sent over the DC link is fed into the South African grid. A 275 kV AC line from the grid returns power from the grid to the Maputo region. Power is also supplied directly from Cahora Bassa to the Mozambique Central Region grid. The amount is relatively small; at the time of the mission visit it was just 10 MW. The maximum allocation of power to Mozambique is 200 MW.

Exports from Cahora Bassa to South Africa reached a maximum of 11 542 GWh in 1979. Sabotage of the line in Mozambique reduced the sales to 3 035 GWh in 1981; they recovered to 5 643 GWh in 1984 and were then stopped completely. The foregone foreign exchange earnings are about \$15 million. Counting the cost of electricity imported from South Africa, the total cost to Mozambique is about \$25 million per year.

In late 1988, Mozambique, Portugal and South Africa reached an agreement to restore power transmission by 1990. South Africa has promised to invest \$20 million in repairing the damage to the DC link. Armed banditry has, however, continued unabated and the repair work has yet to start. The lower rate of growth in the South African economy in recent years has, moreover, lessened the need for increases in its electric power supplies. It is therefore still impossible to predict when the line will be back in service.

In the longer term there are plans to build another 1600 MW power station on the north bank of Cahora Bassa. Discussions have been held on the possibility of using it to provide supplies to Zimbabwe by means of a 400 kV line and to Malawi by a 275 kV line, with possibilities for further linkages to other SADCC countries. Such long range plans provide a welcome diversion from the grim reality of the present in Mozambique but are highly unlikely to reach fruition until well into the next century.

4.1.2 Electricity costs

Based on 1988 figures, the cost of electricity from Cahora Bassa is estimated at 0.5 US cents per kWh which is extremely low by international standards. The tariff charged for supplies to the Maputo region by South Africa is 2.7 US cents per kWh which, although it is much higher than Cahora Bassa, is still low by international standards. It is equivalent to 22 MT/kWh at the official exchange rate of 800 MT/\$ in late 1989.

4.2 Electricity consumption patterns

The total number of consumers in 1988 was 112 000, of which 93 000 were domestic. There were 18 000 general business or small industry connections, 675 medium voltage consumers and 293 high voltage consumers. Maputo had 49 000 domestic connections, about 53% of the national total.

In all, around 2.5% of the national population have access to an electricity supply. If the proportion of the total population living in the urban areas and their immediate surrounds is in the range 25-30%, the proportion with access to electricity is around 10%.

The average billed consumption per domestic consumer in 1988 was 1 940 kWh per year, roughly 160 kWh per month. The consumption, however, varies considerably between areas, being 2660 kWh per consumer in Maputo, around 2000 kWh in Quelimane, Tete and Chimoio, and only 1100 kWh in Beira. The low figure in Beira is at least partly a result of the recurring sabotage of the power lines and other problems with the supply.

4.3 Financial status of EDM

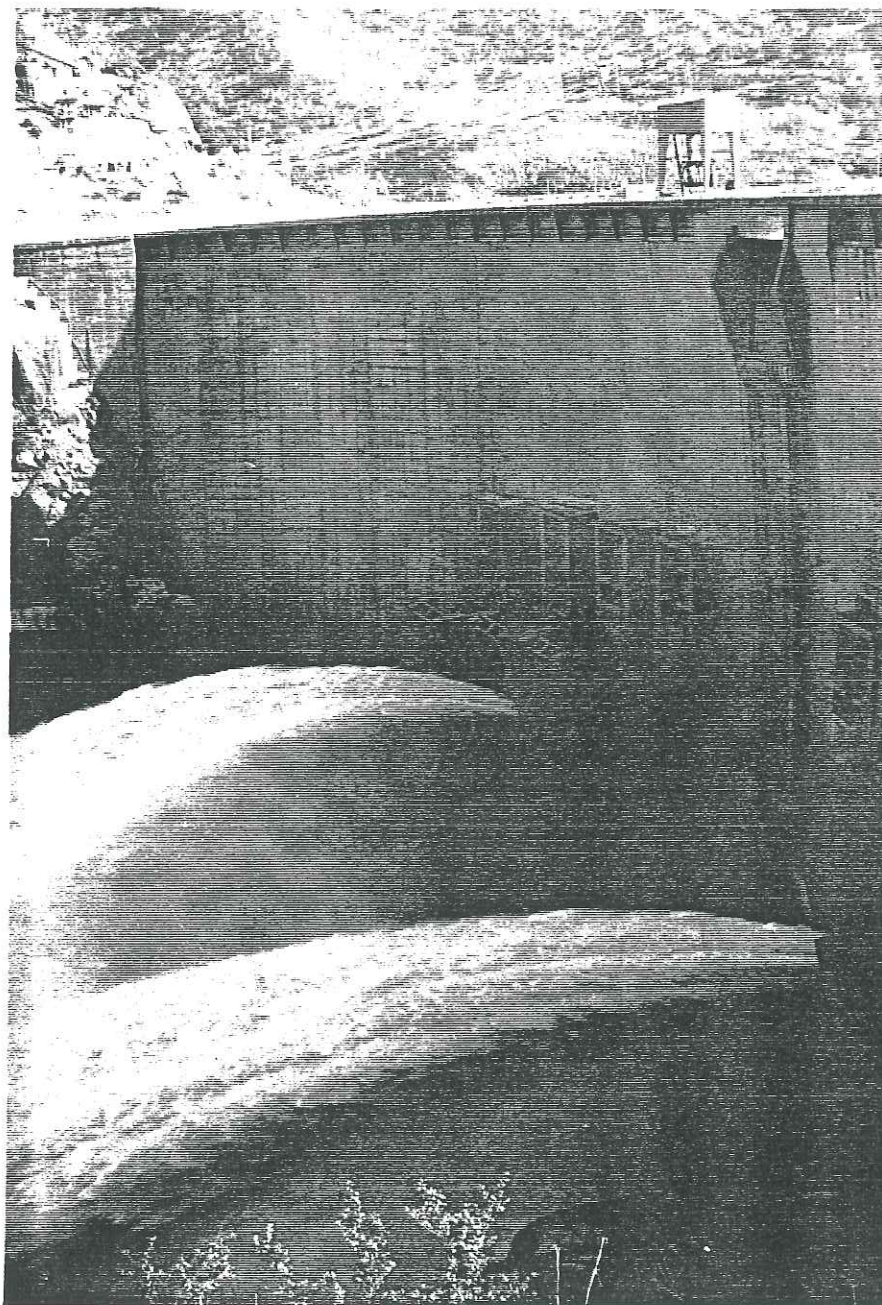
Financial control in EDM was extremely weak during the 1970s and early 1980s. Its accounts were incomplete, decentralised among former operating companies and badly out of date. Tariffs had not been adjusted since the mid-1960s. Bill collection was extremely poor and arrears in payments, from other state organisations in particular, amounted to \$5 million. The company survived on loans from the Banco de Mozambique and government subsidies.

The introduction of the ERP, with its massive devaluation of the metical, brought further problems. Interest and repayments on foreign loans and payments for coal and electricity imports from South Africa cost an extra 112 MT billion in 1987 and 55 MT billion in 1988.

Under the World Bank's ETAR project, a framework for the economic recovery of EDM was prepared in parallel with the introduction of the ERP. It was agreed that EDM would receive technical assistance to develop a management operation system which would enable it improve its operations, budgeting and planning; determine and value EDM's assets; install sound accounting, planning and budgeting systems; and establish a manpower development training programme.

But before this can be put fully into operation, the mammoth task of sorting out the financial position of EDM has had to be undertaken. The preparation of annual accounts for past years has, however, proved to be far more complicated than anticipated and non-audited accounts for 1984-6 have just been prepared. Work is proceeding on the subsequent years. Another major task is the valuation of the assets or patrimony of EDM.

In September 1989, EDM submitted a proposal to the Government outlining how it would like to see its financial structure revised. Under the proposal, the Government would take over the accumulated foreign debt of 190 MT billion and accumulated losses of 87.7 MT billion. This would henceforward be regarded as government equity in the company. Moreover, as long as the



As long as the power line to South Africa is out of action the majority of Cahora Bassa's water runs to waste

present security problems remain, all medium and long term investment in the form of foreign grants or loans or Government subventions should also be regarded as equity. The Government has not yet made known its decision on this.

Another major question to be resolved is that of the large amounts owing to EDM from various state and private organisations, and the 4.2 MT billion owed by EDM to PETROMOC. EDM is at present negotiating with its major debtors with a view to rescheduling their debts at 13% interest over a number of years and some have already begun repayments on a monthly basis.

There is an intention that EDM should eventually achieve a rate of return of 8% on its equity. What this means in practice will depend upon the Government response to the financial restructuring proposal and on the valuation of its patrimony. In the immediate future, the aim is to run the company without subsidy from 1990/91 onwards.

Recent operating accounts show that EDM's income just covers operating costs, without payment of any interest or capital charges. Given that it is importing 53% of its supplies from South Africa and that a further 33% are produced from imported coal and petroleum fuels, it remains extremely vulnerable to further devaluations in the metical.

5 . 0

**THE URBAN HOUSEHOLD ENERGY
PROJECT**

5.0 THE URBAN HOUSEHOLD ENERGY PROJECT

The Urban Household Energy Project is described in detail in the World Bank Staff Appraisal Report dated 12 May 1989. This sets out the aims and objectives of the project, the means to be used to meet them, and the anticipated economic and financial costs and benefits. The following project description is drawn from the Staff Appraisal Report.

The overall project objective is to reduce the impact of the ERP on the general population. This is to be achieved by increasing the availability of household energy and reducing the cost of fuels to a large segment of the urban population. It is also expected to bring additional benefits in the form of a reduction in deforestation and environmental degradation around the main urban areas. In the longer term, it is intended to provide a basis for the supply of lower cost fuels to meet about 50% of the needs of the urban population.

It is envisaged that the economic benefits will accrue primarily to the lower and middle income groups, bringing an anticipated reduction of about one third in their household fuel costs. The poor are also expected to benefit indirectly as a result of lower woodfuel prices because of the effect of switching away from woodfuel on woodfuel markets. Project benefits also include institutional strengthening and a rehabilitation of energy facilities. The project will also support the ERP and assist in maintaining the social harmony required for its continuation.

The total cost is \$50.8 million of which \$41.2 million is in foreign currency. Parallel funding of a further \$30 million in foreign currency is being allocated to the project from Commodity Aid Funds and an existing IDA credit for the import of electricity, kerosene, LPG and coal. This gives an overall project cost of \$80.8 million. The urban electrification component is the largest in the project and accounts for about \$26 million in investment costs.

The calculated economic rate of return for the project as a whole is 50%, made up of over 100% for LPG, 50% for coal and kerosene, and 14% for electricity. The economic analysis is based upon a comparison between the cost of the fuels supplied under the project and the cost of the fuelwood they are assumed to displace.

The project commencement date was set for 1989 and a formal call for tender enquiries was published by the Mozambique government in September 1989. The scheduled completion date is 30 June 1996.

The project will be coordinated by the MIE with support from other institutions. It will be implemented by EDM, PETROMOC, and a number of smaller Mozambican enterprises. It will be reviewed in September 1990 with a view to making any adjustments felt to be necessary.

5.1 Project components

This is a complex project containing electricity, kerosene, LPG, coal and woodfuel components. The urban electrification component is the only part of the project for which Danida support has been considered.

5.1.1 Urban electrification component

Under the project, the medium and low voltage distribution system is to be strengthened and extended in selected areas in Maputo, Beira, Nampula, Nacala, and other towns such as Quelimane, Chokwe, Xai-Xai, Chimoio and Tete. In addition, it is planned to provide connections to a total of some 40 000 new domestic consumers. This will increase the present number of domestic connections by 43%.

The cost of house wiring, which will be borne by the householder, is estimated to be about \$150. It is assumed that lights and a cooker, together with the necessary pots and pans for cooking on an electric stove, can be purchased for a further \$100 to give a total average cost per household of \$250.

The Banco Popular de Desenvolvimento (BPD) will be responsible for providing householders with the necessary loans. It will assess the credit-worthiness of applicants and make loans in line with its normal credit policies. It is expected that EDM will act as the collection agent, including the loan repayments in households' monthly bills.

The electrification component of the project includes a sum of \$6.0 million which will be made available for the import of components required for the local manufacture of low and medium voltage equipment, 40 000 electric stoves, 200 000 light bulbs, and fittings such as sockets, plugs, and switches. The total capital cost of the electrification component is about \$26.0 million. The proposed Danida contribution is \$3-5 million.

5.1.2 Kerosene and LPG component

The project aims to increase the use of kerosene by restoring and reinforcing storage and distribution facilities. It is also making funds available for the import or manufacture of 60 000 kerosene stoves, 80 000 kerosene lamps, aluminium pots and pans, and sufficient kerosene cans for householders and merchants.

Foreign exchange funds, acquired under the parallel funding arrangements, will be used to finance the import of some 75 000 tonnes of kerosene over the project period. The aim is to make kerosene as widely available as possible and no restrictions will be placed on who uses it.

The project also aims to increase the use of LPG. Bottling and storing facilities will be upgraded and funds will be provided for the import of 40 000 tonnes of LPG.

The kerosene component requires a capital investment of \$7 million and a further \$14.2 million for imports. The capital costs of the LPG component is \$0.6 million with a further \$8.4 million for imports.

5.1.3 Coal component

The project aims to promote the use of coal for cooking in a total of about 50 000 households, mainly in Maputo, Beira and Tete. The total estimated



Housing typical of that proposed for electrification under the Urban Household Energy Project. The house to the left of the upper picture is already wired and is waiting for a connection.

coal consumption over the project period is 47 000 tonnes.

The coal programme requires a capital investment programme of \$2.3 million and an expenditure of \$1 million on coal imports over 5 years.

5.1.4 Woodfuels component

An overall woodfuel strategy has yet to be prepared. The project therefore aims to achieve the maximum that is physically and economically feasible in the short term.

It will provide support for the Biomass Energy Unit being set up under ETAR in the National Forestry and Wildlife Directorate. One of the Unit's earliest tasks will be to undertake consumer surveys to establish the present patterns of supply and consumption of woodfuels. The Unit will also design and test improved wood and charcoal stoves and will investigate ways in which woodfuel production and the efficiency of charcoal making can be improved. This work is scheduled for completion at the end of 1991, after which decisions will be made on which options to implement.

Assistance is also being provided for an aerial survey of biomass resources and the rehabilitation and management of the existing 7 900 hectares of forestry plantations. The total cost of the woodfuels component is \$3.2 million of which \$2.7 million is in foreign currency.

6.0

**MISSION REVIEW
OF THE
URBAN HOUSEHOLD ENERGY PROJECT**

6.0 MISSION REVIEW OF THE URBAN HOUSEHOLD ENERGY PROJECT

The mission finds itself with a number of reservations about the Urban Household Energy Project. The response provided by the World Bank to an earlier working paper setting out the mission's comments in detail has allowed some of the issues in question to be clarified. The mission nevertheless remains concerned over certain aspects of the project. These are discussed in the following sections.

6.1 Inability to reach target group

The project is intended as a response to the inadequate supply and high cost of household energy affecting urban dwellers generally. The economic benefits are intended to accrue primarily to participants from the lower and middle income groups whose household fuel costs are expected to be reduced by about a third. The mission does not question the desirability of achieving such goals - it emphasises its support for them. The mission's reservation is that it does not see how these objectives will be achieved by the project as it is formulated at present.

The financial and technical problems facing EDM in recent years have meant that there is a considerable suppressed demand for domestic electricity connections in the middle and upper income groups. In Maputo, for example, it is estimated that some 25% of families have two members in employment and hence a minimum income of 42 000 MT/month. It is among this group, which is expanding under the ERP, that the majority of new electricity consumers are likely to be found.

Assuming such a family has fuelwood purchases of 200-300 MT per day, their monthly expenditure will be in the range 6000 - 9000 MT or some 15-20% of monthly earnings at the lower income end of the group. Providing such upper and middle income families with alternative fuel supplies under a development assistance programme does not appear to be an immediate priority under present conditions in the country. This is particularly pertinent from the point of view of Danida policy in which the emphasis is placed upon the needs of the poor.

6.2 Questions over evaluation of benefits

The economic evaluation of the project compares the economic cost of the commercial fuels required for the programme with the actual financial cost of the fuelwood that would be displaced. The total amount of wood displaced over the length of the project is calculated to be 1.9 million tonnes, taking into account the relative cooking efficiencies of the different fuels.

The World Bank calculated the total economic benefits of the projects using a market price of 22 MT/kg for fuelwood and an exchange rate of 580 MT/\$. This gave an overall economic rate of return for the project of 50%; that for LPG was over 100%, for coal and kerosene it was 50% each and for electricity it was 14%.

The mission queries the use of the market price as the economic value of the woodfuel saved. It is also concerned about the use of an exchange rate of 580 MT/\$ in the calculation used to compare the benefits of the project inside Mozambique with the costs in foreign currency. Although the rate used was substantially higher than the official exchange rate of 450 MT/\$ at the time, it was very much lower than the parallel rate which was then around 1800 MT/\$. At the time of the Danida mission, the official exchange rate was 800 MT/\$ and the parallel rate was around 2000 MT/\$.

Under Mozambican conditions, the appropriate shadow exchange rate will be somewhere between the official and the shadow rates. There is considerable room for debate about the exact rate which should be used. The mission does not suggest it should be the parallel rate but feels the rate adopted is questionable. The point is that any move closer to the parallel rate would reduce the benefits.

The mission questions the relative efficiency figures used in the calculation of the amount of fuelwood which will be saved by consumers shifting to other fuels. The calculation is based upon an assumed efficiency of woodfuel use of 8%. Work in recent years has shown that the energy efficiency of traditional methods of cooking tends to be considerably higher than conventionally assumed. Under controlled conditions, efficiencies of over 20% can be achieved and it is quite possible for normal kitchen efficiencies to be in the range 12-15%. The Beijer Institute Coal Stove Project in Maputo, for example, assumes that the efficiency of cooking with fuelwood is 17%. The more scarce the fuel, the greater the likelihood of higher efficiencies.

There appears to have been little if any work on measuring cooking efficiencies in Mozambique kitchens and the mission is in no position to say exactly what value should be adopted. The point is that the efficiency could well be greater than assumed. If it is 12%, for example, the savings from shifting to other fuels will fall by 33%; if it is 10%, they will fall by 20%.

The same argument applies to cooking with charcoal which appears to provide about 10% by weight or 20% by energy-content of the woodfuel used in Maputo. The efficiency assumed in the Project Appraisal Report is 12% whereas values found in practice tend to lie in the range 15-25%¹. Again, any move towards a higher efficiency figure will reduce the assumed benefits proportionally.

The mission notes that the electricity costs assumed in the project evaluation are based upon supplies being available from the Cahora Bassa link to South Africa. When this will take place is still completely unknown but cannot physically happen for the next few years as there is still no prospect of the necessary work being able to start.

The mission also notes that a considerable proportion of the electricity used by new consumers is likely to be for lighting, ironing and other

1. Leach, G. and Gowen, M. (1987) "Household Energy Handbook: an interim guide and reference manual". World Bank Technical Paper No 67.

domestic uses rather than for cooking. This will reduce the assumed shift away from woodfuel and hence lessen any impact the project may have on the general level of woodfuel availability and prices.

These and other points made in the working paper sent to the World Bank are obviously arguable in detail, or even in principle. The mission nevertheless feels that the World Bank analysis of the project consistently tends to overstate its benefits. This is a matter of particular concern in the case of the electrification component, with its rate of return of 14%.

Arguably, a return of 14% is itself inadequate given the economic condition of the country and the immediate need for productive projects with a high rate of return. If the mission's points are accepted as having even a partial validity, it is easy to see this rate of return being drastically reduced or even becoming negative.

6.3 Effects on EDM

One of the stated intentions of the project is to improve the financial position of EDM by enabling it to make profitable use of some of its present surplus of electricity generating capacity.

In practice, almost half the planned new consumers are in the Southern Region grid where all the electricity is either imported directly or generated from imported fossil fuels. There are also various supply constraints such as the poor state of Maputo power station and the lack of capacity and poor state of repair of the distribution system. It is only in the Central and Northern grids that there is a surplus of hydro generating capacity. It should also be noted that the present domestic energy charge of 19.3 MT/kWh compares with a bulk tariff of 21.6 MT/kWh for ESKOM supplies at the late 1989 official exchange rate of 800 MT/\$.

The World Bank has pointed out that EDM is committed to a tariff study and to implementing its recommendations "which will ensure that consumers cover the cost of any addition to peak demand." While such increased tariffs are obviously necessary, they will tend to slow the shift to cooking on electricity and will hence undermine the rationale of the project and reduce the benefits from switching from cooking on fuelwood.

From the utility point of view, the provision of supplies to large numbers domestic consumers, even among middle and upper income groups, is likely to be a far from economically efficient approach to improved network utilisation and increased sales. It requires comparatively large investments in medium and low voltage distribution systems for relatively low returns. Given a completely free choice of sales strategies, it would be more effective for EDM to concentrate on developing its sales to bulk energy users.

But granted a concentration on domestic consumers, it is vital that they should consume sufficient quantities of electricity to justify the costs of connection. This implies they should use the electricity not just for cooking but for refrigeration, water heating and other uses. If this is to happen, supplies must be reliable; otherwise, consumers will not be willing to make the substantial investments required to pay for house wiring,

cookers and appliances.

At present, the overall supply system is not reliable. Even if there were an immediate cessation of the violence in the country, there is a major programme of technical, financial and managerial rehabilitation in front of EDM before its operations reach a level likely to inspire public confidence. It is therefore doubtful whether the expected investment in appliances will take place within the time frame of the programme.

In the longer term, and assuming the campaign to promote cooking by electricity succeeds, there may also be problems. A study of domestic fuel use carried out as part of the project preparation shows that the normal cooking time coincides with the present peak hours on the network. Thus the widespread use of electric cookers will tend to increase the peak loads. The medium and low voltage networks will have to be designed to accommodate these higher loads. But because the peaks are of relatively short duration, this higher capacity will be under-utilised for most of the time.

Under present conditions in Mozambique any demand projections must obviously be regarded as highly uncertain. Nevertheless, the problems likely to arise from the introduction of a large amount of electric cooking into the demand pattern are obvious. Until a clearer view of the future is possible and the necessary demand studies have been carried out, the mission remains extremely hesitant about promoting electric cooking on a large scale.

6.4 Acceptability and affordability of electricity for cooking

Many of the peri-urban areas, especially those in which refugees from the violence in the rural areas are living, are essentially extensions of the rural areas. People continue to follow a rural way of life in so far as they can. They live in semi-permanent dwellings, cultivate crops, gather their domestic fuel from the countryside and take little part in the formal economy. Such people have little familiarity with electricity except as a source of light and are most unlikely to be able to afford an electricity connection.

In the more established areas nearer the centre of town, people tend to be more familiar with electricity and its possible uses. But such familiarity does not necessarily lead to an automatic acceptance of electricity as a cooking fuel, even in households which have been connected to the electricity supply.

In some brief surveys carried out by the mission, it was found that households with electric cookers used them very occasionally for making tea and preferred to do their major cooking on wood. There are several reasons for this. People prefer the taste of food which has been cooked on a wood or charcoal fire; they are also more familiar with cooking on a wood fire. The shape and size of the available pans makes them unsuitable for use on an electric cooker. Using wood also allows for better day to day control over the amount of money spent on fuel; neither does it require the accumulation of the kind of sums of money required to pay electricity bills.

It is clear that obtaining an electricity supply is high on the list of priorities of many families once they have a permanent house and a secure income. The first priority, however, is to use it for lighting and radio. The transition to using it as a cooking fuel is likely to be rather slow, especially as people do not perceive any significant financial advantages in doing so; in fact, it appears to be generally believed that cooking with electricity is dearer than using wood. It is therefore difficult to envisage large numbers of lower income families shifting to cooking by electricity.

6.4.1 Comparative costs of cooking with wood and electricity

Among the middle and lower income families who are purchasing wood, expenditure appears to be around 200-300 MT per day. This would give a monthly total expenditure on wood of 6 000-9 000 MT.

The amount of electricity likely to be used for cooking cannot be estimated on the basis of existing woodfuel consumption since obtaining an electricity connection and switching to cooking by electricity implies considerable changes in family life. Some traditional dishes, for example, are impossible to cook satisfactorily on an electric hotplate.

The World Bank assumed a total consumption of 120 kWh for families using electricity and a some lighting. Spot checks on meter readings by the mission, showed that families which cooked with an electric hotplate tended also to have an iron and possibly some other appliances and have consumptions in the range 140 - 240 kWh/month. Under present tariffs, this would result in monthly bills in the range 3 750 - 5 750 MT including the monthly fixed charge. The amount attributable to cooking is perhaps 2 500 - 4 500 MT.

A shift to electricity would also involve taking out a loan of some \$250 to cover the costs of house wiring and the purchase of a stove, pots, pans and light bulbs. This would require monthly repayments of about 6 000 MT, based on an interest rate of 6%, a repayment period of 3 years as assumed by the BPD, and the present official exchange rate of 800 MT/\$. Taken with the electricity bill, this would give a monthly expenditure of 8 500 - 10 000 MT on electricity. It is thus only after the loan had been repaid that any saving would be obtained.

The World Bank has assumed that the repayment period will be 10 years which gives a monthly repayment of 2 300 MT and hence shows a saving for at least some woodfuel consumers. The longer repayment period, however, also raises the question of tariff rates. The intention is that these should be raised in real terms to ensure that EDM not only covers its costs but makes a return on its capital or equity. Any substantial increase in tariffs will tend to slow the shift to cooking by electricity and to concentrate it among upper income consumers.

Again, the level of uncertainty is high and there are few reliable data on which to base firm conclusions. The mission's findings indicate that families do not see electricity as a cheaper cooking alternative. Taking the loan repayments into account there appears to some justification for this view. It is also true that obtaining an electricity supply and taking

out a loan represents a level of financial commitment which will be a deterrent to many families.

The mission therefore feels that the shift to cooking by electricity will be relatively slow and will be determined more by the wish for an improved lifestyle than any appreciable savings. This would indicate that the bulk of the consumers making the shift will be among upper income families.

6.5 Accessibility of loan finance

The Banco Popular de Desenvolvimento (BPD) has been designated as the agency for making loans to cover the house wiring and appliance costs of new consumers. According to the project, this is to be done "in line with their normal credit policies" and after assessing "the credit-worthiness of consumers."

The present policy of the BPD is that loans can be granted for consumer items such as cookers at an interest rate of 35% per year over a maximum period of three years. Loans are normally only given to people in permanent employment or running a registered business. In the case of employees, repayments are deducted from their salary and paid directly to the BPD.

Although full details of how this project will work have not yet been finalised, a concessionary interest rate of 6% has been agreed. The Ministry of Industry and Energy (MIE) will make up the difference between this and the BPD's normal rate of 35%. It is evident that if the BPD is to follow normal commercial practice, its preference in providing loans will be for upper income families. It has made it clear that if it is to lend to lower-income families which it does not itself deem credit-worthy, it will only do so if it is indemnified by the Government or EDM. In the absence of an upper limit on the incomes of applicants, it is therefore probable that a high proportion of the loans will be to upper income families.

There is also the purely technical question of organisational capacity to be considered. The BPD is presently dealing with about 8 000 consumer loans per year. Meeting the project target of 40 000 new electricity consumers implies a doubling of this. The World Bank is fully aware of this problem and according to an agreement between the MIE and the BPD, the project will bear the costs of this.

It is thus clear that provision of loans will involve substantial subsidies in the form of reduced interest rates, repayment guarantees and assistance to the BPD. It appears to the mission that the bulk of the loans will be channelled towards upper income families. Under present conditions in the country, this does not appear to be the optimal use of such funds.

6.6 Problems in switching to coal

The coal component of the project aims at the introduction of coal stoves to some 50 000 families in Maputo. The World Bank points out that this should be seen as complementary to the electrification component in that it

is focused on poorer families.

The project intention is that 2 300 stoves should be distributed in 1990 and that the annual distribution rate should rise to 13 500 by 1995, making a total of 47 600 for the project as a whole. In its initial comments on the project, the mission expressed the view that this programme was extremely optimistic in that it assumed that all the technical, social, environmental, financial and distributional problems associated with the widespread dissemination of coal stoves had been resolved.

A recent Working Paper from the Coal Stove Project¹ reveals some of the problems being encountered and provides a certain amount of support for the mission's views. It is based on a survey carried out in May 1989 in the bairro of Mafalda in Maputo where around 800 coal stoves have been distributed free to families.

The average age of the stoves in use was 8 months and it was found that about 25% were out of action because of deterioration or damage. The number of regular coal users was estimated to be between 100 and 250 families. The physical delivery of coal was something of a problem as a high proportion of the people (62%) bought the coal in 50 kg bags at a price of 1000 MT. They were allowed to borrow a wheelbarrow to take the coal home, but pushing this through the soft ground was not easy and may have been a deterrent to people living an appreciable distance from the coal store. Disposal of ashes was also found to be a problem by the majority of families.

It is obviously far too early for any final judgment on the Coal Stove Project. It is, nevertheless, clear that a number of serious questions remain and that the launch of a major dissemination effort must wait until they are resolved. This has major implications for the calculated benefits and rate of return of the coal component of the project.

6.7 Minor impact of woodfuel component

The woodfuel component of the project is also intended to complement the electrification component and focus on the needs of poorer families. It should be noted, however, that the specific actions intended under the woodfuel component are limited and the direct and indirect impact on family patterns of fuel consumption will be minor in the short to medium term.

The total cost of the woodfuels component is \$3.2 million out of a total project budget of \$80.8 million. Of this, about half is being used for the rehabilitation of peri-urban fuelwood plantations around Maputo, Beira and Nampula which are accepted as uneconomic at present woodfuel prices. There is no present intention of expanding the area of fuelwood plantations. The planned investment is justified only because the previous sunk costs of establishing the plantations can be ignored.

1. ELLEGARD, A. et al (1989) "Investigation of household coal utilization." Maputo Coal Stove Project, Working Paper No 8, Beijer Institute, Stockholm

The other principal activity under the woodfuel component is the establishment of a Biomass Energy Unit (BEU). The principal functions of the Unit will be research and surveys which should lead to the development of a number of options on which funding and implementation decisions will be made after the end of 1991.

6.8 General approach to the woodfuel issue

The creation of the BEU is a logical and useful step which the mission fully supports. It has the potential to identify opportunities for intervention in the domestic fuel sector. The mission is, however, concerned that the assumptions already made will tend to preempt open discussion about the woodfuel issue and the kind of actions which might be taken.

The World Bank project appraisal report asserts that there is a "shortfall" in supply in Maputo which is tentatively estimated at 10-30% and that similar shortfalls are being experienced in other areas. The implication is that there is a quantifiable "gap" between supply and demand. This approach, sometimes referred to as the "gap theory" has frequently been used in discussions on woodfuel issues in the past but is now generally discredited. The reasons are amply discussed in, for instance, Leach and Mearns (1988) ¹.

The assumptions made about woodfuel supply, for example, tend to be based on forest inventory studies, as appears to be the case in Maputo. In practice, a high proportion of woodfuel supplies are obtained from farm and fallow lands, by pruning and pollarding trees. These sources tend to be ignored completely in forest inventory analyses.

The notion of a "gap" or "shortfall" also implies a fixed demand irrespective of price or supply. It takes no account of the fact that people respond to such situations by economising in fuel consumption, switching to alternatives, or changing cooking patterns. It is therefore impossible to quantify such a "gap" in a meaningful way, still less use it as a basis for policy planning in the woodfuel area.

The focus on a woodfuel "shortage" also draws attention away from certain puzzling aspects of domestic fuel consumption patterns in Maputo. Among the 50% or so of the population living at or close to absolute poverty in the city, incomes are so low that woodfuel can only rarely be bought. Supplies must therefore be collected from green spaces and farmlands within the city limits or from the immediate urban hinterland. Families must also rely on scavenged burnable material other than wood. The magnitude of these resources is unknown but appears to be substantial. The degree to which reliance on these fuels is seen as a hardship, in comparison with other problems such as shortage of food, drinking water, schooling and medical facilities is also not known.

1. LEACH, G. and MEARNNS, R. (1988) "Beyond the woodfuel crisis." Earthscan 1988.

The behaviour of woodfuel prices over the past four or five years also tends to support the view that the supply position is less critical than assumed. A survey of woodfuel consumption in Maputo was carried out under the auspices of an FAO project in 1985. This found a wide range of prices depending on where in the city the wood was bought. The average price found was 21.8 MT per kg with a variation of $\pm 37\%$. The World Bank Energy Sector Assessment Mission in the same year found a price of 25 MT/kg. The figure assumed in the project calculations in 1988 was 22 MT per kg. Spot checks and interviews by the mission indicated that the market price had not greatly changed by September 1989.

Given that inflation has been running at around 25% per annum, this suggests that the price of woodfuel has been falling quite rapidly in real terms. This is difficult to reconcile with an hypothesis of severe physical scarcities of wood. At the same time, the World Bank reports the results of survey carried out by ESMAP in which shanty dwellers reported frequent fuelwood shortages; the World Bank also quotes anecdotal evidence that poorer families have been unable to obtain food and fuel because of shortages of both.

Given the conflicting evidence and the lack of information, the mission feels that it is essential to maintain as open a mind as possible about the energy situation in Maputo until the necessary data are available. The starting point of the Biomass Energy Unit should not be an assumption that there is a severe woodfuel crisis. It should rather examine the actual patterns of fuel supply and consumption, the ways in which people deal with scarcity and their own inability to pay for fuel, the reasons for fuel switching and where obtaining fuel fits within families' order of priorities among the problems they have to face. Such information, which is at present lacking, would provide a basis for a broad-based household energy strategy against which future woodfuel initiatives and the direction of the Urban Household Energy Project could be assessed.

6.9 The environmental dimension

The project is assumed to bring benefits in the form of reduced deforestation around Maputo and other cities. These benefits are not quantified or assessed in the formal evaluation of the project. They are, nevertheless, influential in determining the support given to the project at a broad political and public level as well as in the donor community and were regularly mentioned to mission during its discussions in Mozambique as being one of the benefits of the project.

Such environmental benefits depend on the proposition that cutting woodfuel is a major cause of deforestation. It is now widely accepted, and the World Bank agrees, that the principal cause of deforestation is the clearing of land for agriculture. Farmers cut the shrubs and bushes on the area which they wish to cultivate. Some of the bushes are piled around the trunks of the larger trees and burned to kill these trees. Any surplus wood will be sold if there is a market outlet; otherwise it will be burned or left to decay.

The mission had the opportunity to travel some kilometres in the countryside around the town of Tete. There, it was noticeable that though

the forest cover had been stripped, this was for agricultural purposes rather than fuelwood. There were, in fact, numerous dead trees in the landscape which could easily be used for firewood.

Such conversion of land to farming can be extremely damaging. Where it takes place on steep slopes, as was happening around Tete, severe erosion and land degradation are likely. Even when cultivation stops, it may be difficult for the vegetation cover to be restored if the soil has been over-cultivated or is open to grazing by cattle or goats. The point is that this type of land clearing would continue virtually unabated even if all woodfuel consumption were to stop. Unless the flight of people from the insecurity of the rural areas can be restricted, the process may even accelerate in the vicinity of the cities.

The effect of providing alternatives to fuelwood will therefore have little, if any, effect on the stripping of forest cover and the degradation of lands in the areas around cities. The fundamental problem is the lack of the manpower and other resources required to develop and implement the land use policies required for effective environmental protection. The launching of a fuelwood programme, if it is promoted as a means of dealing with the land degradation caused by clearing for agriculture and poor farming practices, can result in a failure to address the real issues.

7.0

CONCLUSIONS

7.0 CONCLUSIONS

It is evident from the analysis presented in the previous section of this paper that the mission has considerable reservations about certain important aspects of the Urban Household Energy Project. These reservations apply as much to the basic targeting and orientation of the project as to the details of its implementation and the economic benefit calculations by which it is justified.

The electrification component is explicitly aimed at the lower and middle income groups and is intended to ease the burden of their fuel costs. The mission feels, however, that the take-up of domestic connections and loans will tend to be among the middle and upper income groups. Given the severe problems being caused for many poor families by the ERP, this does not appear to the mission as a priority area for Danida funding.

EDM is presently faced with a variety of major financial, technical and managerial problems. These are being addressed and funding is being provided under the ETAR project. It seems to the mission that a rapid 40% increase in domestic consumers is likely to make the process of rehabilitation of EDM more difficult. It will require considerable investment in the medium and low voltage distribution systems; it will add massively to billing and administration; and because of the nature of domestic loading it will tend to provide a low return on capital.

The problems for EDM are likely to be greatest in the Southern grid where around half the new domestic connections are planned. There are already capacity problems in the supply system. Moreover, virtually all the electricity supplied in this part of the country is directly imported from South Africa or generated from imported coal or petroleum fuels. At present tariff levels, and the present official exchange rate, the domestic charge per kWh does not cover the cost of electricity imported from ESKOM.

The mission has raised a number of points about the calculation of the economic rate of return for the project. These include the appropriate shadow rate of exchange to be used in compared the value of fuelwood saved with the costs in foreign exchange; the relative cooking efficiencies used in calculating woodfuel savings; and the diversion of electricity to uses other than cooking. Even if exact values to be used in such calculations cannot be agreed, the general tendency of all these is to lower the rate of return calculated for the project. With a calculated economic rate of return of 14%, the electricity component becomes particularly questionable if there is any significant revision of the assumptions on which it was based.

Finally, it is questionable whether in its focus on family expenditures on woodfuel, the project is addressing an issue with a high degree of priority. Among the families most likely to take an electricity supply, the proportion of income spent on woodfuel does not appear to be excessive and there can be little justification for subsidising this expenditure. Among the poor, on the other hand, income are so low that any regular purchase of woodfuel is out of the question. Neither are such families able to benefit from the commercial fuels being made available under the project.

Neither is it possible to feel any confidence that there will be significant indirect benefits from a reduction in woodfuel prices because of a switch to cooking on woodfuel. Partly this is because the magnitude of any such switch is subject to considerable doubt. It is also because there is virtually no reliable information on the existing levels of supply or what determines the level of woodfuel prices.

The mission accepts that EDM will have to continue making additional domestic connections in areas where there is a strong political or social pressure to do so. But it feels that considerable care needs to be exercised over any deliberate encouragement of such connections particularly in the Southern grid area.

Where network extensions are being considered, this should be done on a highly selective basis and should focus on the creation of profitable business for the company. This would involve seeking out areas where there is a large latent demand for electricity particularly among business and industrial users; household connections should only be made if they are clearly cost-effective. There may also be potential for the substitution of electricity for woodfuel in certain industries.

The mission feels it is important, in all cases, that a realistic assessment should be made as to whether the supply and distribution system are capable of meeting such extra supply commitments in a reliable and cost-effective manner.

None of this is to suggest that all subsidies to EDM and the energy sector can necessarily be avoided. The point about the Urban Household Energy Project is that its economic and social benefits are doubtful but its costs are real. The prospect is that it will simply become a vehicle for subsidising the non-productive energy uses of the better-off. This cannot be a priority under present conditions in Mozambique.

8 . 0

RECOMMENDATIONS

8.0 RECOMMENDATIONS

The mission recognises that a heavy commitment has been made at a government and institutional level to the Urban Household Energy Project. The process of implementation has been set in motion and the project is going ahead. It is within this perspective that the detailed recommendations of the mission are presented here.

8.1 Maintain dialogue over Urban Household Energy Project

The World Bank has invited Danida to participate in a review of the project to take place in September 1990. The mission recommends that this invitation should be accepted.

This will provide an opportunity for Danida to contribute to a constructive discussion on ways in which the project might be modified or reoriented to improve its beneficial impact. Danida has indicated that it would welcome the opportunity to support the project in ways which are compatible with its own overall policy objectives and framework of cooperation with the Government of Mozambique.

The Danida policy perspective in such discussions would stress the need to ensure that any energy initiatives contribute to the longer term infrastructural and economic development of the country rather than non-productive consumption. Where energy projects are undertaken for social reasons there should be clear evidence that they are addressing priority needs and they will reach the target group.

8.2 Continue bilateral discussions with EDM

A number of discussions were held with EDM on possible areas of future Danida support. The mission accepted that strengthening the urban electricity supply system and increasing the number of commercial, industrial and domestic consumers on a commercially viable basis has a valid part to play in the economic development of Mozambique.

The potential funding areas considered included contributions to the strengthening of the medium and low voltage distribution networks; extension of the system to commercial, industrial and domestic consumers on a commercially viable basis; substitution of electricity for fossil fuels in selected industrial plants; preparation of master plans; supply of materials and equipment; and the provision of technical and managerial assistance.

It is clear that there are considerable opportunities for further Danish involvement in the electricity sector in Mozambique. Such discussions should be continued and EDM should be encouraged to prepare project proposals for submission to the Danida mission in Maputo and onward transmission to Copenhagen. Schedules of the information required for urban electrification and industrial fuel substitution project proposals

were prepared by the mission and passed to EDM¹.

Any such initiatives which emerge should, where appropriate, be considered within the framework of the Urban Household Energy Project

8.3 Coordinate with other donor agencies

There is intense donor activity in Mozambique at present. It is therefore important that Danida activities in the energy sector are effectively coordinated with those of other donors. Efforts should be made to ensure that Danida is fully informed on activities by other donors to avoid overlap and competition. Opportunities for active collaboration within the Urban Household Energy Project and in other potential project areas should be explored whenever possible.

Particular attention should be paid to the other Nordic donors. Swedpower is engaged in a major planning and design programme in collaboration with EDM under the Urban Household Energy Project. The Norwegian Government has contributed to the World Bank ETAR project. Such involvements provide a basis for the development of collaboration on future projects.

8.4 Clarify policy criteria in the energy sector

During the mission it became evident that there is a need to clarify certain aspects of Danida energy sector policy. Among the issues which need to be discussed are the role of Danish equipment and material suppliers and policy on the use of Danish inputs when these are not competitive on the open international market.

Discussion is particularly needed on the role of energy projects in the overall context of Danida development cooperation with its focus on poverty alleviation. In general, energy initiatives, by their very nature, can only have an indirect impact on poverty. This does not mean that they should not be undertaken since they have an important role to play in the creation and strengthening of the physical and economic infrastructure on which economic development depends.

It would benefit future energy sector appraisal missions if the validity of such objectives were explicitly recognised. It would help ensure that methods of assessment of energy projects are realistically based on the economic and technical merits of proposals and not distorted by inherently implausible attempts to demonstrate their direct benefits in poverty-alleviation.

8.5 Monitoring and responding to the progress of the ERP

Major improvements in the economic performance of Mozambique under the ERP have been claimed by the Government and the World Bank. There are,

1. See Annexe 2.

however, reasons for viewing these with a certain amount of caution. There is, on the other hand, no doubt about its negative effects, particularly on the poor.

Economic stabilisation and adjustment are clearly required in Mozambique. But that does not necessarily mean an unquestioning or open-ended acceptance of the precise approach that has been taken up to now. Forced rapid change under stringent economic conditions runs the risk of rupturing the social fabric of the country and undermining the basis for secure long term development. Independent Danida monitoring and analysis of what is happening are essential.

Danida has indicated that it is prepared to consider supporting initiatives such as the Urban Household Energy Project or the possible Social Dimensions of Adjustment Programme suggested in the World Bank's Policy Framework Paper of February 1989. But it is also essential to maintain a certain distance from the ERP. Overall Danish development objectives may well be better achieved by close coordination with other Nordic and similarly minded donors in measures which are closely tailored to the implementation and absorptive capacities of the economy of Mozambique.

Annex 2

PROGRAMME OF THE MISSION

29/8	Introductory meeting with MIE and EDM
30/8 - 31/8	Quelimane: Visits at bairros, meetings with EDM, Provincial Directorate and Planeamento Fisico
1/9 - 2/9	Tete: Visits at bairros, meetings with EDM, Provincial Directorate and Planeamento Fisico
2/9 - 3/9	Songo/Cahora Bassa
4/9 - 5/9	Chimoio: Visits at bairros, meetings with EDM, Provincial Directorate and Planeamento Fisico
6/9 - 15/9	Maputo: Meetings with EDM, UNDP, National Planning Commission and World Bank
12/9	Debriefing with MIE and EDM

Annex 3

LIST OF PERSONS MET

Ministry of Industry and Energy

H.E. Mr. Branco Antonio Minister
Mr. Lopez, José Director of DNE

National Planning Committée

Mr. Fernandez Director

EDM

Mr. Ruiz, Manuel Chief Engineer, Projects
Mr. Fernandez, Ernesto Director og Enginnering Dept.
Mrs. Palha, Angela Commercial Dept., Quelimane
Mr. Urbai, Ossemane Head of Financial Dept., Quelimane
Mr. Garrido, Jeremias Director, Tete
Mr. Matias, Jodeao Vicente Meter Reader, Tete
Mr. Mienju, Armando Cousellro Executivo da Lidade Chimoio
Mr. Nassiacs, Joaguin Ferreira Dept. de Distribuicao, Chimoio
Mr. de Melo, José Donato Network Engineering Dept. Maputo
Mr. Nicolau, José Miguel Quintas Planning Director, Maputo
Mr. Valente, José A. Deputy Director, Generation Dept., Maputo
Mr. França, Eduardo Teodorico Financial Director, Maputo
Mr. Schwalback, Carlos A.L. Orgão Formação Profiissional Maputo
Mr. Rui, Manuel Distribution, Chimoio
Mr. Monteiro, Domingo Director SHER
Mr. Boca, Alberto Beira
Mr. Kanabar, Kishore Project Co-ordinator, Maputo
Mr. Zandamela, Pascoal Generation Dept., Maputo
Mr. Doane, Vasco Director, Inhambane

Other Organizations and Institutions

Mr. Bernardu, José Alver Provincial Director, Quelimane
Mr. Joao, Anchiade Paiva D.P.I.E., Tete
Mr. Malens, Antonio Louis Director da D.P.I.E., Tele
Mr. Tomé, Felix Planeamento Fisico, Chimoio
Mr. D'Angelo, Massimo Senior Economist, UNDP Maputo
Mr. Tchyaan, Niels Res. Rep. WB Maputo
Mr. Gondie, Andrew Economist WB, Washington
Mr. Braga, Manuel M.P. Direccao De Approvisionnement
Mr. Fana, Gilberto José Director Geral, Celmoque
Mr. Andersson, Arve Resident Project Manager, Swed-Power

Annex 4

DB.V.J.nr.104.O.27.MOZ.1

DRAFT TERMS OF REFERENCE
FOR
A COMBINED IDENTIFICATION/PRE-APPRAISAL
OF
A PROPOSED URBAN HOUSEHOLD ENERGY PROJECT
IN
MOZAMBIQUE

1. BACKGROUND

During the meeting of the Consultative group in Paris on November 4, 1988 the Government of Mozambique presented a household energy project for the donors. At the meeting the World Bank expressed its willingness to support the project, which was seen as making an important contribution to facilitating structural adjustment by alleviating the high costs of household fuel for the urban poor and to safeguarding the environment, as well as developing local manufacturing industry.

At the meeting the Danida delegation expressed interest in supporting the project provided that the Danish grant could be implemented through parallel finance with the World Bank. It was suggested that the Danish contribution could be used for cables etc. to the rehabilitation and extension of the power distribution system in Tete and Quelimane.

During the annual consultation on the Mozambican-Danish Development Cooperation Programme in Maputo, November 1988 the Government of Mozambique welcomed the intention of the Danish Government in considering to support the household energy project. It was agreed that the possible Danish support could be concentrated in the Tete, Quelimane and Chimoio towns, principally in household energy electrification as well as other energy sources which will decrease domestic energy costs and thus have a positive impact on the environment.

2. OBJECTIVES

As indicated in the heading the study is divided into two phases: Identification and Pre-appraisal.

The objectives, i.e. the outcome of the study team's work, are:

- i) Identification of problem areas within the study's framework which are assessed as being suitable for Danida intervention and which are considered to fulfil the objectives for Danida support, e.g. in relation to target groups, tying of equipment to be purchased in Denmark and environmental considerations.
- ii) Formulation of project proposals.
- iii) Preliminary assessment of the expected benefits from the identified project proposals.

The results from the first part are to be discussed with the Mozambican authorities and Danida before continuation with a view to determine the project proposals to be further examined in the second part of the study.

The objectives of the pre-appraisal are:

- iv) A preliminary evaluation of the project proposals in socio-economic, technical and financial terms, and if needed, recommendations on adjustments in project design in order to obtain the expected impact on the economic and social development in the project areas, i.e.
- v) Recommendations for project proposals to be further examined in an appraisal proper.

3. SCOPE OF WORK

The study is to be carried out following the general principles laid out in the Logical Framework Approach (LFA), attached in Appendix 1. In the identification part of the study a project summary for each project proposal based on this method shall be prepared. These summaries are to be suitably updated and amended throughout the study work.

During its stay in Mozambique, the study team will have to undertake the activities itemised below. The work of the study team shall not necessarily be restricted to these as other of the proposed project, although not specifically mentioned hereafter, may need further investigations. Any investigation is to be conducted in a logical, flexible and pragmatic way taking the maximum use of existing data and studies. A list of existing reports and papers is given in Section 6.

Ref. A) Identification

- a) Collect relevant data covering the household energy sector e.g. supply, consumption, sources and prices in order to make an overall description of the sector in technical, organisational and financial terms.
- b) Make a macro-economic description of the Mozambican society including the on-going Economic Recovery Programme (ERP) with emphasis on the effects for the Danida target groups.
- c) Identify the major target groups and discuss a desirable and realistic service level for these in relation to need and purchasing power.
- d) Formulate on basis of the thus collected information and the objectives defined by Danida and the Government of Mozambique development and immediate objectives for the projects to be identified.
- e) Make an initial assessment of household economy and purchasing power for the identified target groups and outline the likely development in these.
- f) Undertake an initial assessment of economic costs for alternative energy supply.
- g) Make an initial assessment of the technical feasibility of the various energy supply methods.
- h) Study the existing tariff policy for electricity and the actual tariffs.
- i) Identify project ideas which are deemed relevant and realistic to obtain the defined objectives taking into account the present and the future purchasing power of the households and which are assessed suitable for Danida financing.
- j) Carry out an initial assessment of the benefits for the main groups of the beneficiaries and the expected impact on the Mozambican society.

Ref. B: Pre-appraisal

The likely outcome of the identification phase will be a number of proposals for various project components, which shall be further investigated and assessed in the pre-appraisal phase.

- k) For each project component assess the need and the demand taking into account the purchasing power of the households.
- l) Carry out a technical assessment of the various project components with special attention to the advantages and disadvantages from the users point of view.

- m) Undertake a financial analysis at household level of the project components by a comparison of the these with traditional energy sources.
- n) Make preliminary investigations into the current financial status of EDM in order to determine:
 - the loan burden of EDM
 - any need for re-financing
 - the cost structure
 - the financial viability of EDM
 - ability to absorb the relevant project components
- o) Assess the organisational capacity and capability of EDM pertaining to planning, implementation, operation and maintenance as well as administration of the various project components.
- p) Make recommendations in relation to implementation and operation of the project.
- q) Undertake an investment analysis of the proposed Danida project with the calculation of the financial internal rate of return (FIRR) and the net present value (NPV) for the proposed project including relevant sensitivity analyses.
- r) Carry out an economic evaluation of the project
- s) Assess the likely impact of the project components on employment, incomes and general welfare of the target population, with special emphasis on gender aspects
- t) Analyse the risks and uncertainties in the assumptions for the project, both in implementation and future operation.
- p) Make recommendations as to which project components should be implemented based on the analyses carried out in k,l,m,n and o above.
- q) Prepare a technical summary of the equipment to be supplied as part of the input for the recommended project.
- r) Prepare a overall description of the TA needed for project implementation and operation.
- s) Prepare a total budget covering materials and equipment and assess the Danish participation in terms of goods and services needed for the proposed project.

4. COORDINATION AND REPORTING

On completion of the identification phase, the findings, preliminary conclusions and recommendations on project proposals are to be discussed with the Mozambican authorities and Danida. This will form

the basis for the subsequent pre-appraisal phase.

A summary of discussions is to be drafted by the identification/pre-appraisal mission and handed over to the project authorities prior to the departure of the team.

A draft final report is to be presented to Danida not later than five weeks after the return of the study team from Mozambique and the final report 2 weeks after receiving Danida's comments to the draft report. The reporting language is to be English.

5. APPRAISAL MISSION TEAM AND TIMING

The appraisal team is composed by the following persons:

- Mrs. Isobel Endresen, Socio-economist
- Mr. Finn Tarp, Economist
- Mr. Bjarke Wiese, Electrical Engineer
- Mr. Gerald Foley, Civil Engineer
- Mrs. Esther Lønstrup, Technical Adviser (team leader), Danida

The fieldwork of the appraisal is scheduled to take place during the weeks 44-46 1988 in Mozambique.

6. LIST OF REPORTS AND PAPERS

- 1) Agreed Minutes of the Annual Consultations on the Mozambican-Danish Development Cooperation Programme, November 1988
- 2) Urban Household Energy Project, Aide Memoire (WB)
- 3) MOZAMBIQUE: Urban Household Energy Project, Credit and Project Summary
- 4) Mozambique: Urban Household Energy Project - Working Paper

Danida ,DB.V, June 19, 1989

Esther Lønstrup

ANNEXES

SCHEDULE OF INFORMATION REQUIRED FOR URBAN ELECTRIFICATION PROJECTS

In order to assess project proposals from EDM, the following information should be made available.

1. Brief description of the purpose of the project
2. Identification of the beneficiaries (potential user groups) of the project.
3. Description of the benefits of the project
4. Location of the area (maps etc)
5. Line routing and substation location
6. Single line diagrams (SLD) of the project and associated connection points in the grid
7. Technical standards to be adopted
8. Information on voltage and short circuit levels
9. Initial and projected loads (10 year period) and load duration curves
10. Projected sales (kWh and financial return) and assumptions on which they are based
11. Estimate of implementation and recurrent costs
12. Proposed implementation schedule
13. Requirements for technical assistance and training
14. Requirements for spare parts, tools and auxiliary equipment

SCHEDULE OF INFORMATION REQUIRED INDUSTRIAL FUEL SUBSTITUTION PROJECTS

In order to assess project proposals from EDM, the following information should be made available.

1. Location of the project area (maps etc)
2. Existing supply conditions
 - * Incoming lines
 - * Substations
 - * Branching points from grid
 - * Present maximum load
3. Present energy consumption
 - * Annual kWh of electricity
 - * Annual consumption of other fuels
 - * Daily/annual consumption pattern (variations or profiles)
4. Description of the manufacturing process
5. Previous studies of fuel substitution for the process
6. Local reliability of power supply
7. List of main component and proposed origin/manufacture
8. Estimate of implementation and recurrent costs
9. Proposed implementation schedule
10. Requirements for technical assistance and training
11. Requirements for spare parts, tools and auxiliary equipment